MoA

Ministry of Agriculture

Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

Household Energy / Protection of Natural Resources Project (HEPNR)

Project brief

First Phase
January 1998 to December 2000

Addis Ababa, December 2000

GTZ Household Energy / Protection of Natural Resources Project
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Abbreviations

ACSI	Amhara Credit and Saving Institution
BoA	Bureau of Agriculture
BoLSA	Bureau of Labour and Social Affairs
BoT&I	Bureau of Trade & Industry
BoWMERD	Bureau of Water, Mines and Energy Resources Development
BMZ	German Federal Ministry for Economic Cooperation and Development
CEINFMP	Cooking Efficiency Improvement and New Fuels Marketing Project
CSA	Central Statistic Authority
CSE	Conservation Strategy of Ethiopia
DoA	Department of Agriculture
DoWME	Department of Water, Mines and Energy
EARO	Ethiopian Agricultural Research Organisation
EFAP	Ethiopian Forestry Action Programme
ESMAP	Energy Sector Management Assistance Programme (UNDP/World Bank)
EEPCO	Ethiopian Electric Power Corporation (previously EELPA)
EELPA	Ethiopian Electric Light and Power Authority
EESRC	Ethiopian Energy Studies and Research Center
EPE	Environmental Policy of Ethiopia
EREPC	Ethiopian Rural Energy Development Promotion Center (previously EESRC)
CEFE	Competency Based Economics for the Formation of Enterprises
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH - German Agency for Technical Cooperation
GoE	Government of Ethiopia
HEPNR	Household Energy/Protection of Natural Resources Project (GTZ)
MoA	Ministry of Agriculture
MoH	Ministry of Health
NRMRD	Natural Resources Management and Regulatory Department (MoA)
RTPC	Rural Technology Promotion Center
SNNPRS	Southern Nations, Nationalities and People's Regional State
Toe	tons oil equivalent
WB	World Bank

1. Introduction

The MoA/GTZ Household Energy/ Protection of Natural Resources Project (HEPNR) started in January 1998, shortly after the signing of a bilateral project agreement between the Federal Democratic Republic of Ethiopia and the Federal Republic of Germany.

The project is jointly implemented by the Ministry of Agriculture (MoA) and the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. GTZ has been commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ) with the implementation of the German contribution in June 96. The total budget approved for the first phase of the project from January 1998 to the end of December 2000 is three million DM.

After a project progress review that was carried out in May 2000, the continuation of the project for a second phase has been recommended. During a workshop with the national, regional and zonal stakeholders, the findings of the review team were discussed and a planning matrix for the second phase of the project prepared. Based on the project-planning matrix a project offer was elaborated and submitted to BMZ. The German Government approved this proposal in November 2000, securing the funding of the second phase until December 2003. The total allocation for the first and second phase amounts to five million DM.

2. Background

Nationally, biomass fuels provide more than 90% of the total energy supply of the country, with 77% being derived from woody biomass, 8.7% from crop residues and 7.7% from dung. National figures conceal considerable regional and local variations in both supply and consumption patterns, as well as temporal changes in these patterns in face of declining stocks and yields of wood fuels. Varying fuelwood prices and costs of supplying alternative energy sources also have large influence on local consumption patterns and the level of biomass consumption, but do not alter the general situation.

Per capita energy consumption in Ethiopia is among the lowest in the world (0.30 toe). However, the energy requirements of a large and fast growing population and the fact that the major proportion is supplied by traditional energy sources, have serious implications on the natural resource base. Looking at biomass supply and demand balances, there is a huge and constantly widening gap between demand and sustainable fuelwood supply. According to EFAP[1], the fuelwood deficit is estimated to reach 47 million m³ in the year 2000, which is more than four times higher than the sustainable supply.

Table 1: Projected fuelwood demand and supply (in 1000 m³)

Year	Demand	Sustainable Supply	Deficit
1997	52917	11689	41228
2000	58403	11225	**47178**
2005	68473	10423	58050

Source: EFAP 1994

Most of the forests in Ethiopia, including the Forest Priority Areas, are already in a stage of degradation. The natural forest cover of Ethiopia has been reduced to 3% of the total land area within a few decades, and the rate of depletion of the natural forests is estimated at between 150,000 to 200,000 ha per annum. Dense and homogeneous patches of forest cover remain only on steep slopes and in remote areas. The expansion of farmland and pastures gradually reduces the forest area, and the dense population heavily drains on the forest resources. Seedlings rarely develop into trees because of livestock grazing and browsing, and excessive wood cutting (firewood, charcoal, timber, construction) progressively degrades the standing stock. The demand of households for forest products in many areas exceeds by far the annual incremental yield. The degradation of forest areas, and the subsequent negative effects like soil erosion, deterioration of watersheds and decreasing land productivity are further accelerated by high population growth and increasing livestock numbers. It is therefore

[1] EFAP 1994: Ethiopian Forestry Action Programme

obvious that the forests will continue to diminish unless fundamental changes occur.

Sustained forest production in the future will depend to a large extent on the implementation of sound forestry management policies and on long-term measures to enhance the supply of fuelwood. However, given the magnitude of demand, and following the recommendations of the ESMAP[2] energy assessment for Ethiopia, the pressure on traditional energy supplies can only be alleviated by near and medium term measures to increase the end-use energy efficiency.

Household energy is a basic need. In Ethiopia, most people depend on biomass fuels for cooking, lighting and space heating. Due to economic and planning constraints, a rapid expansion of the modern energy sector is unlikely to occur in the next future, and woody biomass fuels consumed in rural and large parts of urban households will continue to dominate Ethiopia's energy balance and consumption pattern at least for the next two decades.

Only a minority of households has access to modern fuels like kerosene and electricity. Roughly 4% of the population is connected to the electric grid, and virtually all EEPCO consumers are concentrated in the main urban areas. The main interconnected system (ICS) is supplied by 5 hydro power plants with a total capacity of about 370 MW, out of which 300 MW is considered reliable. About 44 MW of additional capacity is supplied by the self-contained system (SCS).

In 1995, the GoE decided on a 60% tariff increase to be implemented over a five years period. Since at the end of the five years implementation period, the average tariff of ETB 0.33/kWh will cover not more than 72% of the LRMC (long run marginal costs), this is considered only a slow progress toward meeting economic and financial requirements[3]. However, the recent tariff increases have dramatic effects on the existing forest resources. In urban areas, including Addis Ababa, many consumers are switching back from the use of electricity to biomass fuels to meet their cooking requirements, thereby contributing to the depletion of the forest cover.

Between the mid 80th and mid 90th, large efforts have been undertaken by the GoE to displace thousands of tons of woody biomass and charcoal by promoting the use of electricity, kerosene and fuel-saving charcoal stoves. These efforts were mainly concentrating on Addis Ababa and have reduced woody biomass consumption in the capital considerably. However, they have not altered the consumption of woody biomass and charcoal in other urban areas, where people have less access to or no disposable income for conventional and modern fuels.

Typical cooking patterns in Ethiopia are associated to agro-ecological zones. In highland Ethiopia, where agriculture is dominated by cereal production (teff), injera is the main staple food. Injera is baked on a large clay pan (mtad) of about 55-60 cm diameter and requires a large size stove to accommodate the mtad. Generally, the injera mtad is placed on three stones or three ceramic pot rests over an unprotected open fire. Therefore, injera baking requires the bulk of domestic energy demand in large parts of Ethiopia. It is reported that injera baking alone contributes 50% of the total primary energy consumption of the country.

In urban areas, in particular Addis Ababa, non-injera cooking like wot[4] preparation and boiling is performed on a number of different stoves, ranging from open fire to charcoal, kerosene, LPG stoves and hot plates, using a large variety of different fuels.

The following table indicates the use of different stoves in Addis Ababa households. Even though Addis Ababa has the most diversified fuel market, many households maintain the possibility to switch between different types of fuels and cooking devices including the open fire stove, in order to cope with changing supply situations and fuel price fluctuations.

[2] ESMAP 1996: Ethiopia Energy Assessment

[3] dto.

[4] Different sauces served with injera

Table 2: Share of households owning different stoves, Addis Ababa 1994

stove type	efficiency	% households 1994
Open fire place		86%
Charcoal stove		91%
Lakech charcoal stove	0.42	22%
Kerosene stove	0.42	91%
LPG stove	0.55	17%
Electric stove/hot plate	0.60	3%
Electric mtad		62%
Regularly bake injera on an open fire	0.09	45%

Source: ESMAP 1996, citing CEINFMP

In rural areas the use of biomass on open fire stoves clearly dominates all cooking and baking activities. Biomass fuels are mainly collected. Kerosene, if available, is only used for lighting. In urban areas, charcoal is the second important fuel following biomass. Charcoal and wood fuels are highly commercialised in urban areas. Household energy expenditures contribute as much as 35% to the overall household expenditures, and therefore constitute a high burden for low family incomes.

Most Ethiopian households use fuelwood highly inefficiently on an open fire place. Women and children are particularly affected by traditional fuelwood supply and cooking practices. The high workload of women to collect and transport fuels in addition to many other productive and reproductive tasks is a common feature in Ethiopia. During cooking on open fire stoves, women and children are exposed to high levels of emissions from smoke and other pollutants, which are the cause for many eye diseases and respiratory infections. Open, unprotected fires also expose them to high risks of burns and fire hazards.

Since 1989, efforts to improve the end-use efficiency of stoves, mainly by the Ethiopian Energy Studies and Research Center (EESRC, recently changed to Ethiopian Rural Energy Development and Promotion Center)[5], have resulted in the development of three types of improved stoves:

- lakech charcoal stove
- low cost electric injera stove
- mirt improved biomass injera stove

The main success of the CEINFMP project has been the lakech charcoal stove, which is used for non-injera cooking. Working closely with the (informal) private sector, the stove has achieved rapid market penetration in Addis Ababa and has spread to other markets all over the country. The stove has proven to reduce charcoal consumption by roughly 25% relative to traditional metal charcoal stoves. The stove by now has probably reached distribution figures of several hundred thousands. The ease of production and the small size and portability of the stove have largely contributed to its dissemination success. However, high competition among producers and decreasing prices have also led to the production of the “false lakech” stoves, which due to design alterations and reduced quality production do not meet the original fuel saving characteristics anymore.

Production of the low cost electric injera stove has been stepped up by EELPA, in particular to attract new electricity consumers in the early 90th. However, promotion of the stove ceased as a response of increasing demand for electricity in Addis Ababa, which has contributed to high peak loads and load shedding after 1996.

The mirt improved biomass stove for injera baking has been under development by the CEINFMP project since 1991. The stove has an efficiency of 18-21% compared to the open fire stove (8-10%), and therefore reduces fuelwood consumption by half. Target markets have been low and middle income households in Addis Ababa, who cannot afford an electric injera stove. Recent increases of electricity tariffs have increased the market for the mirt stove in Addis Ababa considerably. Since the mirt is a bulky high mass stove, which cannot be easily transported and requires more sophisticated manufacturing skills, substantial dissemination to other markets outside Addis Ababa through trade, as in the case of

[5] The Cooking Efficiency Improvement and New Fuels Marketing Project (CEINFMP), financed by World Bank and DANIDA, was carried out under the EESRC between 1989 and1995.

the lakech, is unlikely to occur. Actual dissemination figures are estimated between 50,000 to 70,000 stoves, mainly in Addis Ababa. Even though stove producers in several towns have been trained, before the CEINFMP phased out in 1996, most of them gave up do to lack of further promotional support, after the initial technical training.

The number of mirt stove producers in Adds Ababa, not counting sales outlets, is about 10, whereas not more than 5 additional mirt producers were active all over the country, when the GTZ-HEPNR project started in 1998.

At present, the GTZ-HEPNR project is the only project fully addressing and promoting household energy efficiency and improved stove dissemination in Ethiopia. There are few other projects promoting improved fuel-saving stoves as a component or sporadic activity.

3. Development policy objectives

The HEPNR project supports the development policy objectives of the Federal Democratic Republic of Ethiopia as outlined in the following policy papers:

- The Conservation Strategy of Ethiopia (CSE)
- The Environmental Policy of Ethiopia (EPE), as approved by the Council of Ministers on April 2, 1997.

The relevant policy documents read as follows:

Environmental Policy of Ethiopia

Article 3.5 Energy Resource

"The policies are:

a. To adopt an inter-sectoral process of planning and development which integrates energy development with energy conservation, environmental protection and sustainable utilisation of renewable resources;

Environmental Policy…

b. To promote the development of renewable energy sources and reduce the use of fossil energy resources both for ensuring sustainability and for protecting the environment, as well as for their continuation into the future;"

Article 3.2 Forest, Woodland and Tree Resources

"The policies are:

c. To ensure that forestry development strategies integrate the development, management and conservation of forest resources with those of land and water resources, energy resources, ecosystems and genetic resources, as well as with crop and livestock production;

i. To find substitutes for construction and fuel wood whenever capabilities and other conditions allow, in order to reduce pressure on forests."

The CSE is even more explicit with regard to energy efficiency, improved stove production and dissemination, and the role of the private sector. The strategies read as follows:

The Conservation Strategy of Ethiopia

"The Strategies in:

Development and Conservation of Biomass Energy Resources are to:

e) Boost technical and social research on the design of improved cooking stoves;

f) Promote local manufacture and distribution of improved charcoal and biomass stoves; and

g) Locate, develop, adopt or adapt energy sources and technologies to replace biomass fuels.

The Conservation Strategy…

Development of Alternative Energy Resources and their Utilisation are to:

b) Acquire, develop, test and disseminate appropriate and improved energy use technologies (e.g. improved stoves, charcoal kilns, solar powered cookers and heaters);

Capacity Building and Institutional Strengthening are to:

a) Strengthen research, planning and project implementation capability of the federal and regional energy agencies;

d) Establish a centre for testing alternative and efficient energy sources, technologies and appliances;

e) Promote and assist the private sector to assemble and manufacture energy development facilities and end-use appliances."

4. Project management

The HEPNR project is implemented under the Natural Resources Management and Regulatory Department of the Ministry of Agriculture. The NRMRD has assigned a Counterpart to the project. The German contribution is co-ordinated by the expatriate advisor of GTZ. In addition, the project has employed up to three Ethiopian experts under a GTZ contract during the first phase, apart from five auxiliary personnel.

5. Project planning

a) national level

The first project-planning workshop after starting the project was conducted in July 1998. The planning workshop counted with the participation of national stakeholders (MoA, EESRC, MoH) and representatives from regional governments (BoA, BoWME) of the four pre-selected Regional States Amhara, Oromiya, Tigray and SNNPRS.

A Project Planning Matrix (PPM) was formulated, which laid the ground for project implementation. Since the planning results deviated from the original project proposal, which was approved by BMZ already in 1996, a modified project proposal was submitted to BMZ. This modified project offer was approved by BMZ in 1999.

b) regional level

In light of decentralisation and envisaging the implementation of household energy measures by regional government institutions and partners, the regions were officially informed about the project by the MoA through the Regional Councils.

During a number of meetings held with regional stakeholders (mainly BoA, BoWME) and following a pre-defined list of criteria, pilot areas were selected within the regions (zonal and woreda level). In order to gather sound planning data, the project conducted household energy baseline surveys in all of the selected pilot areas. The results were presented and discussed during three subsequent project-planning workshops, which were held with the regional/zonal/woreda representatives of the pilot areas.

Based on the planning results, plans of operation were formulated.

6. Project pilot areas

The project is supporting the implementation of household energy measures in three regional states. Due to the beginning border conflict, which restricted the GTZ staff from travelling to the region, activities in Tigray had to be postponed. As mentioned above, following a list of pre-set criteria, the regions defined their own priority areas:

- Oromiya Region: West Shewa Zone (Ambo Woreda)
- SNNP Region: Sidama Zone (Awassa Zuria Woreda)
- Amhara Region: North Gondar Zone (Debark and Dabat Woreda) and Bahir Dar Special Zone

7. Project objectives and results

During the national planning workshop, the project objective has been formulated in the following way:

"The efficient use of biomass resources has been improved by integrating household energy measures into national development programs".

In achieving the project objective, the project shall contribute to the protection and sustainable development of biomass resources and to the conservation of genetic diversity in Ethiopia (development goal). The outputs or results agreed upon are:

Result 1: Capacity to plan, implement and monitor household energy measures improved at different levels

Result 2: Appropriate household energy technologies selected and adapted

Result 3: Pilot dissemination strategies designed, tested and implemented

Result 4: Integration of household energy measures into development plans at different level and into other projects is improved

8. Summary of achievements (end of 1. phase)

The following summary of achievements follows the logic of the "Objectives Oriented Project Planning (ZOPP)" as summarised in the Project Planning Matrix (PPM, see attachment) and lists down the major activities performed by the project according to the results (or outputs) defined in the PPM. In order to provide a better understanding of the conceptual and strategic approach of the project some additional explanatory notes are given, whenever necessary.

Result 1:
Capacity to plan, implement and monitor household energy measures improved at different levels

The capacity building measures of the project were geared towards developing human resources and strengthening institutions to carry out household energy measures effectively. The project not only concentrated on building the capacity of experts at different level, but also included individual private sector entrepreneurs as potential stove producers. The capacity building measures were comprised of workshops and seminars, training courses, in-bought training measures, study tours, technical assistance to producers and financial support for cooperation agreements that were concluded with different implementing institutions.

In the absence of ready-made training courses to cover specific household energy themes, the project has also developed the curriculum for training modules for different target groups.

Workshops and seminars

- Shortly after its commencement, a "National Workshop on Household Energy" was organised by the project This workshop was meant as a starting point to bring all relevant stakeholders from national and regional level together and to discuss different aspects of the current situation and possible interventions in the household energy and environment sector. After a "call for papers", 15 paper presentations were handed in to the project. Topics covered environmental, economic, social and health impacts of biomass energy consumption, the policy framework, household energy intervention strategies and approaches to improved stoves dissemination. Due to external reasons, the workshop was cancelled, however a reader comprising all papers was compiled and edited by the project.

- Directed towards planners and decision-makers in government institutions (higher officials), the project has developed a 3-days seminar under the title

"Demand management interventions in the context of sustainable use of natural resources". Detailed training materials and a simulation model (CD-ROM) have been developed. The model simulates the ecological impacts of three major intervention strategies (supply enhancement, inter-fuel substitution, improved stoves dissemination) on the natural resource base. The first seminar was held with 27 participants in Addis Ababa and was highly appreciated by the experts. Following the recommendations of the participants, the model was later amended by simulation module that takes into account the costs of different intervention strategies.

- 120 experts drawn from different government institutions at national, regional, zonal and woreda level and from NGOs in Amhara, Oromiya and SNNP Region have participated in 4 planning workshops organised by the project.

- As part of capacity building, the project supported the participation of regional experts in the "household energy baseline surveys" conducted in three regions.

Training courses

The project has developed the following training courses for potential stove producers and entrepreneurs.

- Training on energy efficiency and fuel saving stoves
- Technical training on mirt stove production
- Business management and marketing training (adaptation of existing CEFE training – Competency based Economics for the Formation of Enterprises)

Two training manuals with the title "introduction to fuel saving stoves" and a "mirt stove production manual" have also been prepared in English and Amharic. Until the end of the first phase of the project, the following training courses have been conducted:

- Energy efficiency and mirt stove production training

  5 training courses of 3-5 days duration in Awassa (2), Ambo, Gondar and Wolisso. Participants: 47 stove producers, 70 experts (BoA, DoA, BoWME, DoWME, BoLSA, ACSI, RTPC etc.)

  Upon the high demand of experts from different administrative levels and sectors, the project has been offering the training not only to selected stove producers but also to government experts who are involved in project activities. Under a cooperation agreement between the project and the RTPCs of Bako and Sodo, experts from the two RTPC, who have been trained previously by the project, have selected and trained 10 additional stove producers from Bako, Nekempte, Sodo, Humbo and Bodity.

- Business management (CEFE) training

  5 training courses of 5-6 days duration in Awassa, Ambo, Bahir Dar, Sodo Wolaita and Wolisso. Participants: 57 stove producers, several experts

  The CEFE training has proven to be an essential tool for the formation of commercial stove producers. The training includes elements of production and business management, quality production, product pricing, book keeping and marketing.

Study tours in country and abroad

- A study tour to Addis Ababa, for 10 experts from MoA, Bako and Sodo RTPC and West Shewa Zone, was organised to visit improved stove producers in Addis Ababa.

- Study tours to visit the project pilot areas and stove producers supported by the HEPNR project have been organised at various occasions for counterparts of different MoA Departments, as well as for managing personnel of GTZ and external evaluators.

- The project organised a solar cooker demonstration with actual cooking session for experts from different Departments of MoA and for project staff.

- A visiting programme to Germany, encompassing visits to different institutions in the German forestry sector and a visit to the world fair Expo 2000 in Hannover, where the Vice-Minister of Agriculture and other MoA officials participated, was organised together with the GTZ-Project "Advisory Assistance to the Forest Administration".

- Members of the project and the assigned MoA Counterpart participated in a "Household Energy Seminar" in Germany, where partners of different GTZ supported household energy projects in Africa met to exchange conceptual ideas and experiences.

- A study tour to Kenya for 11 stakeholders and counterparts from national, regional and zonal level has been financed by the project and organised together with Intermediate Technology Development Group in Kenya. The purpose of the study tour was to enhance the exchange of information and experience on household energy and renewable energy technologies and to visit different projects in the region.

External training supported by the project

The project has supported capacity building measures and training programmes organised by third parties, as indicated below.

- The project has financed the participation of counterparts of the MoA-NRMRD in the following training courses:

  - Training on Organisational Development (1 expert)
  - Computer training (1 expert)
  - GIS and ArcInfo training (5 experts)

- The project has financed a 4 weeks "forest management training" combining lectures and practical training on forest management, forest inventory, forest development, social forestry, forest surveying and forest protection at Wondogenet College of Forestry for 15 experts of Sidama Zone.

- The project has financed an "environmental awareness creation workshop" for 75 experts from different government sectors and council members of Sidama Zone and SNNP Region, organised by the zonal DoA.

- The project has financed the participation of project staff and the MoA counterpart in the training "project management" and "computer support for project management and monitoring" organised by the GTZ Office in Addis Ababa.

- The project has provided a training on "principles of design and layout" for project staff and the MoA counterpart.

- The project made a financed contribution to the training of local gender experts on gender issues, organised by the GTZ Office in Addis Ababa.

Monitoring

- The project has designed a monitoring system to include performance monitoring in the project. Besides the monitoring of project activities, simple impact indicators are also monitored. The project has started to monitor production and sales figures of improved stoves with all producers, as well as the monitoring of fuel prices in selected pilot areas. For the future, it is planned to build the capacity of regional counterparts and to delegate monitoring to the implementing agencies at regional/ zonal level.

Studies and distribution of documents

- During the first project phase, the project has issued more than 25 studies, reports and major work papers (see attachment). Most of the documents have been distributed to government offices of the three regions, who were

involved in project planning and implementation.

- Several hundred copies of publications on household energy issues (mainly published by the supra-regional Household Energy Project at GTZ Head Office) have been distributed, in particular to government experts involved in project activities.

Result 2:
Appropriate household energy technologies selected and adapted

Review of existing technologies

- Right after its commencement, the project has carried out a literature review in order to gather information on the current status of development and the availability of household energy technologies in Ethiopia. However, comprehensive information was scarce and difficult to obtain. Probably the most important household energy project has been the Cooking Efficiency and New Fuels Marketing Project (CEINFMP), which has been carried out between and by the Ethiopian Energy Studies and Research Center with funds obtained from WB and Danida. The project has developed three types of low cost stoves, as mentioned before, namely:

  - lakech charcoal stove
  - low cost electric injera stove
  - mirt biomass injera stove

  and has been able to disseminate these stoves with quite significant results in the capital city of Addis Ababa. Other institutions who had been working on improved stoves are the RTPC, in particular Bako (charcoal stoves) and a few NGOs (Burayo mud stove, Ambo mud stove).

- Apart from the literature review the project has directly contacted government institutions, NGOs and other organisations in the 4 regions in order to gather information on their previous experience and/or actual involvement in stove dissemination programs. The information has been compiled in the study "Profile of household energy in Ethiopia" prepared on behalf of the project.

- The project commissioned a study "Assessment of household energy technologies in Ethiopia", which provides a typology of stoves and analyses methods of production, dissemination approaches, stove prices and comparative cooking costs.

In general, the reviews also revealed a number of constraints for the implementation of household energy measures in Ethiopia, some of the most important being the absence of actual research on household energy technologies, insufficient institutional capacities in all aspects of planning and implementation of household energy projects, and the lack of basic data in the household energy sector (for example baseline surveys, regular fuel price records etc.).

Selection of the mirt stove

Since the HEPNR project is not involved in basic research, but focuses on promoting the dissemination of improved stoves, the project had to build on existing technologies. The project's decision to select the "mirt" improved biomass injera stove for its dissemination strategy, was supported by the following reasons:

- Importance of injera baking in the Ethiopian society
- High contribution of "injera baking" to the overall biomass consumption of the country (50% of the primary energy consumption)
- Lack of alternative stove options for injera baking in particular for low and middle income groups, except for the electric injera stove and the open fire stove
- Lack of mirt dissemination outside of Addis Ababa and absence of mirt stove promotion programmes, except for some local efforts
- Prospects for involving the private sector in improved stove production and commercialisation, in order to reduce

public expenditures on stove dissemination programs.

- High efficiency of the mirt stove: compared to traditional injera baking the efficiency of the mirt stove is increased by nearly 100%, thereby reducing fuelwood consumption by 50%
- Quality standards, in particular the stove dimensions that are important to maintain the thermal efficiency, are easily kept, as moulds are used for its production
- At a market price between 40-60 Birr, the mirt can be considered a low cost stove, which is affordable to many middle and low income households.

Improvement of other stoves

The project has been requested in many occasions to promote other stoves apart from the mirt, in particular self-built or user-built stoves, since a stove price of 40-60 Birr was still considered unaffordable for the lowest income groups in rural Ethiopia. The project therefore has tested, redesigned and improved other stove models (mud technology) however at a limited scale. Basically the project's philosophy is not to spread scarce resources for the development of different technologies, but to focus on a wider-scale dissemination of an accepted technology in order to achieve any significant impact with regard to environmental protection.

- The project has rehabilitated the "institutional" kitchen of Menagesha Suba State Forest Training Center. The open fire stove for injera baking was replaced by 5 improved injera stoves built on a platform. The highly inefficient "wot" stove was replaced by an improved "institutional stove".

- The project has improved the design of an enclosed injera and wot stove made from bricks, which has been disseminated as a self-built stove through the extension service of Wolmera woreda. The re-designed "Holeta stove" stove has an improved efficiency among other convenience factors. Under close supervision of the project, the stove was installed in approx. 140 households of villages surrounding Menagesha Suba State Forest.

- The Burayo Basic Technology Center (BBTC) under the Oromiya Education Bureau has been working on mud stove technology since 20 years. Even though extended stove production training has been provided to nearly 1000 persons drawn from the Community Skills Training Centers (CSTC), the stove never gained real dissemination success. A number of technical design features made the original stove inappropriate for increased production and dissemination (bulkiness, heavy weight and susceptibility to breakage during transport, use of extremely heavy gypsum moulds etc.). The HEPNR project therefore has commissioned stove testing and design improvements to a technical consultant, who came up with the desired design improvements both on the stove and the moulds and with an increased thermal efficiency. A local subsidy agreement was reached with BBTC to carry out pilot dissemination in 4 pilot areas, which has been started but not yet finalised.

<u>Result 3</u>:
Pilot dissemination strategies designed, tested and implemented

Baseline surveys

- In order to gain insight into the household energy situation of the pilot areas, and to provide a sound database for planning and future monitoring, the project carried out household energy baseline surveys in the three pilot areas. A detailed survey guideline and questionnaire was prepared by the project, before commissioning the surveys to different consulting firms. The three baseline surveys covered a total number of more than 1000 households that were interviewed based on the questionnaire. Apart from household interviews, the baseline surveys covered a longitudinal biomass energy consumption survey, a fuelwood inflow survey to

major town centers, a fuel market survey, and a resources and skills inventory to assess the possibilities of local stove manufacturing. Furthermore, a number of interviews were conducted with community members and stakeholders from different government institutions.

- The results of the baseline surveys were presented and discussed with government officials (regional, zonal, woreda level) and NGOs during a two days workshop, in combination with the project planning workshop. The workshops held in Yirgalem, Ambo and Gondar counted with the participation of more than 100 experts from governments, NGOs and other organisations.

Dissemination strategy

As stated earlier, the project decided to concentrate on promoting the dissemination of the mirt injera stove. The pilot areas were selected zones in 3 regions, excluding the capital of Addis Ababa.

The project strategy is based on the assumption that the involvement of the private sector, i.e. a partnership between the public and private sector, has comparative advantages against an intervention strategy that relies on public resources only. The strategy supports a commercial dissemination approach, whereby individual private sector entrepreneurs are responsible for the production and commercialisation of the stove, which is sold to end-users without any subsidy. The project or the public sector on the other hand is responsible for building the capacity of small entrepreneurs and for promoting the stove to the households through public market demonstrations, awareness raising campaigns, distribution of promotional materials and the use of mass media.

The economic features of the mirt stove are advantageous for such a private sector involvement. The stove has a short payback period and is affordable to large numbers of households. At the same time stove production and marketing generates a profit margin that is the necessary incentive and attractive enough for private entrepreneurs to involve in the business. The public interest in environment protection, in economising large amounts of fuelwood and in improving the health conditions of families, justifies the support provided to individual producers during the initial phase of capacity building and production.
The household energy surveys revealed that low-income households spend between 20% up to 37% of their income on energy supplies. Since injera baking contributes more than 50% of the total energy consumption of households, the individual households can considerably reduce their energy expenditures by using an improved fuel-saving stove. Other advantages are improved health and safety conditions, convenience of use, and improved kitchen environment.

Based on the assumption that households are willing to buy and pay for an improved stove, a rapid penetration of markets, with positive impacts on the environment, can be achieved by promoting commercial stove dissemination. Commercial dissemination starts best in urban areas, where biomass fuels are highly commercialised. Therefore, stove producers are most effectively established in towns, where they can find markets. Urban areas also are major consumers of biomass fuels supplied from the outside areas, and drain on the resources of the surrounding forests. It is also anticipated that the mirt stove will gradually spread to peri-urban and rural areas, as the pressure on the forests increases. Through monitoring the project has got indications that this hypothesis will be verified.

The dissemination strategy adopted by the project consists of three major elements:

- Promotion of mirt stove production
- Promotion of marketing and commercialisation
- Enhancing institutional capacities for the promotion of improved stove dissemination

Until the end of the first phase in December 2000, the project has developed and tested a consistent promotional package, which ranges from the selection and training of

potential producers, technical assistance and financial support for the establishment of production units, facilitation of micro-credits, to market promotion and monitoring.

The project estimates that on average it takes three months to establish stove producers in the major towns of a newly selected zone. All initial steps from the selection of producers to the first market demonstrations are interlinked and follow in a short sequence.

Promotion of stove production

- Selection of potential stove producers: From 57 producers originally selected by the project 40 are active today and are operating stove production workshop in 15 towns of the country. Only the two producers groups in Awassa disintegrated, because of organisational problems and lack of motivation, so that the group production approach was given up in favour of promoting individual entrepreneurs. The selection criteria defined by the project today consider educational background, business orientation and availability of workspace among others. Experts from different government offices and sectors have been involved in the selection process. After gaining first experiences in Awassa, the number of selected producers for each town has been purposively reduced in order to avoid excessive competition between producers on the new markets.

- Technical training, including training on stove efficiency and practical mirt stove production training (see R1);

- CEFE training including production management, product pricing, marketing, basic book-keeping (see R1);

- Technical and financial assistance during the establishment of production workshops, including the construction of workshop sheds, provision of moulds, basic tools and raw materials for start-up production.

- Technical assistance and follow-up during the pilot production phase and initial marketing.

- Regular monitoring with producers, in particular of production and sales figures.

The following tables gives an overview about the support rendered to private stove producers during the first phase of the project.

Table 3: Mirt stove producers supported by the MoA/GTZ-HEPNR Project during the first phase

	No. of Producers selected	Technical training	CEFE train-ing	Production workshops established	Access to producer credits	Market Demonstra-tions	Start of production (remarks)
Amhara							
Bahir Dar	3	3	3	3	✓	✓	April 2000
Gondar	3	3	3	3	✓	✓	April 2000
Debark	2	2	2	2	✓	✓	April 2000
Oromiya							
Ambo	4	4	4	4		✓	March 2000
Guder	2	2	2	2		✓	March 2000
Wolisso	3	3	3	3		✓	August 2000
Bako	1	1	1	1*)		✓	May 2000
Nekempt	4	4	4	4*)		✓	July 2000
Fitche	2	2	2	2		✓	October 2000
Gebre Guracha	1	1	1	1		✓	October 2000
SNNPRS							
Awassa	25	25	25	8		✓	January 2000 (8 active producers)
Sodo	4	4	4	4*)		✓	June 2000
Humbo	1	1	1	1*)			June 2000
Bodity	1	1	1	1*)			June 2000
Mizan Teferri	1	1	1	1*)			June 2000
Total	**57**	**57**	**57**	**40**			

*) Workshop sheds established with producers' own resources, project provided moulds only. In all other cases the project provided construction material for workshop shed, moulds, basic tools and raw material for pilot production

Table 4: Technical training on energy efficiency and mirt stove production

Date	Location	No of trainees		Producers from	Experts from
		Produ-cers	Experts		
02.11.-05.11.99	Awassa	25	-	Awassa	-
17.01.-19.01.00	Ambo	6	11	Ambo 4 Guder 2	Bako & Sodo RTPC, DoA, WoA, WoLSA
29.02.-03.03.00	Gondar	8	22	Bahir Dar 3 Gondar 3 Debark 2	BoA, BoWME, BoLSA, RTPC, RWSEP, BoTIT, DoA, DoWME, DoTIT, DoLSA, ACSI etc.
30.07.-08.08.00	Wolisso	8	21	Wolisso 4 Fitche 2 G/Guracha 1 Mizan 1	BoWME, DoA W. Shewa, N. Shewa, E. Wolega, Bench Maji; WoA, WoTIT, WoLSA, Mizan RTPC, SNV Lalibela
03.07.-07.07.00	Bako (RTPC)	5	-	Bako 1 Nekempte 4	-
	Sodo (RTPC)	5	-	Sodo 3 Humbo 1 Bodity 1	-
22.06.-23.06.00	Awassa	(13)	15	Awassa 13 (refreshment course)	BoA, BoWME, DoA, WoA
Total		**57**	**69**		

Table 5: CEFE business management and marketing training

Date	Location	No of trainees	From
22.11.-26.11.99	Awassa	25	Awassa 25
31.01.-02.02.00 14.02.-16.02.00	Ambo	6	Ambo 4 Guder 2
06.03.-11.03.00	Bahir Dar	8	Bahir Dar 3 Gondar 3 Debark 2
16.10.-21.10.00	Wolisso	12	Wolisso 3 Bako 1 Nekempt 4 Fitche 2 Gebre Guracha 1 Mizan Teferri1
02.10.-06.10.00	Sodo	6	Sodo 4 Humbo 1 Bodity 1
Total		**57**	

Promotion of improved stove dissemination

- In order to create public awareness and to demonstrate the mirt stove to the public, the project organises market demonstrations right after completion of the pilot production phase. Public stove demonstrations with life baking sessions, which in general are carried out on major market places, have proven to be an effective marketing method. A cook shows how to bake injera on the mirt and an announcer explains the advantages of the stove. More than 35 public stove demonstrations have been carried out by the project and have attracted an estimated number of 45.000 to 50.000 spectators until the end of the first project phase.

- In addition, cooperation agreements have been concluded from mid 2000 onwards between the project and relevant government institutions to further promote the mirt stove by carrying out a total number of 100 consecutive stove demonstrations until December 2000. These are:

  - BoWMERD Amhara Region: 20 market demonstrations in Bahir Dar, Gondar, Debark and Dabat
  - DoA West Shewa Zone: 48 market demonstrations in Ambo, Guder, Ginchi and other towns
  - DoA Sidama Zone: 32 market demonstrations in Awassa, Yirgalem and other towns

- Posters and user leaflets, which were designed by the project and printed in the Amharic and Oromifa languages, have been distributed before and during market demonstrations, and mobile loudspeakers have been used to announce market demonstrations and advertise the stove.

- The project has participated in two trade fairs, namely the Awassa and Bahir Dar trade fair with an exhibition of project activities. In addition the mirt stove has been displayed and injera baking sessions were prepared in collaboration with the stove producers, who have been invited to sell their stoves during the fair.

- Two “mirt evenings” for the Council of Sidama Zone and West Shewa Zone respectively have been organised together with a project presentation, an exhibition, video show, stove demonstration and reception.

- Facilitation of micro-credits

  With increased stove production the cash or capital requirements of stove producers will also increase. Raw materials for stove production have to be ordered in time and purchased in bulk, and since many producers sell the mirt stove on credit basis to their clients, they might face shortage of cash to make timely procurements. Therefore, the facilitation of micro credits for stove producers is becoming an essential tool to keep the stove production process on-going.

  In Amhara Region, the project has concluded a cooperation agreement (financial contribution) with Amhara Credit & Saving Institution (ACSI) for establishing a revolving fund for stove producers. Most of the stove producers in Amhara Region have already taken a credit from this revolving fund, which is entirely managed by the institution.

- Cooperation with RTPC on mould manufacture

  At present, there is no research on improved stoves in the country. Previously, apart from the EESRC, the Rural Technology Promotion Centers (RTPC) had assumed this role. In order to enhance the institutional capabilities in the field of stove design and testing, the project has started to involve the RTPC in the technical training and in the production of moulds for the mirt stove. Cooperation agreements (financial contribution, technical assistance) have been concluded with Bako and Sodo RTPC, who have production 20 sets of

metal moulds each under supervision of the project. The moulds have been distributed to stove producers in the project pilot areas. The RTPC have shown strong interest to continue and extend this kind of activities to neighbouring towns by their own. Other RTPC have requested similar support by the project.

Result 4:
Integration of household energy measures into development plans at different level and into other projects is improved

Household energy measures are difficult to link to a single sector only, but require intersector cooperation and coordination between government institutions at different level. The project has contributed to this process by involving a large number of stakeholders, both at national and regional level, and from different sectors, into capacity building and project implementation activities. The most important partners have been the Ministry of Agriculture, the Bureaux and Departments of Agriculture and the respective institutions (Bureaux, Departments) under the Ministry of Mines and Energy at regional and zonal level.

With regard to the integration of household energy measures into development plans, the most striking result was the incorporation of household energy measures into the five-years-plan of the Ministry of Agriculture. The target set for the coming five years starting in July 2000 is to disseminate 250.000 fuel-saving mirt stoves to individual households. In Amhara Region, the Bureau of Water, Mines and Energy Resources Development has integrated a similar target into the five-years-plan of the region.

The project has started information exchange and networking with a number of other organisations and donor agencies, who are involved in the implementation of projects and programs in the field of natural resources management, environmental protection and household energy. Joint participation in workshops has been one means of information exchange and networking, e.g.

- Participation in the first "National Stakeholder Meeting on Household Energy" organised by the IGAD Household Energy Programme, which started in 1999.

- Participation in the workshops "Deployment of Commercial Energy Efficiency Cooking" and „Poverty Alleviation Aspects of Successful Urban Household Energy Stove Programs" sponsored by DFID (Department for International Development, UK).

- Participation in the national consultative meeting on „Women and Energy" organised by Enda-Ethiopia (Environmental Development Action) and ENERGIA, a global network on "Women and Sustainable Energy".

- Participation in the "Regional Workshop on Women and Sustainable Energy" in Kenya, where representatives of about 17 countries participated with the aim of identifying a plan of action for the network.

- Participation in the "International Conference on Solar Cooking 2000", organised by the Ministry of Energy in South-Africa.

- With organisational and financial support, exhibitions, presentations and other activities, the project participated in the preparation and commemoration of the following international events:
  - Earth Day 2000
  - World Environment Day 2000
  - World AIDS Day 2000

- On about 10 different occasions the project has participated with an exhibition of project activities (booth, display of stoves etc.)

- The project has given about 10 project presentations at different occasions, several times upon invitation of regional government institutions.

- The project has published several articles about household energy and environmental issues, in Boiling Point, Akirma, Tefetro and other bulletins.

- The "Forum for Environment" publishes the *Akirma* bulletin on environment and development in Ethiopia. Since May 1999, HEPNR has been member of the advisory board of *Akirma*.

9. Impacts of the project

The first producers selected by the project started production in January 2000. At the end of 2000, a total number of 40 producers were producing mirt stoves in 15 towns of Amhara, Oromiya and SNNP Region. Almost 50% of all active producers are female.

Table 6: Gender distribution of producers

	Producers	Female	Male
Amhara			
Bahir Dar	3	2	1
Gondar	3	2	1
Debark	2	1	1
Oromiya			
Ambo	4	1	3
Guder	2	1	1
Wolisso	3	1	2
Bako	1	-	1
Nekempte	4	4	4
Fiche	2	-	2
G/Guracha	1	-	1
SNNPRS			
Awassa	8	8	-
Sodo	4	1	3
Humbo	1	-	1
Bodity	1	-	1
Mizan	1	-	1
Total	**40**	**19**	**21**

According to the project monitoring, since the first start of commercial production in January 2000 up to March 2001, about 5200 stoves have been produced and 4800 have been sold on a commercial basis to individual households and some institutional clients. It is to be expected that these records are slightly underestimating the real figures, as not all sales might have been registered by the producers and reported to the project.

Observations have been made that the mirt is well accepted by the households not only in urban towns, but also in rural areas. More and more farmers from rural areas have been buying the mirt stove during and after the harvesting season.

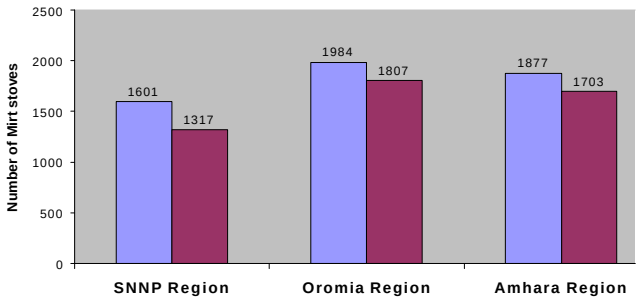
Stove sales have been increased after the stove demonstration programme has started in particular in those zones, where consecutive market demonstrations with life injera baking sessions have been performed.

Table 7: Production figures at the end of first phase

	Stoves produced	Stoves sold	Start of production
Amhara	**1877**	**1703**	
Bahir Dar	1594	1466	04/2000
Gondar	233	197	04/2000
Debark	50	40	04/2000
Oromiya	**1984**	**1807**	
Ambo	758	721	03/2000
Guder	445	419	03/2000
Wolisso	370	351	08/2000
Bako	129	108	05/2000
Nekempt	150	108	07/2000
Fitche	88	68	10/2000
G/ Guracha	44	32	10/2000
SNNPRS	**1601**	**1317**	
Awassa	970	866	01/2000
Sodo	418	300	06/2000
Humbo	15	13	06/2000
Bodity	28	18	06/2000
Mizan Teferri	170	120	06/2000
Total	**5462**	**4827**	

*) Figures compiled between October 2000 and March 2001.

Figure 1: Mirt production and sales figures



In general, impacts of improved stove dissemination programmes can be calculated as the amount of fuel saved, quantified in monetary terms or expressed in protected forest cover. The following figures should be considered as indicative for the expected impacts of the project.

From 5000 households, who are using the mirt stove instead of an open fire stove, the following annual benefits can be obtained:

- With an average of 60 injera baked per household and week, the fuelwood savings amount to approx. 2875 tons per year
- The fuelwood savings in tons equal 385 ha of eucalyptus plantation saved or 2300 ha of bushland and woodland annually.
- The avoided re-afforestation costs for eucalyptus plantation amount to 2.500.000 ETB (6.500 ETB/ha).
- At a fuelwood price of 0,35 ETB/kg, the fuelwood expenditure savings amount to more than 1.000.000 ETB per year.
- Furthermore, these households improve their health and safety conditions due to the protected fire and due to reduced exposure to smoke and other pollutants.

It is estimated that one mirt stove producer can produce 1000 to 1500 stoves per year. 90 to 100 entrepreneurs, who will have been trained by the project until the end of 2003, have the potential capacity to produce 100.000 stoves per year. If all stove producers, who have started stove production and marketing under the promotional package of the HEPNR project produce at full production capacity, and if the demand for the stove can be raised as anticipated, the benefits in terms of economic returns and environmental protection will be significant. The following indicators have been formulated to measure the impacts of the project, based on the target of 110.000 households using an improved mirt stove by the end of 2003:

- Annual biomass savings potentially amount to about 570 kg/household, assuming 80% effectiveness, the total of 110.000 households save approximately 50.000.000 kg or 50.000 tons of biomass per year
- The fuelwood price presently amounts to about 0,35 ETB/kg, thus the total economic savings amount to 17.000.000 ETB.
- Fuelwood savings in tons equal about 6.700 ha eucalyptus forest (12m² = 7,5 tons/ha/year) or 40.000 ha of bush lands and woodlands (2m³ = 1,25 tons/ha/year)
- Re-afforestation costs for eucalyptus forests saved amount to about 44.000.000 ETB (6.500 ETB/ha).

The project strongly believes that the efforts to support the commercial dissemination of the mirt stove will be successful and sustainable. The joint partnership between the public and private sector requires initial inputs by the public sector in terms of capacity building and market promotion, but on the long run will yield a high speed of dissemination, and reduce public expenditures on improved stove dissemination programmes considerably.

10. Prospects for the second phase of the project

After two and a half years of project implementation, the HEPNR project underwent a “project progress review” (PPR) in May 2000, which was carried out by a team of independent consultants in collaboration with counterparts of the MoA and the project. The results of the evaluation have been positive not only with regard to the concept and pragmatic approach of the project and the achievements made, but also with respect to the high commitment of counterparts, the benefits to the target groups, and the economic and environmental impacts of the project.

The PPR mission has recommended the continuation of the project for a second phase from January 2001 to December 2003.

After a workshop, where the review results and the proposed planning matrix for the second phase of the project have been discussed with national, regional and zonal stakeholders, a project offer was elaborated and submitted to BMZ. The German Government in November 2000 approved the proposal, thereby securing the funding of the second phase until December 2003.

An extended mirt dissemination programme has been proposed for the second phase. This programme shall advance the penetration of mirt stoves in other urban and rural areas. As before, target markets are middle and low income households in several region, excluding Addis Ababa. The main elements of the programme have been summarised below:

- The programme will be extended to 17 selected zones in Amhara, Oromiya, SNNPRS and Tigray Region.

- The project will continue to build the capacity of private producers to produce and market the mirt stove. The total number of producers at the end of the second phase shall reach 90. Stove production workshops shall be established in 33 towns of the zones already defined with the regional stakeholders.

- The number of stove producers supported in each town will be proportional to demographic figures. On average not more than one producer per 2500-5000 households should be in place, until substantial demand has been created. Geographic criteria, e.g. the distance to other small towns and potential marketplaces surrounding the production towns, will also be taken into account.

- A total number of 110.000 mirt stoves shall be disseminated until the end of the second phase. In order to reach this high figure, strong promotional and innovative marketing measures will have to be developed and implemented in collaboration with the regional and zonal stakeholders.

- Promotional measures will include market demonstrations with injera baking sessions, production and distribution of posters and leaflets, promotional theatre tours, participation in exhibitions and trade fairs, advertisements and radio programmes.

- Furthermore, the possibilities to establish a retail system in order to increase the sales of the mirt in woreda or other towns outside the major production sites shall be explored.

- A follow-up mechanism will have to be deployed, providing technical assistance to producers if required, as well as ensuring quality control. The monitoring system already in place will have to be refined and new communication channels identified in order to manage the increasing monitoring tasks efficiently (monitoring of production and sales figures, fuel price monitoring, monitoring of simple impact indicators).

- One major task of the second phase will be to strengthen the capacities of organisations and government institutions at national, regional and zonal level with regard to an effective planning, implementation and monitoring of household energy programmes through advisory services and capacity building measures.

Table 8: Mirt stove promotion during second phase of HEPNR project

Region/Zone	Town	Population (CSA 94)	Producers 1. Phase	Producers 2. Phase
Amhara Region			**8**	**15**
Bahir Dar Special	Bahir Dar	96.000	3	1
North Gondar	Gondar	112.000	3	-
North Gondar	Debark	15.000	2	-
South Wello	Dessie	97.000	-	4
South Wello	Kombolscha	39.000	-	3
North Wello	Woldiya	25.000	-	3
North Shewa	Debre Birhan	39.000	-	2
North Shewa	Shewa Robit	14.000	-	2
Oromiya Region			**17**	**12**
West Shewa	Ambo	28.000	4	-
West Shewa	Guder	10.000	2	-
West Shewa	Wolisso	25.000	3	-
West Shewa	Bako	10.000	1	-
North Shewa	Fitche	21.000	2	-
North Shewa	G/Guracha	11.000	1	-
East Wellega	Nekempte	47.000	4	-
East Shewa	Nazaret	128.000	-	4
East Shewa	Debre Zeit	73.000	-	3
East Shewa	Ziway	20.000	-	2
East Shewa	Shashemene	52.000	-	3
SNNPRS			**14**	**10**
Sidama	Awassa	69.000	8	-
Sidama	Aleta Wendo	11.000	-	1
Wolayta	Sodo	36.000	4	-
Wolayta	Boditi	13.000	1	-
Wolayta	Humbo	2.700	1	-
Gedeo	Dilla	34.000	-	2
Gedeo	Yergachefe	12.000	-	1
Gamo Gofa	Arba Minch	40.000	-	4
K.A.T.	Alaba Kulitu	15.000	-	2
Bench Maji	Mizan Teferri	11.000	1	
Tigray Region			**-**	**13**
East Tigray	Adigrat	37.000	-	3
South Tigray	Mekele	97.000	-	4
South Tigray	Alamata	26.000	-	3
South Tigray	Maychew	20.000	-	3
Total	**33 towns/ 17 zones**		**40**	**50**

Figure 2: Mirt stove production sites (1. and 2. phase)