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IMPROVED COOK STOVES

FINAL REPORT

GHG Mitigation and Sustainable Development through
the Promotion of Energy Efficient Cooking in Social Institutions in Ethiopia

Project implemented by

Gaia Consulting Oy and Ethio Resource Group

Financed by

Nordic Climate Facility of Nordic Development Fund and the implementing partners

31.8.2012

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Summary

The GHG Mitigation and Sustainable Development through the Promotion of Energy Efficient Cooking in Social Institutions in Ethiopia project has supported sustainable development in 105 schools in Afar region and two universities and three prisons in Ethiopia through delivering energy efficient food stoves to institutional kitchens.

This innovative project has helped to reduce carbon emissions and improve health conditions, reduced use of child labour and local environmental degradation, supported environmental education and created new business and technology transfer opportunities. Moreover, the project has laid very strong foundations for a nation-wide, and beyond, programme on improved stoves in social institutions.

The project has been implemented by Gaia Consulting Oy and Ethio Resource Group (ERG) with the support of Ethiopian Federal Ministry of Education and the Federal Ministry of Water and Mines. The regional education authorities, the World Food Programme and the Deutsche Gesellschaft für Internationale Zusammenarbeit, (GIZ) have also played a very valuable role in the project. The project was financed by the Nordic Climate Facility (NCF)[1], Gaia Consulting Oy and ERG.

The project represents a modern and effective type of development project which has been designed and implemented by private sector working directly with Ethiopian responsible authorities and participating schools and social institutions. The entire project, implemented in less than 24 months, has generated lasting, cost-effective and sustainable solutions with measurable impacts. It offers an inspiring example of a development project that simultaneously addresses the urgent needs to mitigate greenhouse gas emissions and help to adapt to the impacts of climate change.

[1]The Nordic Climate Facility is financed by the Nordic Development Fund (NDF) and implemented jointly with the Nordic Environment Finance Corporation (NEFCO).

1. Introduction

Climate Change

Climate variability and change pose critical challenges to Ethiopian development aspirations. Despite climate change having risen onto the Ethiopian national policy agenda in the past few years, systematic mainstreaming of climate issues into Ethiopian policy and concrete implementation is still at an initial stage. Decisive efforts are required to ensure that the envisaged goals of sustainable growth are attained, to ensure universal access to sustainable and affordable energy services for all and to strengthen the adaptive capacity of all communities in Ethiopia.

In 2011, under the leadership of the Ethiopian Prime Minister´s Office, the Environmental Protection Authority (EPA), and the Ethiopian Development Research Institute launched The Climate-Resilient Green Economy (CRGE) initiative. The CRGE sets a target of having a national economy which is both climate resilient and carbon neutral by 2025. In order to realize the target, the Government is in the process of putting in place a number of institutional building blocks, including i) a national strategy (CRGE Strategy) that will identify investment priorities, both for adaptation and mitigation, ii) a multi-donor trust fund (CRGE Facility) which will pool and administer climate finance, and iii) detailed plans (including investment plans) for different levels for concretely implementing the climate change strategy. In spring 2012, the components addressing the Green Economy part of CRGE are well advanced and by the end of 2012 the plans for the Climate Resilient part of CRGE should be ready.

Case for Improved stoves in Ethiopia

Cooking is the largest energy consuming end use in Ethiopia. More than 80% of the total energy supplied in the country goes to meeting cooking requirements in the social, commercial and residential sectors. In all sectors, cooking is done mostly with non-renewable biomass fuels using stoves of very low efficiency

Practically all Ethiopian households use wood fuels for cooking. Commercial and social institutions such as bakeries, restaurants, schools, detention centres, universities and hospitals also use wood to cook. As a result the total amount of wood consumed for cooking, estimated at some 62 million tons annually, makes up more than 80% of the total energy consumed in the country and puts huge pressure on natural resource sustainability.

Wood fuels are mostly collected from unmanaged natural forests and woodlands the stock and productivity of which is declining rapidly. Studies indicate that forest cover in Ethiopia to have declined from 40% to 2.4% over the past six decades with 150,000 to 200,000 ha of forests lost annually[2]. As resources diminished, access to them has declined and forcing households to seek

[2] Environmental Protection Authority (EPA) of Ethiopia, 1998. National Action Programme to Combat Desertification.

alternative fuels. In rural areas households have increased their use of crop and livestock residues; in urban areas households and institutions are spending significantly more for their fuel.

The environmental impacts of non-sustainable biomass fuel use have been devastating. Non-sustainable and high rates of wood fuel extraction have destroyed forests and woodlands and the environmental services these provide including soil and water conservation. The switch to crop and livestock residues has had an even greater impact as these are diverted from their traditional use as natural soil fertilizers. The livelihood of millions of households and the budget of thousands of institutions is impacted as users have to spend more effort, time or money to obtain their cooking fuels.

The climate change impacts of non-sustainable wood fuel extraction are also significant. According to Ethiopia's First National Communication to the UNFCCC biomass energy combustion (85% of which is in the form of wood fuels) contributed 66 million tons of CO_2 in 1994.[3]

Government and non-government agencies are implementing programs to address the challenge of non-sustainable biomass energy use. The main focus of these programs has been on disseminating energy efficient household stoves since they utilize only about 10% of the energy traditional stoves consume. So far, nearly 4 million stoves have been disseminated, much of them being charcoal stoves in urban areas. However, stove dissemination could be sustainable only if new households adopt improved stoves and if those who already own a stove continue to replace old ones with fuel-efficient ones. By the end of 2012, there will be about 18 million households in Ethiopia[4]. With the exception of some 5% of the households that are in urban areas, all households in Ethiopia use firewood, charcoal and other biomass fuels for cooking.

Social institutions are major consumers of energy due to the relatively large number of people they serve. The main uses of energy include cooking, water heating, lighting, and electricity to run appliances (washers, driers, communication devices).

In Ethiopia the majority of social institutions still cook with wood using low quality stoves, which lose up to 90% of the energy input and expose those who work with them to harmful air pollutants. Access to social services is still very limited and increasing the number of service institutions and reaching more people is a priority for the government. The number of institutions and people they serve is expected to increase rapidly in the next ten years.

Currently the total number of customers served in the social institutions is estimated to be around one million. Sixty percent of the total number of customers is school children in the School Feeding Program[5]. The annual consumption of wood for cooking in the social institutions is estimated at

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[3] National Meteorological Services Agency, 2001. *Initial National Communication of Ethiopia to the UNFCCC.*

[4] For more information, see the Carbon Study by Gaia Consulting Oy and ERG. In the business as usual scenario, we assume fuel consumption in the residential sector follows the 2.6% population growth rate.

[5] In 2010, WFP supported over 900 schools under Food for Education Program serving about 500 000 students. While explicitly looking at the wood fuel consumption, it is good to note that WFP School feeding programme uses pre-cooked food, which means that water just has to get boiled, and there is no need for extensive cooking. This influences the size of GHG emission reductions reached in-site.

33000 tons, with schools, universities and detention centres being the main consumers of wood for cooking.

Social institutions in Ethiopia cover schools, colleges and universities, clinics and hospitals, and detention centres, which are mainly under public sector management and operation. Overall, energy improvement interventions for institutional cooking applications have been very limited in Ethiopia so far. In the mid 1990s the World Bank assisted *Cooking Efficiency Improvement and New Fuels Marketing Project* implemented by the Ministry of Mines and Energy adopted the improved household "injera" (a traditional flat-bread) baking stove, also known as Mirt stove, for institutional and commercial applications[6]. The Institutional Mirt stove has mainly been adopted by commercial bakers.

Except for a couple of short term projects, no significant effort has been made to introduce energy efficient stoves in institutions for cooking applications (non-baking). It is only recently that the Ministry of Water and Energy and GIZ ECO have initiated actions to promote efficient cooking in commercial and social institutions in Ethiopia. However, promotion has been limited and awareness about the stove among potential consumers is still low. Out of the 400 or so institutional Rocket stoves disseminated in the country so far some 65% have been produced and installed as part of this project **GHG Mitigation and Sustainable Development through the Promotion of Energy Efficient Cooking in Social Institutions in Ethiopia** by Gaia Consulting Oy and Ethio Resource Group.

Apart from improved biomass stoves for cooking and baking, use of electric boilers and hot plates is not uncommon in institutions, particularly in universities and hospitals. However, for lack of maintenance, aging and high replacement cost of electric stoves, there is a tendency to shift back towards firewood. Electric stoves for Injera baking have also been widely used in institutions. Recently, most institutions are outsourcing Injera supply to commercial bakers primarily for management purposes.

Biogas is another potentially clean source of cooking energy in social institutions. This technology has been promoted in the country for the last four decades. However, only few institutions have installed biogas plants, from which they receive the gas used for cooking. The gas usually covers not more than 10% of their cooking energy requirements. An assessment and inventory has been made recently on institutional biogas plants in the country. The study assessed 120 institutional biogas plants of which only 53% were operational[7].

[6] The institutional version of Mirt stove differs from the household version by its metal cladding which adds to its durability and the long chimney for removal of smoke from the kitchen. The Institutional Mirt stove is three times more costly than the household Mirt stove.

[7] Bilhat Leta, National Survey on Current Status of Institutional Biogas Systems Installed in Ethiopia, Horn of Africa Regional Environment Center and Addis Ababa University, 2009.

Table 1. Improved biomass stoves in social institutions

Institution	Fuel used	Purpose	Number of institutions with improved stoves/ technologies	Number of stoves/ technologies installed	Manufacturing
Universities	Firewood	Cooking	Less than 5	35	Local
	Biogas	Cooking	20	24 digesters	Local
Hospitals	Biogas	Cooking	5	5 digesters	Local
Detention centres	Firewood	Cooking	3	22	Local
	Biogas	Cooking	19	19	Local
Schools	Firewood	Cooking	105	207	Local
Source: Information about distribution of stoves obtained from various sources including Ethio Resource Group, Bilhat Leta (2009), and GIZ ECO. The number of beneficiaries was estimated based on the capacity of the stoves/ technologies to serve					

Cooking fuel is a significant economic burden for poor households. Households allocate about 5% of their potential income for collection or purchase of cooking fuels; lower income households spend more, higher income households less than this. The financial expense of providing fuel for cooking in the social and commercial institutions is considerable. Such institutions must pay an average of €30/ton of wood which means that annual financial outlays could exceed €15 000 for the larger institutions such as the universities and detention centres.

Project Objectives

Since autumn 2010, Gaia Consulting and Ethio Resource Group (ERG) have been implementing a project addressing the challenges of climate resilience and opportunities for green growth. Through the project entitled "GHG Mitigation and Sustainable Development through the Promotion of Energy Efficient Cooking in Social Institutions in Ethiopia", 257 Institutional Rocket Stoves have been installed in 105 schools participating in the World Food Program's (WFP) Food for Education Programme in the Afar Regional State, and in two universities and three prisons.

The objective of the project was to reduce greenhouse gas emissions (GHG) while improving the life conditions and wellbeing of the local communities. More efficient stoves reduce the use of fire wood and respiratory diseases while preserving the forests and creating new business for the manufacturing of efficient stoves. Furthermore, the project aimed to find out possibilities to extend

fuel efficient stove use in social institutions and to utilize carbon financing schemes to create solid business setup to disseminate energy efficient stoves.

2. Achievements of the project

The project has managed to cut emissions, reduce deforestation, improve in-door health conditions, as well as contributed to improved education and supported SME development. More importantly, the successful project has provided essential lessons for similar activities and, according to government, NGO and international organization partners, the project has laid a strong foundation for up-scaling improved cook stove programme in Ethiopia, and beyond.

The project has reached the main objectives and goals set for the final monitoring period as well as for the entire project. The project objective of reducing greenhouse gas (GHG) emissions while improving the life conditions and wellbeing of the local communities has succeeded through reduced fuel wood consumption, reduced forest degradation, improved indoor air quality in institutional kitchens and new business opportunities created for new stove producers. During the project a business model to disseminate fuel efficient stoves has been created, and further production of stoves has already been started in Adama University based on the positive results of the project. Also the possibilities for utilizing carbon financing (CDM) to create business around fuel efficient stoves has been carefully studied. According to the emission reduction studies conducted during the project, the carbon emission reductions in schools are not sufficient to meet the requirements of an efficient CDM project. In bigger institutions such as universities and prisons the emission reductions are more significant. However, according to the project results, it seems evident that, thanks to the multiple benefits of the fuel efficient stoves, other financing opportunities such as grant financing for the schools and commercial stove production business models for the universities and prisons would be the most efficient means of scaling up the stove production and reducing fuel consumption in social institutions in Ethiopia.

The expected main results set in the beginning of the project are listed below and compared with the final outputs of the project. The fuel wood reduction rates are based on the calculations made in

the pilot phase of the project. In later interviews and questionnaires with project stakeholders the fuel reduction rates have been proved to be even higher, especially in universities and prisons.

Reduction in fuel wood consumed will reduce CO_2 emissions from biomass

- The fuel wood reduction in schools reached 56 % according to the monitoring results in the early phase of the project.
- The fuel wood reduction in universities and prisons reached 60 %. Later, fuel wood savings as high as 90 % have been recorded by the users.
- The total direct emission reductions caused by the project activities are 1283 tCO2 annually.

Reduction of child labour for fuel collection, more study time for children

- The reduction in fuel wood consumption in schools has reduced the time children spend for collecting fire wood by approximately half.

Reduction of fuel expenditure for universities and other social institutions

- The Institutional Rocket stoves installed in universities and prisons within this project provide savings of 660 tons of fire wood annually. The amount is worth ETB 461 600 (EUR 20 400).

Reduction of local environmental degradation (forest, soil and water conservation)

- The project activities reduce fire wood consumption by 855 tons annually. This equals to 28.5 hectares of natural forest in Ethiopia.

The Rocket stove will eliminate the exposure of indoor air pollutants (IAP) such as carbon monoxide and particulate matters which affect women and children

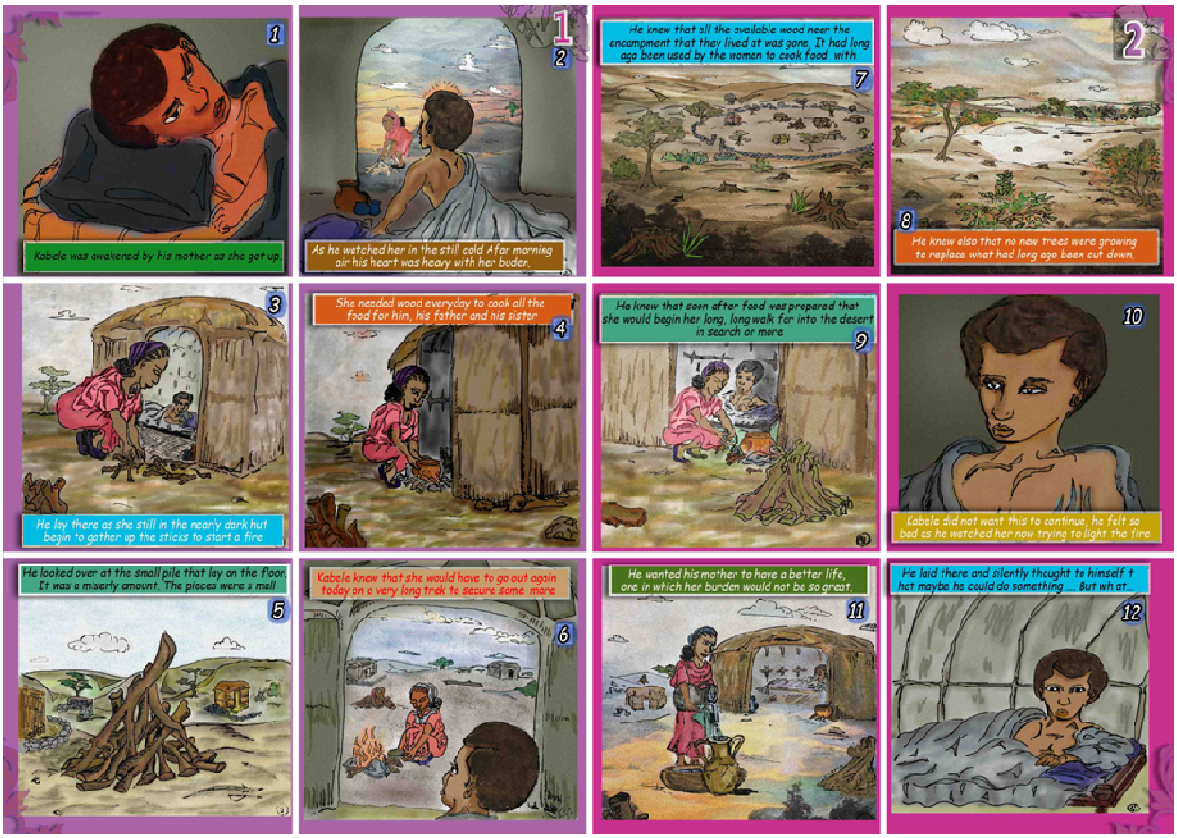
- The reduction in indoor air pollutants gained through the new stoves was estimated through a questionnaire answered by 38 schools. According to the questionnaire, 89.5 % of the cooks estimate IAPs have been reduced by 50 % or more.

Additional income for small and micro enterprise stove producers.

- In the early phase of the project 14 metal workers were trained in stove production and business activities to provide them with skills to start their own Rocket Stove production business. Most of the stoves installed within the project were produced by the trained producers, and some of the trained persons have continued the business after the project orders.

Technology and skills transfer for sustainable technology and climate change

- In addition to the stove producer training mentioned above, the project contributed to skills transfer through co-organising a “Responding to Climate Change – Development Opportunity for Ethiopia” national workshop focusing on carbon finance and climate change adaptation. The workshop was organised together with World Vision and World Bank, and it focused on the latest progress in climate project development in East-Africa and considered new finance mechanisms to promote climate resilient growth.
- Information on energy efficient stoves and carbon financing was also shared through the Carbon Study produced in the last phase of the project. The study was made available to all project stakeholders and other interested actors.



Environmental education comic book for Afar kids

In addition to the above mentioned outputs, the project contributed to environmental awareness raising through producing an educational comic book, posters and an audio visual CD on environment and natural resources protection. The materials have been shared with project stakeholders including the Afar regional education bureau, 9 woreda (district) offices and 105 schools in Afar. A total amount of 1,500 copies of the booklet and 1,000 copies of the posters were printed and 1,000 CDs copied.

3. Climate Impacts

The main climate change impact indicator of the project was reduction of fuel wood in the institutions participating in the project[8]. The results of the fuel wood reduction calculations based on the information collected in the base line study phase and later during the project are presented below.

Type of institution	**Daily reduction in fuel wood consumption (kg)**	**Annual CO_2 emission reduction (tCO2e) (direct calculations)**	**Annual CO_2 emission reduction (tCO2e) (CDM methodology AMS II)**
Schools	699	367,14	130,99
Universities	1 240	651,00	212,54
Prisons	504	264,60	88,45
	2 443	**1** 282**,74**	**431,98**

Table 1. Fire wood and GHG reduction gained through the project

The fuel wood reduction in schools is smaller than predicted in the beginning of the project. The main reason for that is that the daily cooking times in schools is shorter than estimated. The food delivered to schools is pre-cooked porridge flour that is stirred in boiling water and cooks in 10 minutes, so basically the cooks only use the fire wood for boiling the water once a day. The calculations in schools were also conducted only a few weeks after introducing the new stoves, so the cooks probably hadn't yet fully got accustomed to the new stove.

In universities and prisons the emission reduction is closer to the original estimations. In these institutions food is cooked several times a day, and it is prepared from the very beginning. The daily cooking times in these institutions are therefore much longer than in schools, and thus the benefits of Institutional Rocket Stoves (IRS) are more significant. The IRS holds the heat very well thanks to its well designed clay liner. Therefore the stove can be used for cooking multiple dishes in a row the need for additional fire wood being smaller in the later phases of the cooking period. When cooking with open fire, the need for fire wood remains the same even if the fire is kept on for a long period of time.

In universities the fuel wood consumption has kept reducing for several months after introducing the new stoves. In Adama University fire wood savings of up to 90% have been recorded once the cooks have had time to familiarise with the stoves and adapt the best ways to use it.

[8] For more detailed information on the climate impacts, please read the particular Carbon Study written by Gaia and ERG.

4. Development impacts

Children in the project schools spend approximately 50% less time collecting fire wood than before

The development impacts of the project seem to be exactly like anticipated in the project document. School children have to spend less time collecting wood, food can be cooked every day at schools as there is no shortage of fuel wood, universities have to spend less money on fire wood purchases, local environment degradation reduces thanks to smaller fire wood needs, and indoor pollution in institutional kitchens diminishes. The direct development impacts of the project are presented in more detail below. In addition to the direct impacts, the indirect development impacts of the project are multiple in size.

- Children in the project schools spend approximately 50% less time collecting fire wood than before.

- The Institutional Rocket Stoves installed in universities and prisons reduce their total fire wood consumption by 659 tons of fire wood annually, providing annual monetary savings of ETB 461 600 (EUR 20 400).

- The project activities reduce fire wood consumption by 855 tons annually. This equals to 28.5 hectares of natural forest in Ethiopia[9]. The woodland in Afar region is much poorer, and

[9] Food and Agriculture Organization of the United Nations, Global Forest Resource Assessment 2010, Country Report Ethiopia, FRA 2010/065, Rome 2010.

the annual reductions in wood consumption compared to Afar forest types would reach 104 hectares[10].

- According to a questionnaire conducted in the later phase of the project, 89.5 % of the cooks estimate indoor air pollutants have been reduced by 50 % or more after installation of the Institutional Rocket Stoves.

- New income opportunities are provided for 14 metal workers trained in stove production and business development.

5. Sustainability Impacts

Financial sustainability

The economic and financial sustainability of the project has been acceptable. The local stakeholders became very interested in the Institutional Rocket Stove, and it is anticipated that the market for IRS will grow especially within large institutions such as universities and prisons. Adama University has already started producing new stoves for its own use and to be sold to other institutions, while one prison already bought 5 additional stoves from a private stove producer, Marie Construction and Engineering Workshop. For the schools, the easiest way for scaling-up would be additional grant financing targeted to increase the amount of schools participating in the Food for Education Programme with energy efficient stoves.

Social sustainability

The project had the following social, institutional and gender equity related benefits during the monitoring period:

- School children have to spend less time collecting fire wood

[10] In Afar, natural vegetation is primarily woodland the stock of which is 8.2ton/ha

- Children don't skip school days due to lack of meals
- Cooks, who are mostly women, are less exposed to indoor air pollutants in institutional kitchens
- New IRS producers have been trained and they are capable of producing and promoting stoves in their home regions.
- Environmental awareness of school students and rural communities in Afar has been raised though producing and delivering environmental education booklets, posters and audio visual CDs.

The institutional capacity of local energy sector institutions to conduct similar projects is also expected to have grown during the project.

Environmental sustainability

The project contributed to environmental sustainability at many levels. At school level the greatest environmental benefits have been gained from the improved indoor air quality in school kitchens. The old fire places with open fire produced lots of smoke and indoor pollution, which affected cooks' health. The indoor air quality in school kitchens has improved significantly after installation of the new Institutional Rocket Stoves as the new stoves burn firewood better and very little smoke appears in the air. The cooks interviewed during the field trips and in the schools that have answered the project questionnaire have stated that the working conditions in kitchens have improved significantly thanks to the cleaner air.

At local, regional and national level, the project left unparalleled impression in school children, local communities, government officials and academia towards sustainable use of biomass fuels for cooking through the use of improved stoves. The project also contributed to the reduced stress on trees and forests and, thereby, indirectly improved watershed management in Afar, and helps the fight against *propopis juliflora* which is an alien and invasice species in Ethiopia.

On global level the project contributes to reduced CO_2 emissions form fuel wood burning. The project also contributed to environmental sustainability through improved watershed management including water and soil conservation and biodiversity conservation. The exact impacts on watershed management and soil conservation could not been monitored during the project.

6. Financial Report

The project has been very cost-effective. With the overall costs of 256.000€ the project designed and installed 256 stoves, achieved lasting improvements to environmental, social and economically sustainable development and offers a solid ground for up-scaling of similar efforts.

Of the overall costs, the Nordic Climate Facility of NDF financed 212.000€, Gaia Group Oy 23000€ and ERG 21000€. In addition, the project implementation partners, supporting organizations such as the Ministries have contributed significantly to the design, monitoring and coordination of the project.

The key areas of expenditures of the project were

Stove production and distribution	55.000€
Training of SMEs (stove producers)	23.000€
Environmental education	38.000€
Study on carbon impacts and carbon training	35.500€
Project Management and Coordination	91.500€
Admin, audit and tax	13.000€

For more detailed financial report, please contact Gaia Consulting Oy.

The cost effectiveness of the project was as good as originally planned. The social institutions targeted by this project cook with fuel wood. The options available for them are to continue with the existing practices, switch to commercial fuels such as kerosene or electricity or to implement energy efficiency.

Especially some of the participating universities have been very happy with the reductions in fuel wood consumption, as it brings significant economic savings to them. For example Adama University has already started producing new stoves for their own use and for further distribution.

7. Conclusions and recommendations

All main goals achieved on time

The project reached all its main goals. A total number of 256 Institutional Rocket Stoves were produced and installed, and other project activities proceeded as planned.

Collaboration between the project partners and stakeholders is the key

Active cooperation with the various project stakeholders has been very fruitful, and all key partners and stakeholders have expressed their wish to extend the project to a larger number of schools and other social institutions. Close involvement of the local authorities and education authorities in the project has been particularly vital for the success and sustainability of the project.

The cooperation between implementing partners Gaia and ERG has been the core asset of the project. Both organisations are private expert organisations with genuine capabilities, interests and incentives to provide innovative, high-quality and lasting sustainable solutions. Thereby the project management has been very effective and solutions-oriented and the project has enjoyed a significant support from the national and local partners.

Energy efficient cooking presents major potential for emission reduction

Promoting energy efficiency in cooking is one of the priority areas of the CRGE strategy and it has been identified as one of the four priority initiatives for fast-track implementation (the four priority initiatives of CRGE include exploiting the vast hydropower potential; large-scale promotion of advanced rural cooking technologies; efficiency improvements to the livestock value chain; and Reducing Emissions from Deforestation and Forest Degradation, REDD).

Energy efficient cooking presents major potential for emission reduction in Ethiopia and many other developing countries. The CRGE estimates the emission reduction potential from reduced demand for fuel wood through efficient stoves to some 35 Mt CO2e, while other advanced cooking and baking technologies (electric, biogas, and LPG stoves) could offer an additional combined emission reduction potential of more than 15 Mt CO2e.

Multi-benefits beyond emission reduction

The experiences in the Gaia and ERG Improved Cook Stove Project show that emission reduction benefits are only one part of the (usually) multiple benefits of energy efficient cooking / clean cooking solutions. Cooking with wood fuels causes health problems and inefficient cooking stoves and open fire expose women and girls for indoor air pollutants. Smoke from wood fires cause respiratory diseases responsible for up to 5% of total deaths in Ethiopia. It can also cause serious eye diseases for the cooks. Furthermore, collection of wood fuel supplies to resource degradation as more than 50% of woody biomass consumption in Ethiopia origins from unsustainable sources. The rapid forest degradation increases soil erosion, reduces water resources and increases vulnerability of communities to natural climate variability and to the consequences of climate change.

Today, nearly thirteen million households obtain their wood fuels by collection in Ethiopia. Households, primarily women and girls, spend approximately 8-10 hours collecting firewood per week.

Emission reduction potential in the residential sector

The residential sector is the single most important energy consuming sector in Ethiopia. It accounts for more than 80% of the total energy consumed in the country and is responsible for more than 95% of the total biomass energy consumed nationally. The majority of households use biomass fuels and the residential sector consumes approximately 62 million tons of fire wood annually. Currently, less than 10% of households use improved cook stoves. Based on conservative assumptions, following stepwise introduction of stoves in the residential sector, annual emission reduction would reach over 3 million tCO2e in year five.

Improved cook stoves in social institutions offer significant cost savings

Currently there are approximately 1500 social institutions (schools, colleges, universities and prisons) serving food for 1 million people daily in Ethiopia. Most of institutional kitchens use open fire or unimproved stoves causing energy losses of up to 90% and increased risk for respiratory health problems for kitchen workers. Approximately 1 000 000 customers are fed in institutional kitchens daily of which 60% are school children in the WFP School Feeding Program. The annual

consumption of wood for cooking in the social institutions is estimated at 33 000 tons. An Institutional Rocket Stove (IRS) programme could potentially address about 80% of the total demand for cooking in social institutions. Introduction of the IRS in all the institutions could reduce wood consumption by approximately half gaining 12 000 tons reduction in wood consumption annually.

Emission reduction potential in social institutions is also significant, but considerably lower than in residential sector. Based on conservative assumptions, following stepwise introduction of stoves in the social sector, annual emission reduction would be in the range of < 10 000 tCO2e in year five.

Today, there are only 400-500 fuel efficient cook stoves at the social institutions altogether. There is a need for 6000 energy efficient institutional stoves in the public sector social institutions. For most of the social institutions, improved cook stoves would generate significant costs savings. Given the assumptions for a national improved cook stove programme in the social institutions, savings through reduced fire wood consumption could exceed 450 000 EUR. Evidently, an improved cook stove programme in the social institutions could be very effective in bringing multiple benefits.

National commitment lays strong foundation for progressive work on improved cook stoves

There are still several barriers to be overcome in Ethiopia in order to successfully implement the up-scaling. However, a strong national vision and commitment provides a good basis to address barriers related to e.g. quality development (R&D), standardisation, manufacturing up-scale and monitoring evidence of positive impacts, which all are necessary to build awareness, demand and high quality supply for energy efficient stove..[11] Difficulties for various customers and consumers to cover the higher initial cost of clean cookstoves must also be addressed simultaneously.

Climate funding for improved cook stoves

With regards to funding opportunities, climate funding may serve as an additional layer to fund these priority measures in promoting energy efficient cooking. However, the up-scaling initiatives should be carefully prepared, taking note of the preliminary experiences of Programmatic CDM Activities for energy efficient stoves in Asia (in particular in Bangladesh), Latin America (Mexico, El Salvador, Guatemala) as well as Africa (South Africa, Nigeria, Kenya, Congo DR, Côte d'Ivoire, Zambia, Ghana). The country and region specific conditions for fulfilling the CDM criteria should be carefully studied in order to ensure that the funding of initiatives is based on realistic expectations of any additional market based carbon revenues (be it CERs or VERs). In particular the related additionality requirements, technology suitability and sustainability should be studied.

While in many cases the multiple benefits (if properly monetized) of the introduction of energy efficient stoves outweigh the direct investment cost of up-scaling, CDM revenues could under certain conditions add important contributions towards financing such activities. Particularly CDM

[11] Most of these challenges are universal. See *Igniting Change: A Strategy for Universal Adoption of Clean Cookstoves and Fuels*. Global Alliance for Clean Cookstoves. November 2011.

Programmes of Activities could provide an opportune approach to improved cook stoves programme in residential sector, whereas at schools the carbon revenue per school is likely insignificant.

The climate funding options for up-scaling could consist of various components and mixes of climate funding opportunities such as i) multilateral or bilateral grants primarily for project setup, capacity building, technology development, and dissemination, ii) multilateral or bilateral pay-for-performance deals, i.e., payments linked to verified GHG abatement, or iii) various trading schemes or offset markets, i.e., emission reduction, for example resulting from Clean Development Mechanisms (CDMs), sold to companies (in ETS) or committed countries (cap and trade) or via voluntary carbon markets.

Arguments for up-scaling are clear

Our project - GHG Mitigation and Sustainable Development through the Promotion of Energy Efficient Cooking in Social Institutions in Ethiopia – has generated multiple benefits and further strengthens the case for up-scaling . The experiences from this particular project are also concurrent with the global experiences, and highlight the need to approach up-scaling in a comprehensive manner if a massive roll-out of energy efficient cooking solutions are to be successfully and sustainably realized in Ethiopia. This would require addressing technological aspects, financing aspects, awareness and cultural aspects as well as environmental considerations in an innovative, coordinated and holistic manner.