Fuelwood-Efficient Stoves Investment Plan 2012-2015

FINAL VERSION

Content

Abbreviations

BAU – Business as usual

CDM – Clean Development Mechanism

CDM EB – Clean Development Mechanism Executive Board

CER – Certified Emission Reductions

CRGE – Climate-resilient Green Economy

CO_2 – Carbon Dioxide

CPA – CDM Programme Activity Design Document

DA – Development Agent

FES – Fuelwood-efficient stove

GE – Green Economy

GHG – Greenhouse gas

GoE – Government of Ethiopia

GTP – Growth and Transformation Plan

KPI – Key Performance Indicator

MoA – Ministry of Agriculture

MDG – Millennium Development Goal

MRV − Measurement, reporting and verification

Mt − Megatonnes

NAMA – National Appropriate Mitigation Actions

MoWE – Ministry of Water and Energy

PDD – Project Design Document

PoA – Programme of Activities

R&D – Research and Development

RCT – Randomized Control Trial

REDD – Reducing emissions from deforestation and degradation

STC – Sub-Technical Committee

UNFCCC – United Nations Framework Convention on Climate Change

USD – US dollar

Technical note

This investment plan is derived based on the data and sources of information available to the fuelwood-efficient stoves taskforce until December 2011. While information on project roll-out is provided and deemed realistic, this is necessarily subject to the availability of funding and other resources in a given time period.

The assessment of activities and expenditures was conducted on a federal level and describes the strategic approach for all regions. However, the specific nature of activities and associated expenditures will differ by regions based on their starting positions with respect to institutions, infrastructure, and prior experience with stove programmes as well as cultural habits. Hence, projects that implement parts of the programme outlined in this investment plan will have to detail activities and expenditures based on the local implementation context.

The funding need identified is estimated based on current prices and production technologies. It is therefore likely that the actual funding need will slightly differ from the figures quoted in this investment plan.

A. General Information

This investment plan assesses the funding needs and describes the implementation approach to realize the fuelwood-efficient stove initiative that is part of Ethiopia's Green Economy strategy. It has been developed by a task force at the Ministry of Water and Energy and sets the strategic direction for Ethiopia's future national stove programme. It is intended to serve potential investors as guideline for developing project proposals that focus on the implementation of specific parts of this programme.

This chapter gives an overview on the specific purpose and content of the investment plan as well as important contact information to engage in more detailed discussion on possible projects.

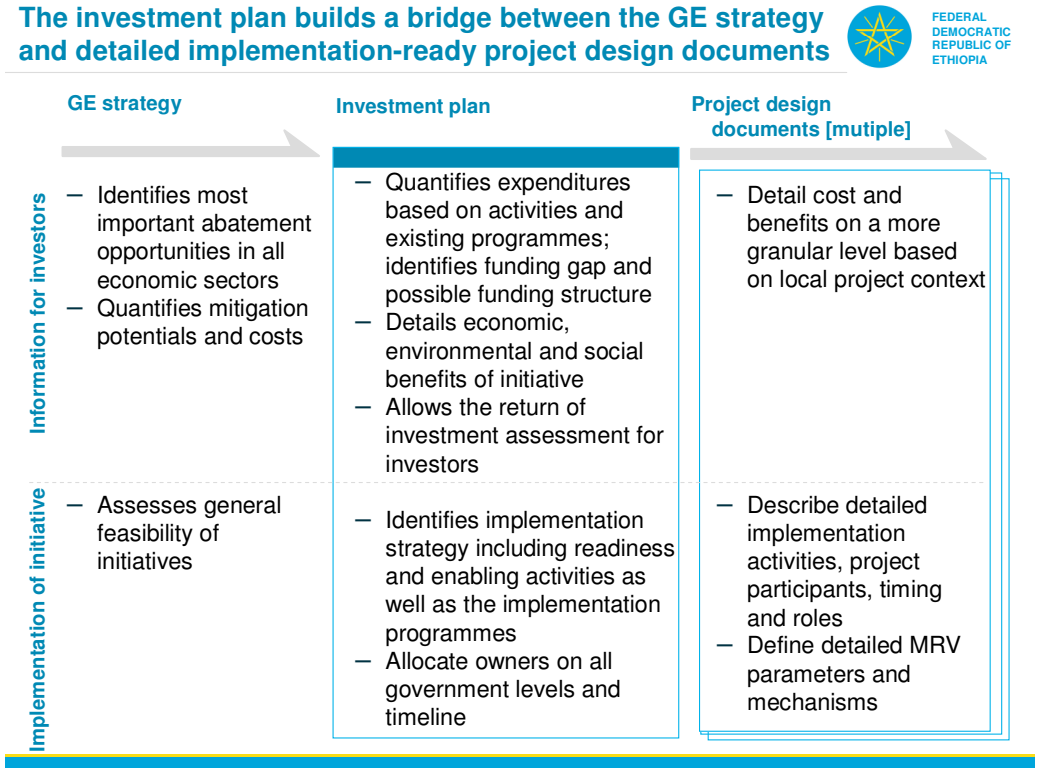
1. PURPOSE OF THIS DOCUMENT

The Government of Ethiopia has endorsed its Green Economy strategy in 2011. The strategy aims to build a sustainable economy ('Green Economy') that will also help realise the country's ambition of reaching middle-income status before 2025 in a resource efficient way.

The process to develop a Green Economy (GE) plan, from its strategic conception to readiness for implementation, contains three major steps (Exhibit 1):

- **Step 1: Defining the GE strategy at federal level**. As part of the Climate-Resilient Green Economy (CRGE) initiative, the Government of Ethiopia (GoE) has outlined a strategy to build its Green Economy. The initiative follows a sectoral approach and has so far identified and prioritised more than 60 initiatives, which could help the country achieve its economic and social development goals while limiting 2030 greenhouse gas (GHG) emissions.
- **Step 2: Developing an investment plan for each initiative.** Based on the description of initiatives in the GE strategy, an investment plan is an essential step in moving an initiative of the GE strategy towards implementation by providing all relevant information for potential investors (e.g., expenditures, return on investment) and describing crucial activities for future implementation at federal, regional and local government level.
- **Step 3: Developing Project Design Documents (PDDs) for implementation of projects.** During the creation of a PDD, more problem solving will be required to elaborate specific implementation details (e.g., concrete timeline, responsibilities) and to adapt the main activities to local particularities using the key processes, work packages, and responsibilities identified in this investment plan as a guide. The PDDs will take into account and build on activities of existing programmes.

EXHIBIT 1



Focusing on step 2, building on the initiatives identified for Ethiopia's GE strategy (GoE 2011), this investment plan at hand serves two purposes (Exhibit 1):

- **Investment assessment**:
  - **Clarity on necessary expenditures**. For the activities identified, this investment plan quantifies bottom-up additional expenditures – i.e., spending in addition to business-as-usual expenditures – to achieve the targeted distribution of 9 million stoves by 2015. It also gives an outlook on expenditures between 2016 and 2030. The investment plan also provides an overview on the split of these expenditures at different government levels. Furthermore, the review gives an overview of the required human, technical, and financial resources.
  - **Funding and information for investors**. In chapter 3, this investment plan suggests a possible funding structure to cover the expenditures for the stove scale-up programme and specifies the benefits in return, which encompass CO_2 mitigation potential and economic and social returns. Furthermore, it outlines working packages that can be financed by investors/international development partners and defines the types of funding required.
- **Preparation of future implementation**:
  - **Problem solving and implementation**. This investment plan gives a holistic assessment of the activities required at different government levels to achieve the target and overcome the challenges experienced in existing programmes. Based on a review of current activities, it outlines how current efforts have to be improved and which additional actions are required. Necessary actions are

bundled into improvement programmes along the entire value chain of stove production, and owners of these activities are assigned.

- **Holistic transformation strategy**. Finally, this investment plan refines the government target for stove distribution until 2015, building on the Green Economy target as defined in the GE strategy. It details the stove technology used, annual roll-out rate, and necessary coverage on a woreda level. This will facilitate the setting of verifiable targets for regions and improve the effectiveness of the planning of distribution efforts.

Potential investors are invited to contact the GoE to discuss and agree on specific ways to support the fuelwood-efficient stove initiative and develop PDDs based on this investment plan.

2. PRINCIPLES OF THIS INVESTMENT PLAN

This investment plan has been developed in accordance with the following key principles:

- Develop an integrated strategy that sets a direction for all future stove projects
- Ensure the broad involvement of all regions and woredas from the start
- Leverage existing institutional infrastructure where possible
- Build on national and international best practices
- Foster private market activities where possible
- Involve local stakeholders.

3. CONTACT INFORMATION

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4. CONTRIBUTORS

This investment plan was developed by a task force at the Ministry of Water and Energy in cooperation with regional energy departments. McKinsey & Company has provided analytical support throughout the process.

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B. Executive summary

Background and motivation – In order to develop a Climate-Resilient Green Economy (CRGE), the GoE has identified the deployment of fuelwood-efficient and fuel-shift stoves as one of the immediate priorities. Accelerating this deployment has environmental, economic and social benefits. First, it can help reduce the consumption of fuelwood – by far the largest source of rural energy – and decrease GHG emissions related to forest degradation by 51 Mt CO_2e annually in 2030 or about 20% of the total abatement potential identified. Second, in addition to this environmental impact, efficient stoves can increase disposable rural household income by up to 10% through savings on fuelwood consumption. Third, it has the potential to create a stove industry worth USD 15 million in GDP in 2015. Finally, it will improve livelihood of Ethiopians, especially health conditions for women and children, by reducing indoor air pollution significantly, increase gender equality by freeing up time spent on fuelwood collection, and provide commercial opportunities for local entrepreneurs in poor rural areas. (Chapter 1)

Aspiration and focus of this initiative – The GoE's green economy target for the efficient stove initiative detailed in this investment plan has two horizons: (i) in the long term (2030) deploying 31 million fuelwood-efficient stoves in rural and urban areas, and (ii) in the short term (2015), 9 million stoves in rural areas. The focus on fuelwood-efficient stoves (as opposed to stoves using other type of fuels) was chosen because increasing their distribution in rural areas offers the highest potential of all advanced cooking technologies, accounting for around 65% of the overall mitigation potential of improved stoves in 2030. A separate investment plan that focuses on the distribution of stoves in urban areas, encompassing fuel-shift stoves, will be developed in 2012.

The mid- and long-term purpose of the stove initiative is to establish an economically and socially sustainable market for stoves. However, rural areas do not yet provide an economically viable market environment for private producers of fuelwood-efficient stoves. Besides a weak demand side, producers face challenges in accessing capital and knowledge about production and promotion strategies. Thus, based on the analysis of current public and private activities, this investment plan suggests improvement programmes to overcome current market imperfections and unleash private sector activities, including at SME level. (Section 2.1 and 2.2)

Assessment of current context - An assessment of current programmes reveals the following situation. In addition to the already existing capacity for distributing 2 million high-efficiency stoves by 2015, nearly 7 million additional stoves will have to be produced and distributed between 2012 and 2015. This investment plan describes how to achieve the GoE's 9 million stoves target by improving activities across the entire value chain of stove production and bundles these activities in improvement programmes. (Section 2.3)

EXHIBIT 2

Improvement programmes will be implemented through projects on federal, regional and woreda level

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Improvement programmes and main activities		Main responsibility/ Number of projects	Additional funding required 2012-2015 In USD million
Readiness	▪Enhance institutional capabilities ▪Define cooperation procedures and guidelines ▪Build IT and transport infrastructure ▪Define MRV mechanisms and processes ▪Improve R&D facilities	**AETPD Directorate** 1 project centrally managed on federal level	12
Productivity Improvement of stove production	▪Provide loans to rural cooperatives ▪Design and conduct training programmes for cooperatives on production and business ▪Support mid- and large scale urban producers to produce lowest cost	**AETPD Directorate/ Regional Energy Departments** 1 project in every region	8.6 [for all regions]
Promotion & distribution improvement	▪Create distribution channels for stoves produced in rural areas ▪Increase awareness of non-economic benefits of high-efficiency stoves in rural areas ▪Introduce smart subsidies in non-viable market environments	**Regional Energy Departments/ Woreda energy experts** 1 project in every region, sub-projects in woredas	8.3 (+7.3 in subsidies) [for all regions]
CDM pilot projects	▪Develop detailed baseline for stove usage ▪Improve quality control of stove production ▪Verification system for emission reductions	**AETPD Directorate/ Woreda energy experts** 4 CDM projects in a first piloting phase	0.3

Implementation approach, institutional set-up and MRV – Four programmes have been identified as critical across the stove production value chain to overcome challenges in distributing 9 million high-efficiency fuelwood stoves in rural areas by 2015 and to overcome current market imperfections (Exhibit 2). All four programmes make use of existing government infrastructure and build on current distribution efforts (detailed description of activities in section 2.4):

- The **readiness programme** will put in place the necessary technical and institutional enablers to improve the coordination and planning of stove distribution efforts across all government levels. This encompasses an enhancement of personnel in federal, regional, and local government offices (in total around 300 new employees), the build-up of an IT infrastructure for improved communication and data exchange, the definition of procedures and guidelines for the cooperation of governmental and non-governmental stakeholders, the provision of measurement, reporting, and verification (MRV) procedures to track stove distribution, and the improvement of research and development (R&D) facilities.
- The **productivity improvement programme** will help to create a viable private sector stove industry that uses modern production equipment to manufacture high-efficiency baking and cooking stoves. The productivity of stove manufacturers can be improved significantly by providing loans and trainings to cooperatives of producers in rural areas instead of individual producers. Rural cooperatives will be given access to soft loans to purchase modern production equipment and will receive appropriate training as part of this programme to jump-start their production of baking stoves that can be produced with locally

available material. At the same time, providing investment capital to some mid- to large-scale producers in urban areas will allow to mass-produce large amounts of metal parts for cooking stoves. These metal parts can be delivered to rural areas where they are finally assembled by local producers. This will reduce the price of stoves and increase the quality of stoves produced.

- The **promotion and distribution improvement programme** will help to increase awareness and availability of stoves in rural areas, since cooperatives of rural producers do not have the capability to do so. The programme will orchestrate a joint approach with Development Agents (DAs) of the extension programmes of the Ministry of Agriculture (MoA) and the Ministry of Health (MoH) to increase knowledge in rural households about various benefits of stoves. To this end, DAs will be trained by energy experts on woreda level and equipped with promotional material in order to communicate the economic and health benefits of high-efficiency stoves. Furthermore, based on the existing infrastructure of the agricultural extension programme, local distribution and training points for stove users will be set up (for example, in existing farmer training centres) that can also be used by private producers as outlet for their stoves. At the same time, an adequate level of subsidies for stoves has to be determined in each woreda to increase the affordability of stoves for poor households. The exact amount depends on the local availability of free fuelwood to households and purchasing power in rural areas (historically, the level of subsidies has been around 20% of the stove price). Upgrading both production and promotion in a woreda will allow the penetration rate of fuelwood-efficient stoves in rural households to increase to up to 80%. In order to achieve the 9 million target by 2015, a total of 350 woredas (out of 718 on a national level) need to be part of the operational improvement activities.
- **CDM pilot projects** will be conducted to establish access to carbon markets. Mobilising carbon credits with the help of CDM projects could deliver substantial financial resources and enable the self-sustained financing of stove distribution in the medium and long term from 2015 onwards. Strict MRV mechanisms, which are required to access carbon markets, will be piloted in a small number of woredas from 2012 onwards in the context of the carbon market. The creation of suitable MRV mechanisms includes the development of baselining methodology and procedures to verify emissions reductions at household level that adhere to the UNFCCC requirements.

Central coordination of all programmes will be led by the **Alternative Energy Technology Promotion & Dissemination** (AETPD) Directorate of the Ministry of Water and Energy (MoWE). The AETPD will set up a programme coordination bureau in the Directorate. This bureau will be responsible for managing relations to governmental and non-governmental stakeholders, planning the national roll-out, supervising Research and Development efforts, and disseminating knowledge/training material. It will work in close alignment with the Environmental Unit of the MoWE that forms the link to the CRGE initiative. Furthermore, the AETPD Directorate already coordinates activities in Regional Energy Departments that are responsible for local implementation of the productivity and promotion improvement programme. (Section 2.6)

MRV mechanisms to track the success of the programmes will encompass three levels of granularity to track the key parameters 'number of stoves distributed' and 'emission reductions realised'. On the first level, the programme bureau will oversee regional household surveys to compile the penetration rate of different stove technologies in households. This will enable the compilation of a rough baseline of the types of stoves used in different regions. On the second level, the programme bureau will establish a system to monitor the number of stoves sold. Data collected by energy experts on woreda level will deliver a more granular picture of the stoves distributed in all woredas. With the help of an online database, these numbers will be kept up-to-date and available to all project participants. On the third level, usage of stoves and emissions savings will be measured at household level. To this end, energy experts in a woreda will conduct household visits. This final step is required for CDM projects and will not be necessary in all woredas. (Section 2.7)

EXHIBIT 3

Funding of additional expenditure of USD 40 mn between 2012 and 2015 will rely up to 90% on grants

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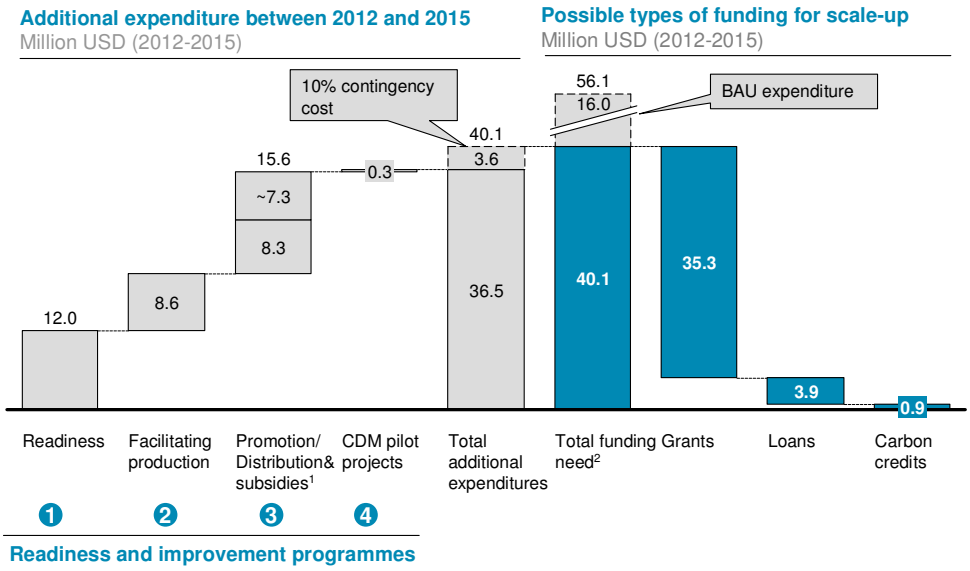

1 Specific amount of subsidies depends on situation in woredas; 20% assumed average for subsidies in poor rural areas based on historic experience
2 Based on historic data, funding of planned programmes in BAU amounts to USD 16 million over the next 4 years

Expenditures, sources of funding, and return on investment – Overall expenditures[1] to conduct the scale-up programme add up to USD 56 million between 2012 and 2015, of which nearly USD 40 million is additional to funding to continue existing public and private programmes in a BAU scenario.[2]

[1] If not indicated otherwise, the term expenditure summarises cash-flow based capital expenditures (Capex) and operational expenditures (Opex).

[2] Between 2016 and 2030, projected additional expenditures of approximately USD 200 million will be required to distribute a total of 125 million stoves (including replacements for old stoves, given that stoves are assumed to have an average service life of 2.5 years (baking stoves) and 4.5 years (cooking stoves)). The distribution of a total of 125 million stoves is necessary in order to have 31 million stoves operating in rural areas by 2030 to achieve the targeted GHG emissions reduction.

Type of funding	**Total amount between 2012 and 2015** in USD million	**Important returns for investors**
Grants	35.3	▪ Total abatement potential of 14 Mt CO_2e between 2012 and 2015 (~USD 2.5 per tonne mitigated) ▪ Contribution to 7 of the UN Millennium Development Goals. Amongst others: avoidance of approximately 1,000 to 2,000 deaths per year due to indoor air pollution ▪ Creation of over 300 jobs in the public sector ▪ Average GDP added of USD 10 million annually (~USD 40 million between 2012 and 2015; ODA rate of return of 1.2)
Loans	3.9	▪ Start-up financing for entrepreneurs especially in rural areas; direct creation of 5,000 jobs in local producer cooperatives ▪ Soft loans with an interest rate of 4 to 8%, 2 years until return
Carbon revenues	0.9	▪ Potential revenues of USD 10 per tonne of CO2e avoided

Table 1 Overview of additional funding needs and potential returns from distribution of fuelwood-efficient stoves between 2012 and 2015

The additional USD 40 million required between 2012 and 2015 consists of the following components[3] (Exhibit 3): the readiness programme will incur costs of USD 12 million, mainly for additional personnel and technical equipment, involving all regions and over 700 woredas right from the start of the programme. The productivity improvement programme to support stove production facilities will require USD 8.6 million. To improve the promotion and distribution of stoves, another USD 8.3 million will be needed to involve 350 woredas by 2015. Subsidies for stoves could add up to another USD 7.3 million, depending on the specific needs for subsidies in rural areas in different woredas. The exact amount of subsidies will be determined with the help of an evaluation scheme based on randomised control trials as part of the readiness programme and is planned to start 2012. Finally, a contingency cost of 10% of all funding requirements was added to the overall funding need (USD 3.6 million). (Section 3.1)

While a significant share of the funding needed between 2016 and 2030 can potentially be covered by revenues from carbon credits and via revolving loans, 90% of the funding between 2012 and 2015 will rely on grants to support the set-up of critical institutional and technical enablers. Loans have to be provided to stove

3 Numbers represent real expenditures for conducting the programme, but do not include administrative costs for developing PDDs or managing grants on the part of development partners.

producers to enable them to set up production facilities with modern technical equipment. Due to complex MRV requirements and thus a long ramp-up time, revenues until 2015 will be limited. Before 2015, only about 1% of funds can be provided with the help of revenues from carbon credits. (Section 3.2)

Investors and development partners engaging in the fuelwood-efficient stove initiative will unlock significant environmental, social and economic returns:

- **Environmental benefits:** Significant savings on GHG emissions of around 14 Mt CO_2e can be achieved between 2012 and 2015 (corresponding to approximately 8 Mt of wood), resulting in costs of less than USD 3 per tonne CO_2 mitigated. In addition further benefits can be obtained.
- **Health benefits:** Fuelwood-efficient stoves dramatically reduces health risks by reducing toxic indoor smoke. An estimated 1,000 to 2,000 deaths per year due to indoor pollution could thus be avoided.
- **Social benefits:** The programme contributes to 7 out of the 10 Millennium Development Goals of the United Nations. For example, freeing up time now spent on fuelwood collection by children and women is expected to improve universal primary education and gender equality will improve**.**
- **Economic benefits:** The programme will create 5,000 private sector jobs largely in rural areas by installing new production capacity in the form of producer cooperatives. This is in line with the government's Growth and Transformation Plan (GTP) target of creating job opportunities especially in rural areas.

Policies to secure the supply of sustainable fuelwood for rural areas with high fuelwood demand will be elaborated in close alignment with initiatives in the REDD sector. In addition, based on the sequencing of the roll-out of stoves, this investment plan will enable the definition of specific deployment targets at the regional level. The national target for stove distribution in the GTP can thereby be refined and broken down, which will help to improve the enforcement of stove distribution in all regions. (Section 4.2)

Work packages and next steps – The improvement programmes described above have to be translated into projects that can be financed and implemented with the help of development partners. For each project, a PDD has to be developed that will build on the main activities described in this investment plan, but reflect the local peculiarities of the implementation environment. (Chapter 4)

Implementation for all programmes is planned to start in 2012. To develop a PDD the following steps will be necessary in the four improvement programme areas:

- The **readiness programme** will be centrally planned and coordinated by the AETPD Directorate at the MoWE. It is meant to be conducted as a single project and to start in early 2012 by setting up a programme coordination bureau. In the context of a PDD, a more detailed schedule has to be developed for the roll-out of capability-building efforts at the regional and local government levels, taking into account the current level of capabilities in different regions.
- The **productivity improvement programme** strives to enhance the execution of stove production and promotion in rural areas. A revolving fund has to be set-up

to support rural cooperatives and urban producers. Based on experience in prior projects, disbursement of the fund itself will be managed by the Regional Energy Departments. The interest rate for loans and selection criteria for producers have to be discussed with development partners for a PDD. A productivity programme taking into account the specific local context will have to be developed for every region. However, alignment of regional approaches is ensured by the AETPD Directorate on federal level.

- For projects that are part of the **promotion and distribution programme**, the current status of cooperation with extension programmes of the MoA and MoH in different regions has to be taken into account. Also, the current level of engagement by private and public institutions in promotional activities is important for planning specific improvements (i.e., already existing efforts like regular market demonstrations). A decision about the stove subsidy level will depend on local circumstances (access to free fuelwood, income level).
  A promotion and distribution programme taking into account the specific local context will have to be developed for every region. However, alignment of regional approaches is ensured by the AETPD Directorate on federal level.
- Because of the very limited experience with **CDM projects**, the GoE plans to test the feasibility of stove CDM projects in four pilot woredas, starting as early as 2012. The GoE acknowledges the request of project developers to apply for small-scale CDM projects on a national level, but wants to limit the activities of each project to a specific region to facilitate the comparison of results and help to avoid double counting. Central supervision of all CDM projects takes place on federal level by the AETPD Directorate.
  As soon as the woredas have been selected, the development partner and AETPD programme bureau should work together to produce a PDD adhering to UNFCCC standards. The PDD has to encompass a baselining methodology and should leverage existing data on stove usage and the planned verification method for emission reductions. In light of the complex MRV requirements, the implementation of CDM pilot projects has to be conducted and supervised on a daily basis by energy experts in woredas. Project developers are asked to contact the GoE to jointly select appropriate woredas for the development of a PDD.

Potential investors are invited to contact the experts at the MoWE and EPA listed in section A.2 of this document to discuss and agree on specific support for the fuelwood-efficient stove initiative before they develop a project proposal.

1. Background and Motivation

As part of its Climate-Resilient Green Economy (CRGE) strategy, the Government of Ethiopia has identified fuelwood-efficient stoves as one of the Green Economy initiatives for fast-track implementation. Within the CRGE strategy, the scale-up of the usage of fuelwood-efficient stoves in rural areas offers the largest share (65%) of the total CO_2e abatement projected for the improved stoves initiative overall, which consists of both fuelwood-efficient and alternative-fuel stoves. The initial focus on stoves as a priority initiative of the GE strategy is motivated by the expectation that it will have wider socio-economic benefits as it will reduce indoor air pollution from open fires and save time previously spent on gathering fuelwood for the country's predominantly rural population.

This section briefly explains how the stove initiative fits within the CRGE strategy and describes the scope and purpose of a shift to high-efficiency stove technology to provide rural energy in Ethiopia.

1.1 INTRODUCTION TO THE CRGE

Ethiopia is committed to overcoming poverty with the help of economic development activities that combine gains in material wealth with gains in environmental sustainability. For this purpose, the Government of Ethiopia has established the CRGE strategy. The strategy aims to protect the country against the adverse effects of climate change ('climate resilience') and to build a sustainable economy ('green economy') that will help realise the country's ambition of reaching middle-income status before 2025.

Following a conventional economic development path would have adverse effects, including a sharp increase in GHG emissions and unsustainable use of Ethiopia's natural resources. To avoid such effects, seven sectoral teams involving more than 50 experts from more than 20 leading government institutions analysed the opportunities for a green and more resource-efficient development path: the green economy strategy. In a parallel effort, the government is in the process of identifying climate-resilience preferences, which will – together with the GE strategy – be consolidated at a later stage to form one fully integrated CRGE strategy.

Ethiopia's strategy to build its green economy has prioritised more than 60 initiatives based on their ability to help the country achieve its socio-economic development goals while limiting GHG emissions in 2030 to around today's 150 Mt CO_2e. The GE initiatives are grouped into four sectoral pillars:

1. **Agriculture**. Improving crop and livestock practices for higher food security and farmer income while reducing emissions
2. **Forestry**. Protecting and re-establishing forests as carbon stocks
3. **Electric power**. Expanding renewable power generation for domestic and regional markets

4. **Infrastructure and industry**. "Leapfrogging" to modern and energy-efficient technologies in transport, industrial sectors, and buildings, avoiding problems associated with adopting practices known to be inefficient and polluting.

The efficient stoves initiative is part of pillar 2, as it will reduce forest degradation. Implementing the GE strategy will allow Ethiopia to contribute to the global climate effort. Full realisation of all of the initiatives would essentially mean carbon-neutral development. Ethiopia would abate around 250 Mt CO_2e in 2030 – this equals a decrease in GHG emissions of up to 65% compared to a business-as-usual approach in 2030 – while the economic growth components of the initiatives would enable Ethiopia to reach middle-income status before 2025.

For 80% of the initiatives, abatement costs are less than USD 10 per t CO_2e.[4] Many of them offer positive economic returns on investments, thus directly promoting economic growth and creating additional jobs with high value-added. Implementing the initiatives also offers wider benefits. For example, they would improve public health, through better air and water quality, and would promote rural economic development by increasing soil fertility and food security.

As financial and human resources are limited, the Government of Ethiopia has meanwhile evaluated the 60 prioritised initiatives and drawn up a short-list of the top initiatives for each of the four pillars that will have the highest overall beneficial impact. From this set of about 15 initiatives, the Government has selected achieving **rapid replacement of traditional cooking fires and stoves with modern fuelwood-efficient stoves in rural areas** as one of three initiatives for fast-track implementation. The other two fast-track initiatives are exploiting Ethiopia's vast hydropower potential and improving efficiency along the livestock value chain. Analysis shows that these three initiatives have the best chances of promoting growth immediately, capturing large abatement potentials, strengthening Ethiopia's leading role in sustainable growth, and attracting climate finance for their implementation.

1.2 PURPOSE OF THE FUELWOOD-EFFICIENT STOVE INITIATIVE

Rural residential cooking and baking are a major driver of rural energy demand, accounting for 72% of rural energy use, 88% of which is generated by fuelwood (Exhibit 4). Fuelwood consumption is the single largest source of GHG emissions in Ethiopia. In 2010, this source caused nearly 17% of Ethiopia's GHG emissions.

4 USD 10 per t equals roughly the lower range of the price of carbon credits under the European Trading Scheme in 2011.

EXHIBIT 4

Most of residential use of fuel is woody biomass for cooking – making efficient stoves the key lever

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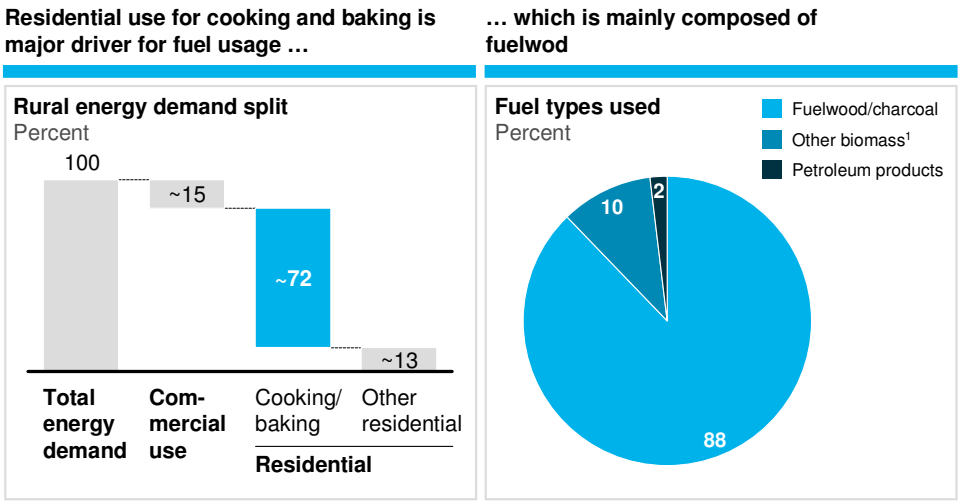

1 Mainly agricultural residues
Source: EEPCo; GIZ; MoWE

As most households, particularly in rural areas, use highly energy-inefficient open fires or three-stone hearths, the improvement potential is huge. The dissemination of technologies that reduce fuelwood consumption offers both environmental and socio-economic benefits.

1.3 ENVIRONMENTAL APPRAISAL

Introducing efficient stoves has two distinct effects on GHG emissions. First of all, it should reduce forest degradation by saving around 0.9 t biomass/year per household in woody biomass that is not cut. Secondly, woody biomass acts as carbon sink. This means Ethiopia's forestry sector can even yield negative emissions via sequestration, i.e., storage of carbon in the form of wood, at a level that surpasses emissions from deforestation and forest degradation. This sink or savings effect is projected to amount to 2.2 t/year per household.[5]

Of the 15 initiatives given priority as part of Ethiopia's CRGE strategy, shifting to fuelwood-efficient or alternative-fuel stoves − 'efficient stoves' − offers the highest overall potential to reduce GHG emissions: an estimated 34 Mt CO_2e (fuelwood-efficient stoves only) and as much as 51 Mt annually by 2030 when alternative-fuel stoves and fuelwood from regenerated plantations are included, or about 20% of Ethiopia's projected total abatement potential.

[5] Assuming two stoves per household. A detailed description of the calculation can be found in the Appendix

1.4 ECONOMIC AND SOCIAL APPRAISAL

Scaling up the use of efficient stoves will not only reduce emissions. It also offers significant additional benefits with respect to the economic development of households, job creation, and better health, safety, and social conditions. Overall, deployment of efficient stoves helps to address at least seven of the ten Millennium Development Goals (MDGs) of the United Nations[6].

1. **Increased disposable income** by halving household expenditure on fuelwood and creating jobs. If 9 million efficient stoves can reach around 4.5 million households (assuming one stove for cooking and one for baking) by 2015, this will increase disposable household income by an average of USD 60 per year for fuelwood-purchasing households and save significant time for fuelwood-collecting households. The total opportunity costs add up to USD 270 million in 2015, thereby helping to reduce poverty (MDG 1)[7]. The scale-up of efficient stoves is also expected to create a manufacturing and service industry worth USD 15 million in gross domestic product (GDP) by 2015 and create jobs in rural areas.
2. **Healthier and safer working/living conditions**. Efficient stoves burn cleaner than the traditional open or three-stone fires, thereby reducing toxic smoke and indoor air pollution estimated to cause more than 50,000 deaths and a significant number of cases of respiratory diseases in Ethiopia a year (WHO 2006). The use of efficient stoves also leads to a reduction of unhealthy burnt food, burns to household members, and other injuries, e.g., when gathering wood (e.g., snake bites, overloading, and violence). Efficient stoves also promote better nutrition, which, along with more free time, increases learning capacities. Stoves therefore help to reduce child mortality, improve maternal health, and combat diseases (MDG 4, 5, and 6).
3. **Time savings**, enabling education and fostering greater gender equality. Fuelwood-efficient stoves especially foster children's ability to attend to school (MDG 2) and promote gender equality (MDG 3) by reducing the amount of time women and children spend on collecting fuelwood. Traditional fires or stoves require laborious gathering or buying of fuelwood or charcoal, a task that traditionally falls to women and children. Efficient stoves thus also help to improve school attendance by children who would otherwise spend time on collecting fuelwood.

Finally, most of the levers aiming at reducing forest degradation by shifting to more efficient stove technologies are profitable investments from a societal perspective: the benefits (mostly reduced costs for purchasing or collecting fuelwood) surpass the cost of implementing and operating these technologies.[8]

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6 Since this section focuses on economic and social benefits, "Ensuring environmental sustainability" by mitigating greenhouse gas emissions (MDG 7) is not specifically listed

7 This calculation assumes that households that collect fuelwood bear opportunity costs due to time for collection and diseases or injuries directly related to collection (e.g., snakebites) that are worth the money saved on buying fuelwood (see WHO 2006).

8 One exception to this currently are LPG stoves as the technology and fuel cost required by far surpass the savings from reduced fuelwood consumption. The spread of LPG stoves has therefore been postponed to 2015 onwards.

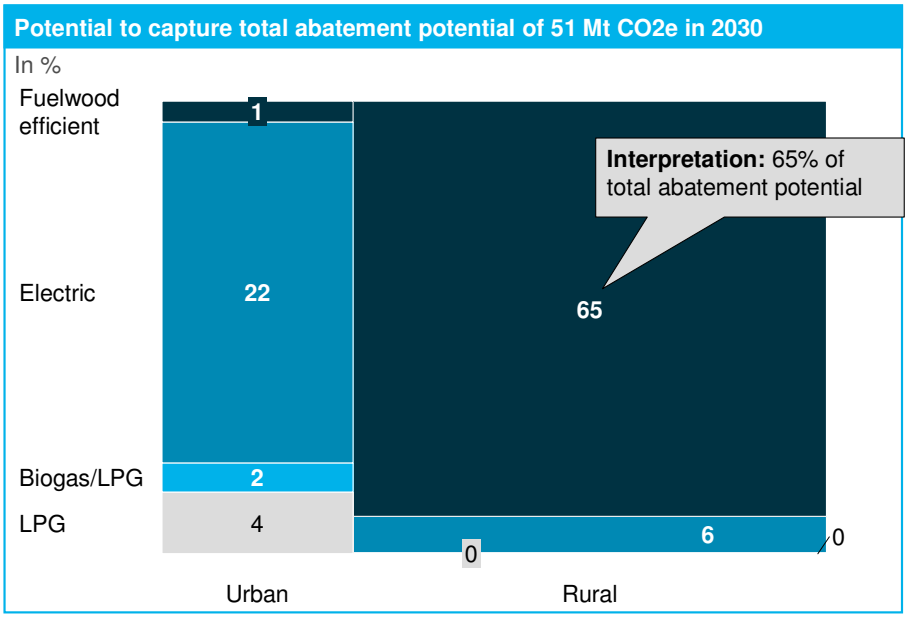
2. Implementation approach

This chapter describes the focus of the investment plan and presents four improvement programmes that will be conducted during the implementation. The main activities of these programmes are described in detail in section 2.4. Additionally, it will outline the necessary institutional set-up and MRV mechanisms to monitor the success of the programmes.

EXHIBIT 5

The highest potential to reduce GHG emissions can be captured by distributing fuelwood efficient stoves in rural areas

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA



2.1 ASPIRATION AND FOCUS OF INVESTMENT PLAN

The single most important lever to avoid deforestation is to reduce demand for fuelwood through increased usage of improved stoves, offering a total potential reduction of 51 Mt CO_2e in 2030. Among all stove technologies, increasing the distribution of fuelwood-efficient stoves in rural areas offers the highest CO_2e mitigation potential, with almost 34 Mt CO_2e avoided annually in 2030. Other advanced cooking and baking technologies (i.e., fuel-shift stoves like electric, biogas, and LPG stoves) offer an additional combined potential of more than 17 Mt CO_2e. Accordingly, the scale-up of fuelwood-efficient stoves in rural areas is the most important step and will deliver 65% of the total CO_2e mitigation potential from improved stoves in 2030 (Exhibit 5). Achieving the GoE's specific Green Economy target of distributing 9 million high-efficiency stoves by 2015 can be realised by focusing on fuelwood-efficient stove technology.

The focus of this investment plan is therefore to detail how to distribute **9 million fuelwood-efficient** stoves in **rural areas** between 2012 and 2015 and build the

foundation to deploy 31 million operational fuelwood-efficient stoves in rural areas by 2030. Starting in 2012, an investment plan to improve deployment of fuel-shift stoves will also be developed. These 'fuel-shift' stoves are more relevant in urban or semi-urban settings, but will also be increasingly relevant rurally as the rural electrification plan progresses.[9] However, since the activities necessary to distribute these types of stoves differ significantly from fuelwood-efficient stoves they are covered in a separate investment plan.

2.2 OVERALL IMPLEMENTATION APPROACH

The dissemination of 9 million high-efficiency fuelwood stoves in rural areas by 2015 will reach an estimated 22.5 million people in 4.5 million households (assuming two stoves in each household, one for cooking, one for baking). By 2030, 31 million stoves should be operational in rural households, saving half the costs that an average household incurs for fuelwood, and reducing total GHG emissions by about 34 Mt CO_2e a year in 2030.

Ideally, the distribution of stoves would be driven by market forces between producers and consumers. However, there are challenges on the demand and supply side that gainsay relying only on market forces only. First, consumers in rural areas often do not have sufficient economic incentives to buy a high-efficiency stove. Over 80% of rural population collects its fuelwood for free and often does not have enough economic resources to afford a high-efficiency stove at all.[10] Thus rural areas do not provide a viable market environment for private producers of fuelwood-efficient stoves. Second, on top of a weak demand side, producers face challenges accessing capital, knowledge about production and promotion strategies due to poor access to information and low level of education.

The stove distribution programme presented here intends to help overcome these challenges and establish a sustainable market for stove producers in the mid- and long-term. Experience from other countries shows that direct and indirect subsidies are essential for building up such a viable market. However, the degree of direct subsidies (e.g., payments for producers and consumers) and indirect subsidies (e.g., provision of training, loans and production material) has to be adjusted to the specific local context.[11] The programmes described in this chapter include analyses of which subsidies are necessary along the entire value chain of stove production and how existing private and public efforts can be leveraged. Efforts will be coordinated through public agencies on federal, regional, zonal and woreda level.

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9 Although the plan is to achieve 100% coverage with the electricity grid by 2030, the percentage of households with a grid connection is expected to be only around 35%. Additionally, consumption share is projected to be only around 15% in households with grid connection.

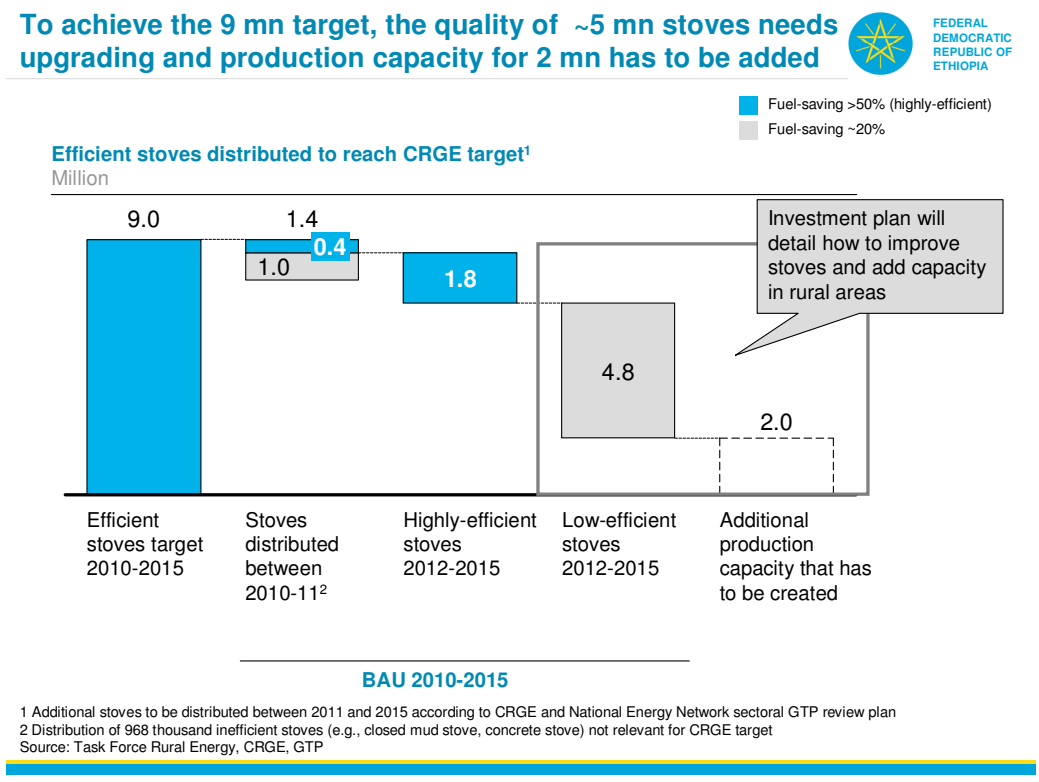
10 There are also other reasons that prevent stove usage such as socializing around the fire and fumigation of thatches. However, according to a survey by the GIZ they only seem to be important for a minority of less than 10% (GIZ 2008).

11 For a detailed discussion of international experiences see (GIZ 2009).

Overall, the analysis of international best practices was helpful to understand common pitfalls in historic stove programmes and to identify the cornerstones of a successful implementation.[12]

2.3 ASSESSMENT OF EXISTING PROGRAMMES

EXHIBIT 6



Existing programmes to distribute fuelwood-efficient stoves provide a basis but are insufficient for the required scale-up for four reasons: 1) the number of stoves distributed is too small, 2) the efficiency of the stoves distributed is too, 3) rural areas are under-served and 4) central coordination is weak.

Ad 1) and 2) Ethiopia has conducted a series of initiatives over the last several years to distribute stoves and can build on remarkable results. Although most stoves distributed have been of the low-efficiency type (concrete or closed mud stoves), the distribution of over 3.5 million stoves in the five years between 2006 and 2011 has been successfully supported by the Rural Household Energy End-Use Efficiency Improvement Project (RHEEIP) at the Ministry of Water and Energy (MoWE) as well as by prior government projects and efforts by international development partners. With the help of these programmes, a group of dedicated experts on stove distribution on federal and regional government level has been established. Extrapolating from existing distribution efforts by the Government of Ethiopia and international development organisations, an estimated 2 million stoves will be produced by 2015

[12] See amongst others (World Bank 2011) and (GIZ 2009)

that meet efficiency standards suitable for achieving the Green Economy objectives (see Exhibit 6). By contrast, nearly 5 million stoves calculated for production by 2015 do not yet meet these standards and must be upgraded to meet the Green Economy target of 50% savings on fuelwood. Finally, production capacity for another 2 million stoves must be added to reach the 9 million fuelwood-efficient stoves target for 2015.

Ad 3) So far the focus of programmes has been very much on urban and peri-urban areas, which have also received the majority of high-efficiency stoves. In these areas, existing programmes by international development partners, like the GIZ, have trained small-scale producers with small output. In rural areas, distribution of stoves has historically been conducted as part of the extension programmes of the Ministry of Agriculture and the Ministry of Health. Distribution via the Ministry of Agriculture's Extension Service[13] will continue, but focused on fuelwood-efficient stoves instead of low-efficiency stoves, e.g., closed mud stoves or concrete stoves, which have been the focus to date. Programmes usually promoted stove technology to local consumers and distributed the stoves for reduced prices. However, this distorted the development of a sustainable market in rural areas (GIZ 2009).

Ad 4) Overall coordination of stove programmes has been conducted on federal level by the AETPD Directorate at the Ministry of Water and Energy. On a regional level, Regional Energy Departments have been responsible for planning and coordination of projects with development partners. This approach has generally proven to be successful. However, closer interaction between the different government levels is important going forward. Increased MRV requirements and a national roll-out of fuelwood-efficient stoves in rural areas can only be achieved with an improved IT infrastructure. This will enable government agencies to gather and exchange statistical data about stove usage to plan the roll-out and evaluate success. Also, cooperation should be increased through the development of common guidelines and procedures for stove projects. Many projects will and should be managed on a regional or local level. Nevertheless, continuous exchange of information about these projects and adherence to uniform guidelines (e.g., for subsidies) is important to guarantee the success of the overall initiative.

All improvement programmes to scale up stove distribution will build on the successful achievements of stove programmes in the last years and aim at strengthening existing institutions to overcome the challenges described above.

[13] The extension service is a programme of the GoE that supports the adoption of improved agricultural technologies in rural areas (ILRI 2006)

2.4 DETAILS OF THE IMPROVEMENT PROGRAMMES

EXHIBIT 7

Improvement programmes will be implemented through projects on federal, regional and woreda level

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

	Overall objectives	Main activities
Readiness	▪Create strong focal point for planning and supervising roll-out of stoves ▪Put in place critical roll-out enablers on federal, regional and local level ▪Establish a system to continually monitor success of stove initiative	▪Enhance institutional capabilities ▪Define cooperation procedures and guidelines ▪Build IT and transport infrastructure ▪Define MRV mechanisms and processes ▪Improve R&D facilities
Productivity Improvement of stove production	▪Establish a viable private cookstove producer sector ▪Reduce costs per stove produced ▪Improve quality of stoves	▪Provide loans to rural cooperatives ▪Design training programmes to teach cooperatives on production and business issues ▪Support mid- and large scale urban producers to produce lowest cost
Promotion & distribution improvement	▪Improve availability of stoves in rural areas ▪Compensate lack of economic incentives for rural consumers	▪Create distribution channels for stoves produced in rural areas ▪Increase awareness of non-economic benefits of high-efficiency stoves in rural areas ▪Introduce smart subsidies in non-viable market environments
CDM pilot projects	▪Access carbon credits ▪Gain experience with CDM projects	▪Develop detailed baseline for stove usage ▪Improve quality control of stove production ▪Verification system for emission reductions

Based on existing efforts and the ambitious goal of distributing 9 million high-efficiency fuelwood stoves in rural areas by 2015, four improvement programmes have been identified as critical across the stove production value chain (Exhibit 7):

- A readiness programme to strengthen institutional and technical enablers on all government levels
- A productivity improvement programme to increase overall number of stoves produced and their quality
- A distribution and promotion programme that will increase awareness and availability of high-efficiency stoves in rural areas
- A carbon market programme that pilots CDM projects to generate carbon credits and thereby support distribution of stoves in poor rural areas

The following sections provide a detailed description of the main activities involved during the implementation.

2.4.1 Readiness programme

Overall concept

Currently, the institutional set-up and technical infrastructure on all government levels is insufficient for the requirements of a large-scale roll-out. Especially in need of improvement are the availability of information and coordination of activities between

different government levels and non-government actors to deliver the programmes more effectively. Constraints on personnel and the technical infrastructure are a major bottleneck for an increased distribution.

To overcome these challenges, the readiness programme encompasses four main activities: 1) enhance institutional capabilities on all government levels, 2) define cooperation procedures and guidelines, 3) build IT and transport infrastructure, 4) define MRV parameters and guidelines, and 5) improve R&D facilities.

Main activities

- **Enhance institutional capabilities on all government levels**, consisting of three sub-activities:
  - Establish a programme coordination bureau at the federal level. Personnel capacity in the existing task force for stove distribution at the AETPD Directorate will be expanded with at least four new external hires, who will form a newly created programme coordination bureau (encompassing a financial officer, an IT expert, an R&D coordinator and a procurement offices). The AETPD Directorate reports to the Ministry of Water and Energy and will be responsible for the overall programme supervision, alignment of stove projects in regions, and the design and collection of MRV parameters. After its initiation, the coordination bureau will be responsible for the creation of a process manual that gives detailed descriptions of processes and jobs required on different government levels.
  - Upgrade staffing in Regional and Zonal Energy Departments as well as energy experts on woreda level. Regional energy departments in all regions need additional personnel to accommodate the increased workload and adhere to reporting standards. An IT expert and a financial officer will be hired to manage funds and manage the implementation of the technical infrastructure needed for MRV requirements (see section 2.7 for perspective on main MRV parameters to be tracked). Every woreda has to employ an energy expert, responsible for reporting numbers, training of local producers, and supporting stove promotion activities. Approximately 70% of woredas already have such a position. To ensure a national roll-out, a new position has to be created in those woredas that currently do not have such an expert.
  - Conduct training activities for government employees working on the stove initiative. Experts at the regional and woreda level should be involved in trainings that are conducted by experts from the programme coordination bureau at the federal level at least once a year. Topics will include overall dissemination strategy and planning, new stove types available, approach to production, etc. These trainings will last around five days and are conducted in the regions. Expenses for travel, accommodation, and per diems have to be covered. Training topics and material will be designed by the programme coordination bureau.
- **Define cooperation procedures and guidelines,** which consists of three sub-activities:

- Develop a holistic project manual for woredas on how to conduct improvement projects. The manual should include blueprints for necessary documents and step-by-step instructions on how to train extension workers, collect MRV-relevant information, etc. It will be developed together with external consultants and ensure a uniform approach during the roll-out.
- Conduct workshops with Regional Energy Departments. These workshops will be organised by the programme coordination bureau and are used to share best practices between the regions, provide updates on the latest developments, and brief staff on future plans. These workshops have to be continued after the initial ramp-up phase to ensure ongoing exchange between the federal and regional levels.
- Conduct workshops with international development partners, the private sector, and other important government agencies (e.g., Ministry of Health). These workshops will be organised by the programme coordination bureau to share best practices between stakeholders, provide updates on the latest developments, and brief international development partners on future plans. These workshops have to be continued after the initial ramp-up phase to ensure ongoing exchange between external stakeholders and the government.

- **Build IT and transport infrastructure** on federal, regional, and woreda level; this activity encompasses two sub-activities:
  - Provide essential office equipment to conduct daily operations on all government levels. This includes the IT infrastructure (e.g., a computer workplace and internet access) as well basic office material such as paper, telephone, etc. and expenditures for maintenance of the equipment. The programme coordination bureau will be responsible for the preparation of procurement guidelines and disbursement of money to regional energy departments that will supervise procurement of equipment in woredas.
  - Provide essential transport equipment. Government employees on federal and regional level will need transport equipment to conduct field visits and travel to trainings that they will host in regions or woredas. The investment plan foresees two pick-up trucks on a federal level and one pick-up truck for each region and covers all maintenance costs.
- **Improve R&D facilities**, which consists of three sub-activities:
  - Provide research equipment for the enhancement of a research lab at federal level and create a job for a research coordinator. This includes all necessary equipment for stationary measurement, development, and certification of stoves. The lab will enable the analysis of newly developed stove types in other countries, research on adoption measures, and the development of instructions on how to build stoves in production facilities at the rural level. On a federal level, the existing lab at the MoWE will be enhanced with relevant equipment to design new stoves.
  - Set up small research labs at the regional level. These labs will be equipped with basic workshop tools and measuring devices that allow the adaptation of stoves to specific regional needs, as well as a thorough measurement and

analysis of stoves produced by regional manufacturers. Experience has proven that regional workshops are important for conducting analyses and trainings on a regional level, since a transportation of a stove to a lab on federal level is often not feasible. Labs will be managed by Regional Energy Departments.

- Organise training activities for R&D staff to learn about the latest developments in stove assessment and design. International experts will provide annual training to R&D technicians on a federal and regional level in a one-week workshop. It will be used to discuss new stove types and possibilities to adapt them to the Ethiopian context.

- **Define MRV parameters and guidelines**, which consists of four sub-activities:
  - Develop an information-system/online database to track relevant data for MRV mechanisms, as required for most international funding programmes (for a description of MRV parameters see section 2.7). This step therefore has top priority in the first half of 2012. The programme coordination bureau at federal level will supervise the development of an online database for stove-related data. It will provide online access to basic indicators, such as stoves sold at woreda level and active producers. Furthermore, it will allow users to produce reports automatically.
  - Procure Portable Emission Measurement systems for Regional Energy Departments to control the quality of stove production. These tools will enable experts in Regional Energy Departments to visit stove producers and assess the quality of stoves produced in the workshops. The mobile devices have to be purchased from a specialised company in the United States and should be present in every region (sharing the measurement devices will be difficult due to transportation).
  - Finance external services. Help from external service providers and consultants will be necessary to evaluate the current distribution level of stoves and conduct household surveys on stove usage, cooking/baking preferences, and purchasing power. Conducting these surveys on a regular basis in all regions will provide data not only to evaluate the success of the stove distribution scale-up, but also to facilitate better planning of the roll-out and design of stoves according to local needs.
  - Design an evaluation scheme for the stove distribution programme. To gauge the success of the programme in a systematic way and decide about critical questions like the amount of subsidies granted, an evaluation scheme should be developed and put in place early on. To this end, a randomised control trial evaluation scheme will be designed with external support.[14] This evaluation exceeds the scope of the usual MRV mechanisms as it involves a comparative study among different woredas that fulfils scientific requirements. Consequently, it is planned to have this activity conducted by an external service provider or academics and supervised by the programme coordination bureau.

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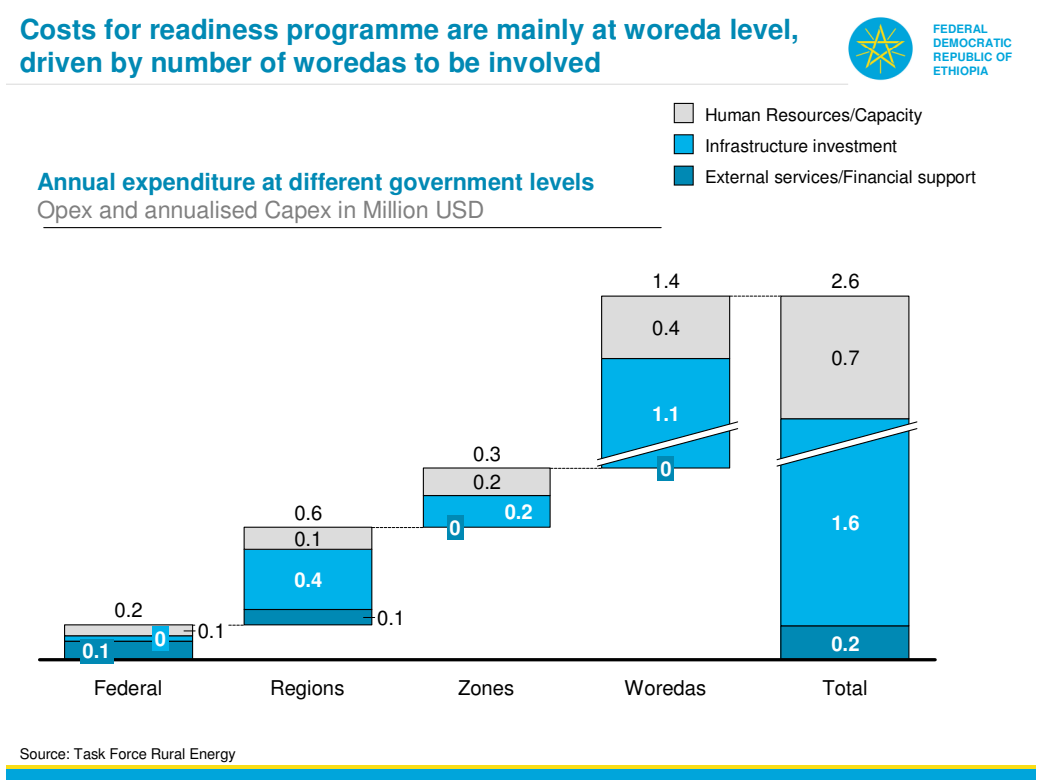
14 Randomised control trials are a popular technique to evaluate the success of policy interventions in social sciences. They have proven to be a helpful tool to measure the effectiveness of aid programmes.

From the beginning, the readiness programme will encompass all regions and all woredas. This ensures that the roll-out, especially after 2015, can be conducted on a national level. The specific requirements for additional investments in personnel and technical equipment will depend on the initial situation in the regions and woredas and have to be quantified during the development of a more granular PDD.

Required expenditures

Based on the activities outlined, expenditures are calculated to amount to USD 2.6 million per year for all government levels.

EXHIBIT 8



Most of the cost is incurred for procurement of the technical infrastructure that will be necessary to enable nationwide participation in MRV mechanisms and expenditures for additional personnel that has to be employed. The activities that are necessary for the set-up of an MRV system build on the international requirements to track and evaluate cookstove distribution (see discussion of MRV system in section 2.7). Exhibit 8 illustrates the different investment requirements by type at the different government levels. Due to the large number of woredas that will be part of the readiness programme (a total of 718 woredas in the country is included; data based on CSA 2007), the major share of the cost will be incurred for expenditures on a woreda level. Nevertheless, disbursement of funds will be handled by the Regional Energy Departments and supervised by the programme coordination bureau.

The readiness programme is the centrepiece of the scale-up in the distribution of stoves. Staffing for relevant positions at the federal and regional levels as well as stocktaking of the situation at the woreda level has to start at the beginning of 2012.

This will be accompanied by the set-up of the necessary enablers for an MRV system, such as the design of the database, first round of household surveys, and the design of an evaluation scheme.

Since the AETPD Directorate at the Ministry of Water and Energy has been responsible for all stove-related programmes for a number of years, it will lead the transition process and disbursement of funds until the programme coordination bureau has been set up and will supervise the overall roll-out in the regions. Regional Energy Departments would be responsible for the implementation of activities in the region and supervising activities in woredas.

2.4.2 Productivity improvement programme

Overall concept

Currently, public programmes focus on trainings for small-scale manufacturers to set-up new production capacity. This results in very high programme costs per stove produced. Due to the focus on small-scale manufacturers, the annual stove output per active producer is too low to achieve the 9 million target by 2015. For example, according to a survey by GIZ, fewer than 2% of Mirt producers are capable of producing more than a thousand such stoves per year (GIZ 2008). The average stove producer has an output of only 300 stoves a year. Moreover, a large number of inefficient stoves is being produced each year due to a lack of expertise and adequate manufacturing equipment. Especially in rural areas, a high share of closed mud and concrete stoves is put on the market as part of the activities of the GoE extension programmes in the health and agriculture sector.[15]

Based on best practice examples in Ethiopia and other countries, costs per stove produced can be reduced by up to 80%, while increasing the quality of stoves at the same time. As part of the productivity improvement programme, producers will be provided with capital to procure modern production technologies, and trainings will focus on larger groups of cooperatives instead of single producers. Production of low-efficiency stoves can be thus be replaced by modern, more efficient and cheaper technologies such as the Gonzyie and Tikikil stoves[16]. Assisting stove workshops in specialising and using a smart division of labour in the production process will further help to reduce costs. This will be facilitated by training programmes that teach producers about new production techniques and opportunities to split work and cooperate with other producers.

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[15] Technologies for cooking and baking stoves differ significantly. The Gonzyie stove is an example of a low-cost but high-efficiency alternative to closed-mud stoves. With a retail price of around 60 birr in 2011, it costs only 50% of the price of a Mirt stove for baking. Its production relies on locally available material such as clay soil so that it can be manufactured in rural areas. However, ensuring the quality of stoves with respect to durability and emission savings requires a precise manufacturing process that has to be enabled with the provision of adequate training and production equipment. Current mud stoves do not meet the quality standards required to achieve the emissions abatement targets of the CRGE. For cooking, the Tikikil stove provides a high-efficiency alternative to concrete stoves distributed in many rural areas. These Tikikil stoves make use of steel parts that can be mass-produced and a clay-soil-based ceramic plate.

[16] This investment plan assumes the usage of Gonzyie and Tikikil stoves as technologies for baking and cooking stoves to calculate programme costs. However, this is not a prescriptive decision on which technology must be used by producers. The only requirement is that fuelwood savings of the stove used are around 50%.

Planned activities

In summary, activities in this programme encompass the support for the set-up of rural and urban production facilities and cooperation between these two:

- **Provide loans to rural cooperatives of producers**. Training and set-up costs per stove produced can be reduced by almost 80% by focusing the programme activities on cooperatives of producers instead of individual producers. Advanced production equipment can be shared among several producers in a cooperative, requiring only a moderate investment per producer. With this modern equipment, the output of a workshop can be increased significantly and the quality of stoves produced improved. Furthermore, experience with existing projects shows that this will reduce the number of producers who leave the business (i.e., do not produce any stoves one year after they opened their business).
  To equip a local cooperative with adequate technical equipment (i.e., a clay-soil extruder, shed, workshop equipment, etc.), an average investment of USD 9,000 is needed. This could enable a cooperative to produce around 4,000 Gonzyie stoves and 5,000 ceramic parts for cooking stoves per year.
  As part of the productivity programme, one cooperative of approximately 15 to 20 stove producers will be supported in every woreda. This cooperative will be able to provide enough stoves to satisfy the local demand. To set up these cooperatives, access to capital (and thus modern production equipment) will be provided in the form of loans. The selection of producers who will receive the loans is to be managed by the energy experts on woreda level, who will choose producers based on their qualification profile.
- **Support mid- and large scale production in urban areas.** Experience from other countries such as China shows that modern technical equipment can dramatically enhance the output of workshops producing metal-based cooking stoves, facilitating a production level of up to 500,000 stoves a year. When a small number of producers receive the capital to procure the necessary technical equipment and the working capital needed to start production, their stove output can secure the availability of cooking stoves in all rural areas, while reducing the manufacturing costs and thereby stove price significantly. Besides a supply of stoves to rural areas, this will facilitate the build-up of an export-oriented stove production industry.
  The required initial capital for one mid- to large-scale producer amounts to approximately USD 250,000. This will cover the required machinery, working capital for the first year and transport costs to deliver stoves to rural areas. Transport costs could also be reduced if the urban stove producers concentrate on making the metal part and cooperate with producers in rural areas for the clay-based part.
  As part of the productivity programme a small number of large-scale producers will be provided with the necessary capital in form of loans. Selection of producers that receive a loan will be conducted on a federal level by the programme coordination bureau at the AETPD Directorate. Detailed selection criteria will be developed as part of a PDD.

- **Design training programmes for cooperatives.** The productivity improvement programme embraces a new concept of splitting the production of cooking and baking stoves among rural and urban areas. Fragile, clay-soil-based baking stoves will be manufactured in rural areas. The producers can be located close to the supply side for the raw material (usually clay) and will not have to transport stoves after production over long distances to the consumer. This will help to limit the number of stoves damaged during transport as well as to decrease the traditionally high transport costs. On top of the production of modern baking stoves such as the Gonzyie, rural producers can also provide the ceramic plate for cooking stoves. In exchange, mid- to large-scale production facilities in urban areas can specialise in the production of the metal-based parts of cooking stoves such as the Tikikil cooking stoves. The metal part can be transported at a low cost for the producers to rural areas for final assembly. The programme helps to spread this concept of smart division of labour in two ways:
  - Training and support of producers will be planned to adhere to this concept. Adherence encompasses the set-up of adequate training curricula by the programme coordination bureau at federal level, focussing on advanced technologies such as the Gonzyie and Tikikil stoves that are qualified for this production concept. Regional Energy Departments will select adequate producers and help to match urban and rural producers to jump-start cooperation between them. On top of this, woreda-level energy experts will also be responsible for providing an annual 2- to 3-day training for every cooperative and consulting the producers in case of problems. Trainings will cover production techniques and basic business knowledge that producers will need to run their business successfully and will be based on a curriculum that is designed at the federal level.
  - The design and adjustment of stoves to specific rural needs (e.g., health, mobility, local cooking preferences) are a crucial element to increase acceptance among rural consumers. With the help of improved R&D facilities, installed in Regional Energy Departments, stove technologies such as the Gonzyie and Tikikil have to be adapted to local needs as reported by DAs and observed in household surveys (part of the readiness programme). These efforts will help to develop improved production techniques that will be taught to local producers during the workshops with energy experts.

The activities described above will help to provide baking and cooking stoves in rural markets in larger quantities while lowering the cost of a stove. A decision to concentrate the programme activities on workshops with professional equipment and highly trained manufacturers will improve the quality of the stoves and sharpen the focus of the training efforts provided.

Most employment opportunities will be created in rural areas in the context of the cooperatives. The expenditures for the productivity improvement will be discussed together with the promotion and distribution programme in section 2.4.3. Expenditures for both programmes can be accounted for on a woreda level.

2.4.3 Promotion and distribution programme

Overall concept

Deployment of improved stoves in rural areas currently consists largely of low-efficiency stoves. Overall, rural areas present a difficult environment for the distribution of stoves. Consumers have little economic incentives to buy stoves, since most rural households have only a very low income and collect fuelwood for free. Furthermore, previous programmes on stove distribution focused their efforts mainly on urban and peri-urban areas, so that awareness of the benefits of high-efficiency stoves and the availability of the product itself is still low. Here, it is believed that public-sector-driven programme is necessary to help private producers to distribute their stoves by increasing awareness as well as helping to improve the availability and affordability of stoves.

DAs from the extension programme of the MoH and the MoA are already today in place across the country and in close contact with households in rural areas through various training centres for local farmers. In cooperation with Regional Energy Departments, they can help to create awareness of efficient stove technology and also improve the distribution through existing training centres. Finally, since in poor rural areas, the economic incentives to buy stoves are limited, smart-subsidies have to be introduced for consumers, based on the local circumstances such as availability of free fuelwood.

Planned activities

In more detail, the promotion and distribution programme covers three activities:

- **Increase awareness of high-efficiency stoves.** Over 80% of rural households still collect their fuelwood for free so that there is often no immediate economic incentive for rural households to buy improved stoves. The health argument is more immediately compelling than annual savings on fuelwood. Promotion campaigns have to be adjusted to inform people about non-economic benefits. Historically, promotion campaigns have focused on TV and radio commercials to raise awareness, neglecting that many households do not have access to this media. Experience from other programmes shows that the most effective approaches to creating awareness in rural areas are demonstrations of the increased efficiency and therefore lower requirement for fuelwood at local markets and household visits, which should be rolled out in woredas. In each woreda, at least six market demonstrations per year will be conducted.
- **Create distribution channels for stoves in rural areas**. The lack of points of sale for high-efficiency stoves forms a significant barrier for the purchasing of stoves in rural areas. The programme plans to overcome this deficit in two ways. First, DAs can collect orders from rural households, source the required number of stoves directly at a producer's site, and deliver them to a distribution point close to households in a kebele, e.g., the administrative office or farmer trainings centre. Second, baking stoves can be purchased from the woreda's local producer (who will be set up as part of the productivity improvement programme). Since cooking stoves will also be finally assembled at a producer's site in rural areas, cooperatives can function as an outlet for both cooking and baking stoves. Energy

experts will help rural producers to establish a link to urban mid- and large-scale manufacturers in order to start cooperation.
To strengthen the link between energy experts in woredas and DAs who have already established a close link to rural households, training sessions for extension workers will be conducted by the energy experts at least once a year for two days at kebele level. To enable visits of DAs, improved mobility for energy experts is of utmost importance. This can be facilitated by providing each woreda's energy expert with a motorbike, which will allow these experts to conduct field visits in rural areas.

- **Introduce smart-subsidies in non-viable market environments.** Since most rural households still have only limited disposable income to spend on stoves at all, the price of a stove is still a major factor in the purchasing decision. So far, there has not been a consistent approach to subsidies. Some programmes have distributed the stoves for free, while others provided consumers with vouchers to support the purchase of stoves. The appropriate level of subsidies that does not interfere with the build-up of a regular market for stoves has to be determined at the woreda level. Evaluations based on the results of randomised control trials can be used to this end (the set-up of these evaluation schemes is part of the readiness programme). Experience from other countries show s that a common level of subsidies for stoves in rural areas is around 20 to 30% (GIZ 2009).

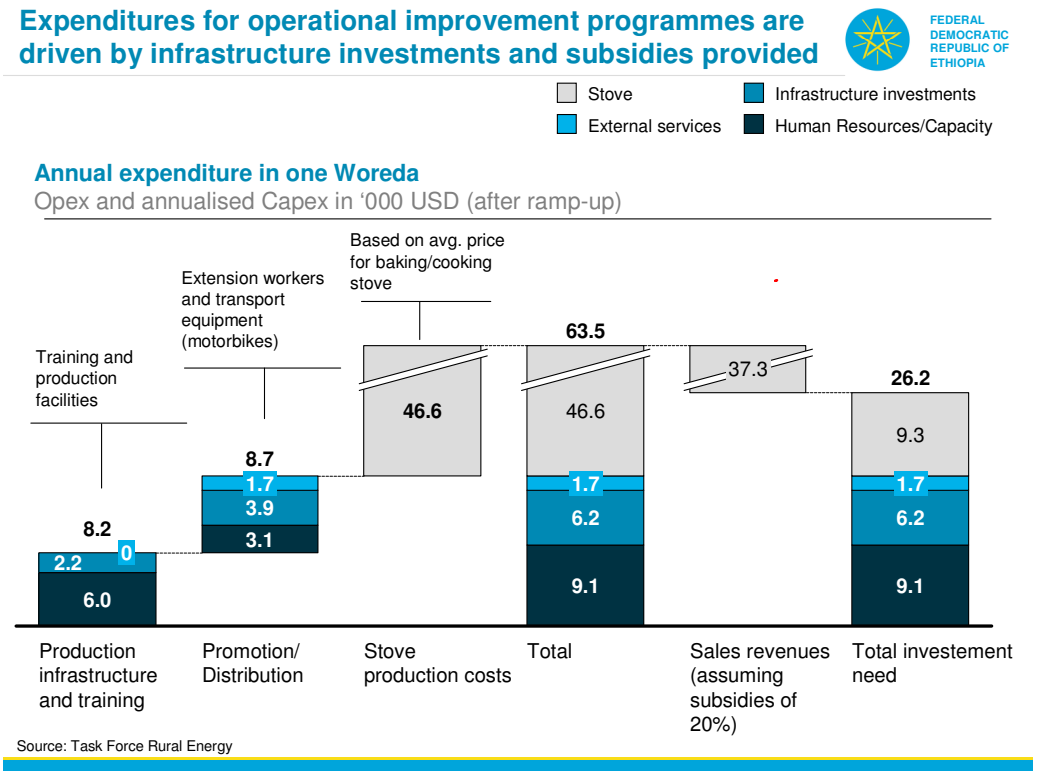
Historically, distribution of fuelwood-efficient stoves to rural households has largely been neglected. The activities described can improve the situation at a low cost. The most important part is the close cooperation between Energy Experts at regional and woreda levels and DAs from extension programmes.

Expenditures

Exhibit 9 provides an overview of the expenditures that are necessary for the implementation of improved production and distribution activities in one woreda (i.e., for programme 2 (productivity) and programme 3 (promotion) combined).

After a ramp-up phase, the activities encompassed by these two programmes should enable an annual distribution of around 8,500 baking and cooking stoves in a woreda. In an average woreda, this is enough to guarantee the supply of high-efficiency stoves (for initial purchase or replacement) for 80% of rural households.

EXHIBIT 9



Overall, to improve the situation of stove production and distribution on a woreda level, expenditures of around USD 26.2 thousand are required per year. This includes subsidies for the stove itself, since the supply of affordable stoves is a crucial element of any strategy aiming to increase sales of high-efficiency stoves in rural areas. Based on an average stove price of USD 6 (average of the retail prices for a Gonzyie, USD 4, and a Tikikil stove, USD 8), it is assumed that subsidies of around 20% or USD 1.25 per stove are required. The specific amount necessary and the approach (i.e., cash or voucher-based subsidies) will be tested with help of randomised control trials.

Besides subsidies, the highest expenditures are incurred for investment in infrastructure such as the production equipment for producers and the transport equipment for energy experts at woreda level, plus expenses for continual training of producers.

These costs will be incurred annually in every woreda that is part of the fuelwood-efficient stove initiative (capex for transport equipment is annualised). The roll-out planning, outlining how many woredas will be included in each year, is discussed in section 2.5.

2.4.4 Carbon market programme

Overall idea

Financing stove programmes has historically relied on bi- and multilateral funding that will not be sufficient for the nationwide scale-up by 2030, as foreseen in the GE

strategy. Besides increased expenditures to expand the number of stoves distributed, subsidies for stove purchases in rural areas will require additional funding.

The high amount of emissions saved by the deployment of efficient stoves can be used to generate carbon credits with the help of CDM projects or National Appropriate Mitigation Actions (NAMAs). These carbon credits can become a significant source of revenues in the medium and long term. However, the MRV mechanisms required to meet international standards for participation in such mechanisms have to be carefully prepared and piloted. Experience with CDM projects in Ethiopia is still very limited (since the official inception of the CDM under the Kyoto Protocol, Ethiopia has registered one project).

Planned activities

The carbon market programme will prepare the use of CDM projects or accredited NAMAs that generate carbon credits. To this end, it will be necessary to test MRV procedures at the woreda level and pilot the preparation and approval of Project Design Documents (PDDs) in cooperation with international developers. On an ongoing basis, the success of CDM projects for stoves will need to be backed up with periodic and strict mechanisms to track stove production and distribution on the one hand and emission reductions at household level on the other.

The specific activities encompassed by the carbon market programme are as follows:

- **Develop detailed baseline for stove usage**. To enable participation in CDM projects, a detailed baseline is needed showing stove usage and emissions caused by stoves in the areas where carbon credits are to be generated. This effort goes beyond the household surveys that will be conducted as part of the readiness programme. For example, the details of the baselining work include assessing the specific sources of fuelwood supply for the local consumers.
- **Improve quality control of stove production**. The quality of stoves produced and distributed has to adhere strictly to the level of savings proposed in the CDM project (generally, to qualify for a CDM, the degree of stove efficiency in saving fuelwood has to be more than 30% compared with an open fire). To ensure this quality, producers involved in the CDM project have to receive extra training and the quality of the stoves they produce must be regularly quality-controlled at the production site. A full time employee with relevant experience and knowledge has to be recruited in woredas with CDM projects. On federal level, another expert has to be recruited to supervise and coordinate the gradual increase in relevant CDM projects, the development of a uniform baselining methodology, and definition of efficiency standards. For this job, expert knowledge of CDM methodology is required to review PDD proposals or Small Scale CDM Programme Activity Design Documents (CPA) in the context of a Programme of Activities (PoA).
- **Verifying proper usage by household users**. CDM requirements call for a verification of emission savings at the a household level, i.e., a certain number of sample households. For cookstove projects that adhere to the Gold Standard methodology, the sample size need to be more than 1,000 households in a woreda

(CDM Gold Standard 2008). Besides a verification of the actual usage of stoves by consumers, a household that is part of the sample needs to have emission-measuring equipment installed (in most cases a particulate matter and emission monitoring device) for several days of testing. This will necessitate the procurement of at least two of these devices per woreda participating in CDM projects. Additionally, training is also necessary to ensure proper usage of stoves by consumers to guarantee the desired emissions savings. (Training can be provided by the central R&D lab and the regional R&D lab outposts.)

Most of the activities described above have to be conducted on a woreda level. This specifically includes training stove producers and ensuring the proper quality of stoves used. It also entails the verification of emission reduction in sample households by measuring emission reductions in the households itself. On a federal level, a specialist in the programme coordination bureau should be dedicated to the build-up of CDM projects and well versed in international requirements for project approval and verification of emissions. The development of the PDDs and CPAs necessary to register a project with the CDM Executive Board (EB) will be conducted by international development partners.

Expenditures

As part of this programme, the plan is to involve a first batch of four woredas in CDM projects over the next four years. This leads to a potential volume of 100,000 stoves in rural households that can generate carbon credits for their annual emission reductions. The preparation of necessary activities to select and involve those woredas should start in early 2012. Expenditures to conduct such a CDM readiness programme in the next four years would add up to USD 0.3 million, mainly incurred for PDD development, registration, and procurement of mobile measurement equipment for verification of emission reductions at a household level.

2.5 ROLL-OUT AND SEQUENCING

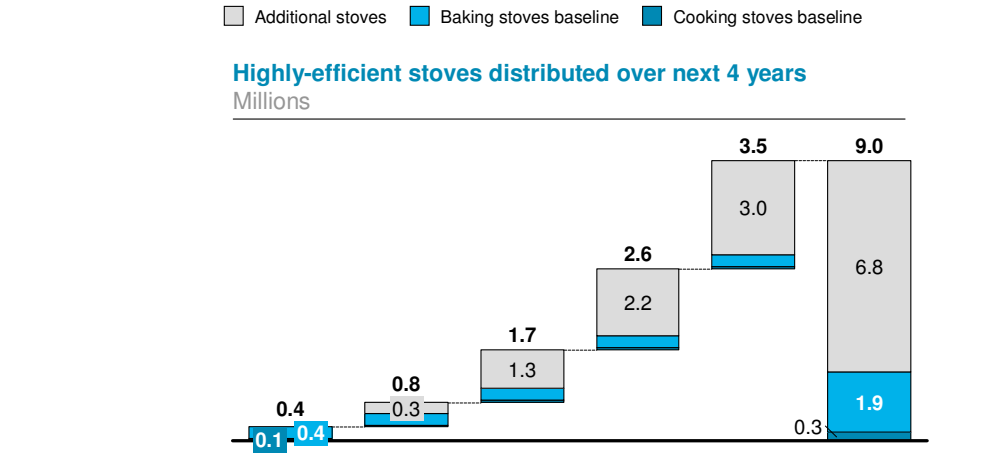
Between 2012 and 2015, the four improvement programmes described in this chapter will enable the distribution of an estimated 6.8 additional stoves compared with the BAU scenario. While all woredas will be part of the overarching readiness programme from the beginning, the scale-up will ultimately be driven by gradually involving woredas in the operational improvement programmes (i.e., programmes 2 and 3 on production and promotion/distribution).

It is assumed that in each woreda that is part of these improvement programmes, around 8,500 high-efficiency stoves will be distributed annually from newly installed production capacity. Exhibit 10 illustrates how the growing number of participating woredas per year will increase high-efficiency stove distribution from 0.4 million in 2011 to 3.5 million in 2015. By 2015, nearly 50% of Ethiopia's woredas should be involved in the operational improvement programmes. By 2020, all woredas will be included.

EXHIBIT 10

Roll-out is based on conducting improvement programmes in an increasing number of woredas per year

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA



	2011	2012	2013	2014	2015	Total 2011-2105
Number of woredas to be included in roll-out	0	50	140	250	350[1]	

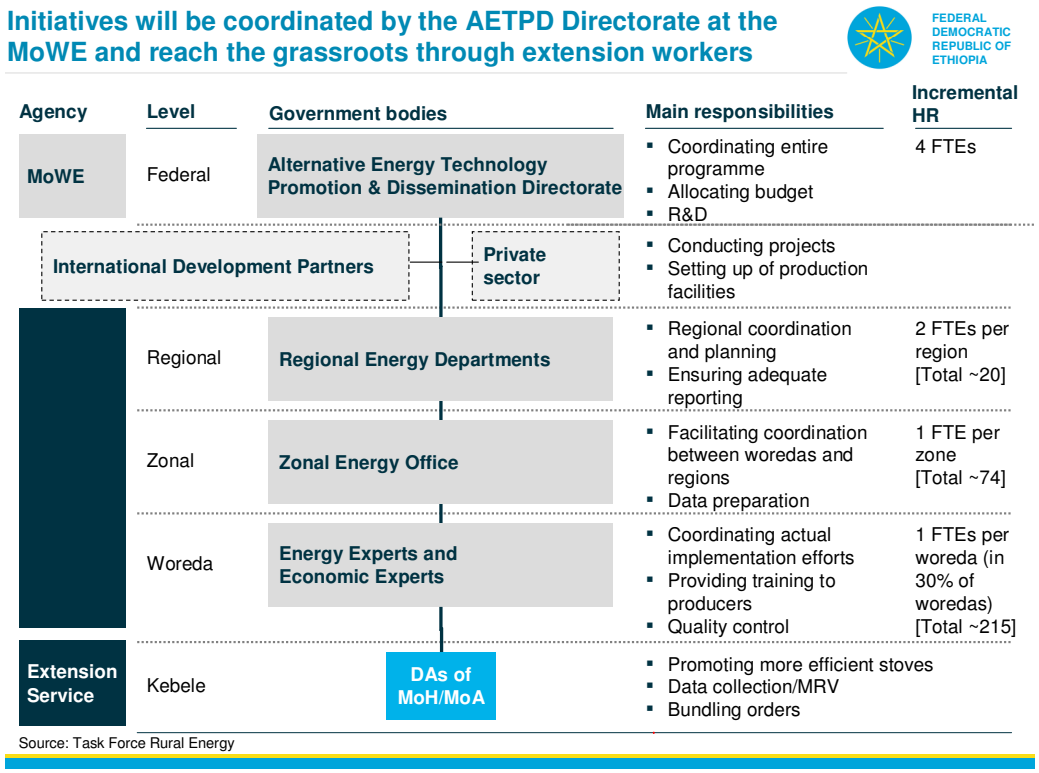
1 Out of a total of 718 woredas (including 1 woreda for Addis Ababa due to different political structure)
Source: Task Force Rural Energy

Given that 50 woredas are supposed to participate in the programme in 2012, all regions will be integrated in the scale-up programme actively from the beginning. At an early stage, it will be important to select woredas that already have experience in stove distribution, and build the capabilities of other woredas as part of the readiness programme before they join the operational improvement programmes. This will enable a fast ramp-up of the operational improvement activities with a high success rate.

The total programme expenditures to achieve this scale-up are discussed as part of the Business Plan in the next chapter.

2.6 INSTITUTIONAL SET-UP

EXHIBIT 11



As shown in Exhibit 11, the distribution of efficient stove technology will be enabled by an elaborated institutional structure that is linked to the overall CRGE institutions by close cooperation with the **Environmental Unit** of the **Ministry of Water and Energy** (MoWE). Proceeding from the central government level, the institutional set-up comprises the groups described below.

The **Alternative Energy Technology Promotion & Dissemination** (AETPD) Directorate will be the focal point for all activities relating to the development and supervision of the stove initiative. This encompasses overall national coordination and coordination with international organisations. A programme coordination bureau at the Directorate will be responsible for managing the budget, planning the roll-out, supervising Research and Development efforts, and disseminating results. This bureau will work in close alignment with the Environmental Unit of the MoWE that forms the link to the CRGE initiative.

At the regional level, **Regional Energy Departments** will be responsible for regional coordination and planning of the scale-up and for ensuring appropriate reporting. Adaptation of stoves to specific local needs will also be possible in regional R&D labs. At the zonal level, the Extension services will work with the Zonal Energy Office to facilitate coordination between woredas and regions and to oversee reporting on stove distribution. At the **woreda** level, the **Extension Services** will work with energy experts and economics experts on coordinating actual implementation efforts, providing training to producers, overseeing quality control.

At the most local level of the **kebele**, the Extension Services will work with the **health and agricultural Development Agents** (DAs) to promote the use of high-efficiency stoves. They will also collect data for MRV assessments and bundle stove orders to increase efficiency. This work will be conducted by existing DAs.

At the national level, the AETPD Directorate's **programme coordination bureau** should be fully operational in the third quarter of 2012, with the completion of the layers described in a cascading effort over the course of 2013. In total, the institutional setup for the fuelwood-efficient stove initiative is projected to require the addition of over 300, mostly highly qualified, new government employees.

2.7 MEASUREMENT, REPORTING AND VERIFICATION

EXHIBIT 12

Introduction of an MRV system ensures the control of programme success with an improving level of granularity

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

	1 Create transparency on current distribution and production level in region	2 Control quality of stoves	3 Control stove quality at consumer site[1]
KPIs	▪ Penetration rate of cooking and baking technologies in **households**	▪ Number and type of **stoves distributed**	▪ **Emissions savings** at household level ▪ Level of **forest degradation**
Activity	▪ Create **bi-annual baseline** on penetration rate of cooking and baking technologies in households with the help of **household surveys** ▪ Compile **list of active producers** and their production capacity ▪ Design **database to register information** about stove distribution	▪ Regularly **assess producers activities** and output via interviews ▪ **Ensure quality standards** of stoves through visits at production site ▪ Provide quarterly updated reports on stoves distributed on **woreda level**	▪ Provide overview on **exact number of stoves sold and used**; register buyer of stoves ▪ Measure the **emission reductions realized at consumer site**
Respon-sibility	▪ MoWE/AETDP Directorate ▪ Regional Energy Departments	▪ MoWE/ECA ▪ Regional Energy Departments ▪ Woreda Energy Expert	▪ Regional Energy Departments ▪ Woreda energy experts ▪ DAs ▪ Development Partners

1 Only for woredas with CDM projects
Source: Task Force Rural Energy

The set-up of an MRV system is one of the centrepieces of the successful roll-out. It is an important prerequisite for successful planning and coordination of the overall stove distribution activities. Furthermore it will allow regular reporting of Key Performance Indicators (KPIs) on project development to international development partners. It relies on provision of the necessary technical infrastructure (IT systems) as well as personnel to gather and manage data as it is supposed to be put in place by the readiness programme.

Conceptually, three different levels of MRV parameters for stoves are foreseen: household surveys, producer data, and emissions abatement (Exhibit 12).

At the first level, household surveys in regions will enable the creation of a nationwide baseline on stove usage by households. Experience has shown that regularly conducting these surveys will already help to evaluate programme effectiveness and gain a better understanding of regional needs that can steer the planning process. Conducting these household surveys will start in 2012 as part of the readiness programme.

At the second level, stoves distributed are registered by collecting data from producers that were trained as part of the productivity improvement programme in woredas. Collecting this data on a woreda level will facilitate a detailed understanding of the development of stove distribution. The woreda-level energy experts are responsible for collecting this information and will use an online database that is hosted on a federal level to provide monthly data snapshots. Development of this online database and provision of the necessary IT infrastructure to collect the data will start in 2012 as part of the readiness programme and should be ready to use as of early 2013.

The third level is necessary to measure and report on emission reductions in a way that is compliant with the strict MRV requirements of CDM projects. This requires registration of buyers of stoves and measurement of usage and actual emissions reductions in households. These MRV mechanisms do not have to be conducted in every woreda, and should be limited to areas where carbon credits are generated. They will be part of CDM pilot projects in selected woredas and will start in late 2012/early 2013.

3. Funding needs and benefits

The overall funding needed to implement the fuelwood-efficient stove initiative from 2012 to 2015 is USD 56 million. Based on historical data, the funding of planned programmes in the business-as-usual (BAU) scenario amounts to USD 16 million over the next four years.[17] Hence, an additional USD 40 million must be financed by grants, loans, or carbon credits between 2012 and 2015 to implement the scale-up programme. Of these USD 40 million, USD 36 million will be covered by grants (i.e., 90% of all funding needs). Furthermore, almost USD 4 million is required in soft loans for producers in rural and urban areas. Due to a long ramp-up time, only a small amount (USD 0.9 million) can be financed with the help of carbon credits from CDM projects until 2015.

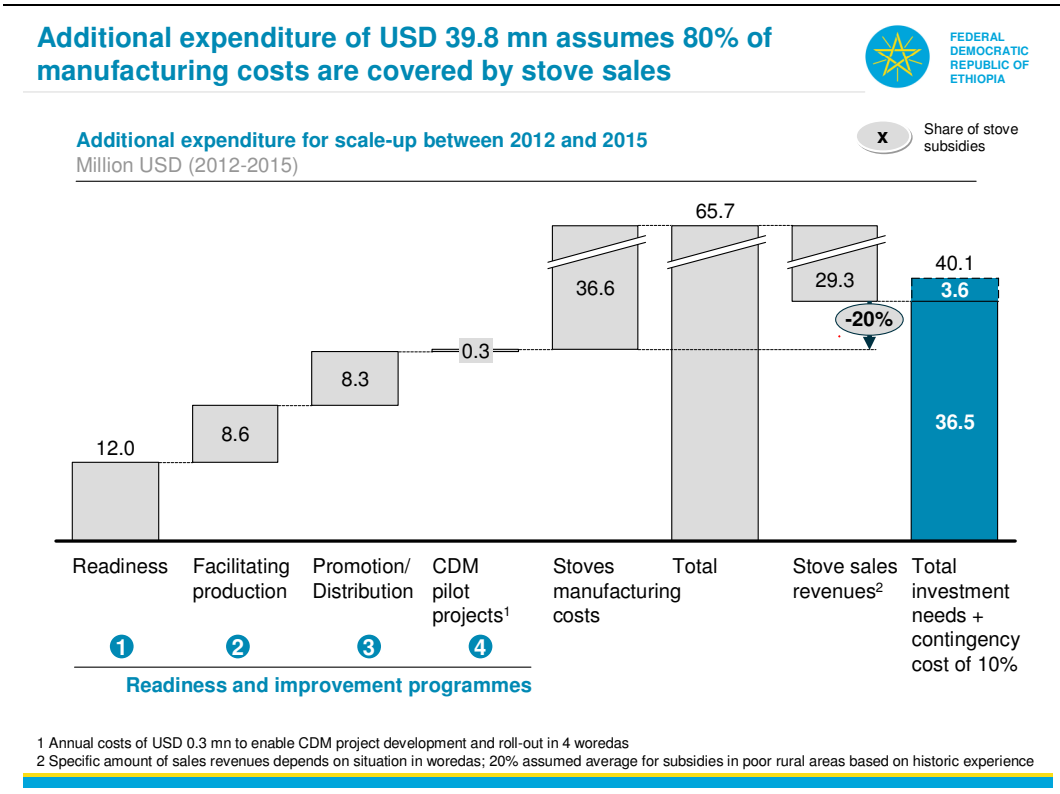
In return, the grants provided will generate significant environmental, social, and economic benefits. Based on the roll-out plan described in section 2.5, emission savings of around 14 Mt CO_2e can be realised between 2012 and 2015. In addition, the fuelwood-efficient stove initiative is expected to contribute to seven MDGs and, by reducing indoor air pollution, will help to avoid an estimated 1,000 to 2,000 deaths per year. Also, more than 5,000 jobs in rural areas can be created with the help of soft loans that will give local entrepreneurs a chance to develop a business. Loans will offer an interest rate of 4 to 8% in return and an average repayment period of 24 months. Given current market prices and market price expectations, carbon credits can be sold with expected price of about USD 10 per tonne.

This chapter details the additional expenditure between 2012 and 2015, the type of funding required, and the potential return on investment for development partners. Furthermore, it provides an outlook for expenditures until 2030.

[17] Based on average spending on stove distribution in the past three years by GoE and international partners; not considering spending on woreda level and for small-scale projects by NGOs (<3,000 stoves); includes expenditures for distribution of low-efficiency stoves; almost USD 11 million of forecasted expenditures as a result of a single project by GIZ.

3.1 ADDITIONAL EXPENDITURE BETWEEN 2012 AND 2015

EXHIBIT 13



The amount of USD 40 million is based on expenditures for activities in addition to the ongoing efforts described in chapter 2. It breaks down into USD 12 million for institutional and technical enablers (mostly increased personnel and technical equipment as described in chapter 2) and USD 16.9 million to support producers with loans and training and to improve access to rural households for energy experts on a woreda level with improved transport equipment. An additional USD 7 million is required for subsidies to consumers in poor rural areas. Finally, an amount of 10% has been added as a contingency for unforeseeable expenditures (Exhibit 13). Table 2 gives an annual breakdown of expected costs for the different programmes until 2015.

Table 2 Annual expenditures for scale-up programme between 2012 and 2015

Annual expenditures in USD million	2012	2013	2014	2015	**Total**
Programme					
Readiness	4.5	2.1	2.2	3.2	**12.0**
Productivity improvement	1.5	1.6	2.5	3.0	**8.6**
Promotion & distribution improvement	0.8	1.7	2.6	3.2	**8.3**
CDM pilot projects	0.2	0.0	0.0	0.1	**0.3**
Subsidies	0.4	1.4	2.3	3.3	**7.3**

Contingency cost	0.7	0.7	1.0	1.3	**3.6**
Total	**8.0**	**7.5**	**10.6**	**13.9**	**40.1**

The success of the initiative will be monitored with the help of an MRV system that can report on the numbers of stoves distributed and the penetration rate of stoves in households down to a woreda level (for a description of the MRV system see section 2.7).

3.2 FUNDING STRUCTURE AND RETURN ON INVESTMENT

The funding structure for the expenditures identified between 2012 and 2015 can rely on grants, loans, and revenues from carbon credits and is depicted in Table 3.

- Almost 90% of the funding will be based on bi- and multilateral grants, adding up to USD 35.3 million. These funds will be used mainly to build up institutional and technical enablers as well as to finance subsidies for stove purchases. In return, the initiative provides an aggregated mitigation potential of 14 Mt CO_2e at a cost of around USD 2.5 per tonne of carbon avoided. Furthermore, the increased distribution of stoves will contribute to the fulfilment of at least seven MDGs (see chapter 1). Amongst others, it will help significantly to reduce mortality in rural areas due to indoor air pollution. Based on WHO estimates, the increased usage of fuelwood-efficient stoves in Ethiopia could reduce the number of annual deaths by 1,000 to 2,000 (WHO 2006).
  Employing additional experts as part of the readiness programme would create at least 300 new, highly qualified jobs in government institutions and thereby add around USD 0.5 million p.a. to national GDP.
- Loans for about USD 4 million will be used to provide investment and working capital to cooperatives to set up production facilities and to urban mid- and large-scale producers. This money will enable producers to procure modern technical equipment and thereby increase the output of their workshops significantly. The loans could also be provided as revolving funds. This approach has been successfully conducted in the past with the help of the Women's Stove Association.
  The provision of loans as seed money for local entrepreneurs can create approximately 5,000 new jobs in rural areas by 2015 and increase national GDP by about USD 10 million p.a..
- Almost USD 1 million in revenues from carbon credits generated with the help of CDM projects could be mobilised between 2012 and 2015. Due to complex MRV requirements and thus a long ramp-up time, revenues until 2015 will be limited. Carbon credits from cookstove projects are estimated to yield a carbon price of USD 10 per t on the international offset market (e.g., ETS or voluntary market).

Type of funding	**Additional funding need between 2012 and 2015** in USD million	**Important returns for investors**
Grants	35.3	▪ Total abatement potential of 14 Mt CO2e between 2012 and 2015 (~USD 2.5 per tonne mitigated) ▪ Contribution to 7 of the UN Millennium Development Goals. Amongst others: avoidance of approximately 1,000 to 2,000 deaths per year due to indoor air pollution ▪ Creation of over 300 jobs in the public sector ▪ Average GDP added of USD 10 million annually (~USD 40 million between 2012 and 2015; ODA rate of return of 1.2)
Loans	3.9	▪ Start-up financing for entrepreneurs especially in rural areas; direct creation of 5,000 jobs in local producer cooperatives ▪ Soft loans with an interest rate of 4 to 8%, 2 years until return
Carbon revenues	0.9	▪ Potential revenues of USD 10 per tonne of CO2e avoided

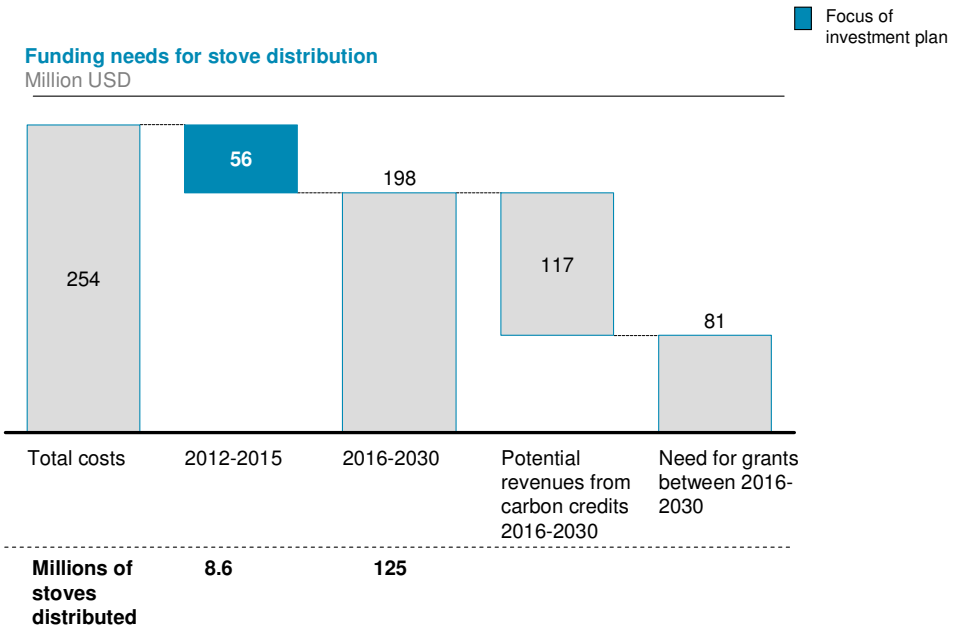
Table 3 Overview of additional funding needs and potential returns from distribution of fuelwood-efficient stoves between 2012 and 2015

3.3 OUTLOOK ON EXPENDITURES UNTIL 2030

EXHIBIT 14

Funding needs from 2016 to 2030 can be reduced significantly by relying on revenues from carbon credits

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA



To achieve an 80% penetration of rural households by 2030 and assuming an efficient enclosed fuelwood stove has a service life of 2.5 years (cooking stoves) or 4.5 years (baking stoves), another USD 198 million may be needed between 2016 and 2030 to distribute an overall volume of 125 million stoves, resulting in 31 million operational fuelwood-efficient stoves by 2030[18]. Costs per stove distributed will decrease, since it is assumed that the amount of subsidies can be reduced over time, and only recurring costs for institutional and technical enablers will have to be funded (e.g., salary for government officials, replacement of IT equipment).

A major share of expenditures between 2016 and 2030 can be covered by revenues from carbon credits if a total number of 40 woredas, equivalent to around 500,000 rural households (about 3% of all households covered by the programme), can be integrated into CDM projects or NAMAs over the next 10 years (Exhibit 14).

[18] This number depends on rural households' adoption rate of electricity for cooking and baking. This number is assumed to be only around 15% for rural households in 2030 due to higher electricity prices compared with collection of fuelwood. These numbers will be reviewed and adjusted if necessary in the future.

4. Work plan and next steps

Chapter 2 described the different improvement programmes to scale-up distribution of fuelwood-efficient stoves in rural areas. This chapter outlines how these programmes will be translated into projects that can be financed and conducted by development partners in cooperation with the GoE. This encompasses an overview of the required type of funding per year that needs to be provided by the CRGE facility or direct funding from development partners (section 4.1) as well as necessary next steps to develop a project design document (PDD), responsibility for management of the programmes within the GoE, and an overview of existing implementation vehicles (section 4.2).

Finally, section 4.3 gives an overview of the overall resource requirements and needs for alignment with other national policies.

4.1 NEXT STEPS IN FUNDING

Exhibit 15 gives an overview of the grants, funds, and carbon finance required by or before 2015 for the initiative's different programmes (for a detailed description of funding needs see chapter 3).

EXHIBIT 15

Overview on funding needs per programme

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

in mn USD	2012			2013			2014			2015		
Programmes	Grants	Loans	PfP*	Grants	Loans	PfP*	Grants	Loans	PfP	Grants	Loans	PfP*
Readiness	4,5			2,1			2,0		0,3	2,6		0,6
Production	1,1	0,4		0,8	0,8		1,5	1,0		2,1	0,9	
Distribution/ Promotion	0,8			1,7			2,6			3,2		
CDM	0,2			0,0			0,0			0,1		
Subsidies	0,4			1,4			2,3			3,3		
Contingency	0,7			0,7			1,0			1,3		
Total	**7,6**	**0,4**		**6,7**	**0,8**		**9,4**	**1,0**	**0,3**	**12,5**	**0,9**	**0,6**

* PfP – pay for performance

Funding will either be provided by the CRGE facility directly or by development partners that register their funding at the CRGE facility. As outlined in chapter 3, the vast majority of funding in the first years will be necessary in grants to enable future

pay for performance oriented funding. After the build-up of the fundamental MRV infrastructure as part of the readiness component, funding can shift increasingly to pay for performance oriented schemes rewarding programmes based on their success in terms of the number of stoves distributed and resulting annual emission savings (for an outlook on a future MRV framework see section 2.7).

4.2 NEXT STEPS IN IMPLEMENTATION

This investment plan has identified the most important activities and associated costs for an implementation of the improvement programmes. However, development of specific project proposals will require a more detailed cost assessment and activity planning, taking into account the local implementation context and existing implementation vehicles. These contexts may vary significantly between different regions and woredas and have to be taken into account. Additionally, every programme has to be further specified as part of the discussions between project developers and the GoE during the development of a PDD.

Exhibit 16 gives an overview on existing projects in different areas that could serve as implementation vehicle and total additional funding required over the next years. It also indicates where new projects are going to be required to realize the improvement programmes as outlined in this investment plan.

EXHIBIT 16

Implementation vehicles for future projects

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

	Existing implementation vehicles	Main responsibility/ Number of projects	Additional funding required 2012-2015 In USD million
Readiness	▪GIZ Energy Coordination Office Ethiopia ▪MoWE/World Bank - Rural Household Energy End-Use Efficiency Improvement Project ▪*New project - TBD*	**AETPD Directorate** 1 project centrally managed on federal level	12
Productivity Improvement of stove production	▪GIZ Household Energy project ▪MoWE/Worldbank - Rural Household Energy End-Use Efficiency Improvement Project ▪MoWA stove programme ▪*New project - TBD*	**AETPD Directorate/ Regional Energy Departments** 9+2 projects (1 project in every region)	8.6 [for all regions]
Promotion & distribution improvement	▪MoWE/World Bank Rural Household Energy End-Use Efficiency Improvement Project ▪GIZ Household Energy project ▪Worldvsision cookstove programme ▪GAIA ▪Menschen fuer Menschen ▪MoA/MoH extension programmes ▪*New project - TBD*	**Regional Energy Departments/ Woreda energy experts** 9+2 projects + X (1 project in every region, +sub-projects in woredas)	8.3 (+7.3 in subsidies) [for all regions and woredas]
CDM pilot projects	▪*New project - TBD*	**AETPD Directorate/ Woreda energy experts** 4 CDM projects in a first piloting phase	0.3

The following paragraphs describe next steps and most important activities to start implementation for the different programmes in more detail:

- The **readiness programme** will be centrally planned and coordinated by the AETPD Directorate at the MoWE. It is meant to be conducted as a single project, starting in early 2012. A project implementing this programme will encompass the choice of the IT infrastructure, development of procedures and guidelines, and definition of MRV mechanisms. Implementation of some activities will take place on regional and woreda level, involving all woredas in Ethiopia from the beginning of the programme. This includes the additional staffing for teams dealing with energy-related questions, the deployment of the necessary IT infrastructure, and the build-up of regional R&D labs. Close interaction between the organisation primarily responsible at the federal level and the Regional Energy Departments is crucial during the development of a PDD. This will enable the planning of the roll-out speed and timeline for different regions in the country, based on their current capability level.
  The most important activities that have to be started as early as possible are:
  - The programme coordination bureau at the AETPD Directorate will lead the efforts and therefore has to increase its staff in early 2012. Regions and woredas have to detail their staff requirements so that appropriate staffing activities can be started.
  - To support current and new staff, a detailed project manual has to be developed. It will describe the processes for cooperation between different units and levels of the government and with external stakeholders. It will also specify implementation activities, and provide standard forms for use in setting up stove production facilities, measuring output, etc. The development of this project manual can build extensively on the work of this investment plan.
  - The preparation of an evaluation scheme and the development of a database for MRV efforts should also be kicked off in the first quarter of 2012.
- The **productivity improvement programme** plans to provide soft loans to cooperatives in rural areas and support them with the help of a newly developed training curriculum. Furthermore, a small number of loans will be provided to urban producers to start the large scale production of metal parts for cooking stoves. Disbursement of the funds and training activities will be managed by Regional Energy Departments that work together with local partners.[19] Alignment of selection criteria for stove producers and curriculum will be supervised by the AETPD Directorate. Based on experience from previous projects, the overall fund will be stipulated on a federal level, while the Regional Energy Departments are mainly responsible for developing a joint disbursement strategy with energy experts on woreda level and managing day-to-day operations. This encompasses identification of the right stove model for woredas in the given region. Subsequently, energy experts will be trained to teach local producers about the right production method for this technology and details of the support programme for cooperatives (including selection criteria for loan-based support of producers, conditionalities of loans provided etc.).
  The most important activities that have to be started as early as possible are:

[19] In recent years micro loans on a woreda level have been managed by local Women's Affairs Departments

- It will be important to kick-start a close cooperation with the responsible planning units for the extension programmes of the MoA and MoH in the regions to develop a joint strategy on stove distribution (including the choice of type of stove to be distributed, the training material and sessions for extension workers).
- Programme guidelines for the management of loans and criteria for selecting producers have to be developed. The guidelines will specify the responsible government units for the management of funds on a local level as well as the lending processes; furthermore a handbook for implementing agencies will be developed. Besides the loan programme for rural producers, seed money will be provided to a small number of mid- to large-scale urban producers. They will, ideally, cooperate with rural producers in the production of cooking stoves for rural areas.
- New and locally tailored training programmes will be developed. The curriculum for rural stove producers should focus on the production of modern, highly-efficient stoves that adhere to the local needs with respect to cooking habits and mobility requirements. It is also crucial to develop a concept for closer collaboration between rural and urban producers, potentially facilitated by energy experts.

■ The **promotion and distribution programme** will increase public awareness and the availability of high-efficiency stoves in rural areas. All relevant activities will be coordinated on a regional level by the Regional Energy Departments and implemented by the energy experts in woredas. To develop a PDD for such a project, local peculiarities have to be taken into account for every region. The current degree of coordination between Regional Energy Departments and extension programmes varies, as do the degree and quality of activities of other development agencies in woredas. Understanding the initial situation will be important for the planning of specific improvement activities in the project. Historically, the amount and type of subsidies provided in woredas have differed greatly. To arrive at a consistent joint strategy, it is first necessary to conduct a thorough analysis of the situation of rural households in a specific woreda. The most important activities that have to be started as early as possible are:
  - Assessment of local activities of government bodies, NGOs, and other development partners; identification of successful examples from other sectors; development of a joint strategy for future promotion activities; identification of needs to roll out and planning of campaign;
  - Analysis of income situation and access to fuelwood at woreda level in preparation for a decision about subsidy schemes. This involves household surveys to understand the ability to pay for stoves and most important aspects of a purchasing decision.

■ **CDM projects** aim to translate CO_2 emission reductions into carbon credits. Due to the complex MRV requirements, implementation of a CDM project has to be conducted and supervised on a daily basis by energy experts in woredas. Central supervision of all CDM projects takes place at the federal level by the AETPD Directorate. Because of the very limited experience with CDM projects, the GoE

plans to test the feasibility of (small-scale) stove CDM projects in four pilot woredas. According to guidelines that should be jointly stipulated between CDM project developers and the AETPD Directorate, a thorough baseline of stove usage has to be prepared in a woreda. Furthermore, the experts in a woreda will work closely with producers in the local cooperative to ensure that the stoves are produced to the highest quality standards and they will also be responsible for household visits to verify the emission reductions realised.
The most important activities that have to be started as early as possible are:

- Selection of appropriate woredas for pilot projects with the help of Regional Energy Departments.
- Definition of a baselining and MRV methodology together with project developers and, if necessary, external experts. This methodology has to be developed only once and can serve as a blueprint for subsequent CDM projects.

4.3 ALIGNMENT WITH OTHER NATIONAL POLICIES

Besides the additional human resources, the stove distribution scale-up will require not only infrastructure investments and expenditures for external services or subsidies, but also the creation and alignment of other national policies that are relevant to the fuelwood-efficient stove initiative. This touches three topics in particular:

- **REDD**. The supply of fuelwood should come from renewable biomass plantations.[20] In close cooperation with other initiatives in the forestry sector, planning of plantations would enable even greater emissions reductions beyond the saving realised by more efficient stoves. To this end, alignment with government experts on REDD issues has already started and will be developed further (to be coordinated with the Ministry of Agriculture).
- **GTP targets.** Regional and technology targets for stove distribution can be introduced based on the numbers in this investment plan. In the short term, the sequencing of the roll-out can result in specific objectives that are set for regions and used to review their performance. In the mid- and long-term these targets can be mainstreamed into GTP goals (to be coordinated with the Ministry of Finance and Economics).
- **Efficiency standards.** The Ethiopian Conformity Assessment Enterprise in conjunction with the Ministry of Water and Energy should be responsible for the certification of all stoves and components thereof that are imported into the Ethiopian market. This will ensure adherence to efficiency and quality standards required to satisfy the CRGE strategy objectives (to be coordinated with the Ethiopian Conformity Assessment Enterprise).

[20] This can only be done for woredas that do not participate in carbon credit projects, since they require a supply of fuelwood from non-renewable sources. However, since only a limited number of woredas will take part in CDM projects, there will be ample room for woredas in which biomass plantations will play an important role.

The programme coordination bureau at the AETPD Directorate will ensure that any additional requirements with respect to policy changes will be monitored in the course of the scale-up.

4.4 CONCLUDING REMARKS

The initiative described in this investment plan will have a huge impact on the lives of millions of people in rural areas. In line with the principles of the Human Development Index, it will improve people's capabilities in several dimensions. Besides significant emission savings and returns for the overall economy, it will allow especially women and children to live a healthier life and increase their individual opportunities to choose a life that they value.

This investment plan is a first step in the implementation of the initiative. Realizing the potentials outlined depends on obtaining funding for the necessary expenditures. However, beyond the purely financial aspects described, it also requires support from international development partners in setting up the institutions and conducting the programmes on an operational level. The scale of woredas that have to be involved in the next years, the amount of technology that has to be deployed, and the process management skills required pose a challenge for the public sector.

We are therefore inviting and looking forward to working with our international partners to make this initiative happen. We are convinced that this initiative can be an important showcase of how to facilitate pro-poor and low-carbon development in Ethiopia and could serve as a blueprint for other initiatives and countries.

References

CDM Gold Standard, 2008, *Methodology for Improved Cook-stoves and Kitchen Regimes v.01*, Geneva, http://www.stovetec.net/us/images/stories/pdfs/GoldStandardCarbonCreditProtocols.pdf

Central Statistical Agency (CSA), 2010, *Population and Housing Census 2007*, Addis Ababa, http://www.csa.gov.et/surveys/Population%20and%20Housing%20census/ETH-pop-2007/survey0/data/Doc/Reports/National_Statistical.pdf

International Livestock Research Institute, 2006, *Commercialization of Ethiopian agriculture: Extension service from input supplier to knowledge broker and facilitator*, Addis Ababa, http://cgspace.cgiar.org/bitstream/handle/10568/564/CommerciaIPMSWorkingPaper_1.pdf

Gesellschaft fuer Internationale Zusammenarbeit (GIZ), 2009, *Subsidy schemes for the dissemination of improved stoves*, Eschborn, http://www.gtz.de/de/dokumente/en-stove-subsidies-gaul-2009.pdf

GIZ, 2008, *Impact Assessment of Mirt Improved Biomass Injera Stoves Commercialization*, Addis Ababa, https://energypedia.info/index.php/File:Mirt_impact_assessment_rpt_final.pdf

Global Alliance for Clean Cookstoves, 2011, *Early Action Items*, http://cleancookstoves.org/wp-content/uploads/2011/06/Early-Action-Item-Compilation-FINAL.pdf

Government of Ethiopia (GoE), 2011, Ethiopia's *Climate-Resilient Green Economy; Green economy strategy*, Addis Ababa, http://www.epa.gov.et/Download/Climate/Ethiopia%27s%20Climate-Resilient%20Green%20economy%20strategy.pdf

GVEP, 2009, *Cookstoves and Markets: Experiences, Successes and Opportunities*, London, http://www.hedon.info/docs/GVEP_Markets_and_Cookstoves__.pdf

World Health Organization (WHO), 2006, *Fuel for life*, Washington, http://www.who.int/indoorair/publications/fuelforlife.pdf

World Bank, 2011, *The Rural Household Energy End-Use Efficiency Improvement Project Field Assessment Report*, Washington

World Bank, 2011, *Household Cookstoves, Environment, Health, and Climate Change*, http://climatechange.worldbank.org/content/cookstoves-report

Woody Biomass Inventory and Strategic Planning Project (WBISPP), 2004, *A National Strategic Plan for the Biomass Energy Sector*, Addis Ababa

Appendix: Methodology

About the data and calculations

Ethiopia's energy needs are predominately satisfied by biomass (91%). This includes traditional energy sources such as fuelwood, charcoal, branches, leaves, and twigs. The development of fuelwood consumption is expected to be influenced primarily by population increase, unless a significant change in the energy mix takes place. The main sources used for projections of fuelwood consumption were the WBISPP report (on current levels of degradation due to fuelwood consumption) and CSA population forecasts (WBISPP 2004; CSA 2010).

Spreading the use of efficient stoves has two distinct effects on GHG emissions: First, such stoves reduce forest degradation, with an impact estimated at around 0.9 t biomass/year per household. Secondly, woody biomass acts as a carbon sink. This means Ethiopia's forestry sector can even yield negative emissions via sequestration, i.e., storage of carbon in the form of wood, at a level that surpasses emissions from deforestation and forest degradation. Assuming the scale-up to fuelwood-efficient stoves proceeds as projected, this sink or savings effect is projected to amount to 2.1 t/year per household.

The effect of reduced degradation can be factored in at 100% resulting in an abatement potential of 1.6 t CO_2e per efficient stove per year under the assumption that reduced consumption first decreases direct degradation. The second reduction via the carbon sink effect, however, needs to be discounted by an adjustment factor to cap the total theoretical carbon sink potential of all efficient stoves to the maximum estimated potential for forest regeneration (as this potential will only be reached gradually over time). Applying this factor yields an additional abatement potential of 0.6 – 1.4 t CO_2e per efficient stove per year, depending on the stove type.

Calculation of abatement potential and costs

The Sub-Technical Committee (STC) of the CRGE strategy project analysed different cooking and baking technologies and their socio-economic and environmental benefits. For clarity, the findings are discussed individually here:

- **Fuelwood-efficient stoves**
  - Baking stoves, such as the clay-soil-based mirt stove top for baking Ethiopia's traditional injera sourdough bread
  - Cooking stoves, such as the Tikikil for cooking
- **Fuel-shift stoves**
  - LPG stoves (mostly for cooking)
  - Biogas stoves (mostly for cooking)
  - Electric stoves and electric mitad (for both cooking and baking)

The pattern of usage of these technologies varies between regions and according to cooking/baking traditions. One common feature, however, is that most households

need both a stove for cooking (sauces, coffee) and a stove for baking (injera). This is reflected in penetration and scale-up plans.

The total **abatement potential** has been calculated for each stove type based on:

- **Household reach.** In order to reflect differences in access and cost of alternative fuels/energy sources, the team distinguished between rural and urban populations. The rates are based on a projection of GTP plans (particularly the National Energy Network sectoral GTP review plan), several expert discussions, and triangulation with other countries that have successfully disseminated efficient stoves. For 2030, it was estimated that the following shares of households could be reached (as a percentage of rural/urban households):
  - Fuelwood-efficient stoves: 80%/5% (both cooking and baking)
  - LPG stoves: 0%/5%
  - Biogas stoves: 5%/1%
  - Electric stoves: 5%/53% (weighted for cooking and baking)
- **Efficiency improvement.** This number indicates the percentage of fuelwood that can be saved by employing different technologies. The calculation is based on efficiency evaluations and testing data from the Ministry of Water and Energy as well as from donor organisations active in the promotion of efficient stoves (e.g., GIZ). Potential savings are:
  - Fuelwood-efficient stoves: 50% (average for both cooking and baking)
  - LPG stoves: 100% (cooking only)
  - Biogas stoves: 100% (cooking only)
  - Electric stoves: 100% (cooking and baking)
- **Emissions from alternative fuels.** This takes into account the GHG emissions from alternative fuels used to substitute fuelwood.
  - LPG stoves: Emission reduction of 89% due to the higher efficiency of LPG stoves (comparison of fuelwood emissions and LPG emissions based on IPCC combustion emission factors).
  - Fuelwood-efficient, biogas, and electric stoves: hardly any emissions (assuming that electricity will have near-zero emissions from 2015 onwards, as it will be generated with water).

Taking all factors described into account, the total abatement potential of stoves is nearly 51 Mt CO_2e in 2030. At 34.3 Mt CO_2e, fuelwood-efficient stoves contribute the largest share of this total potential, followed by 14.0 Mt CO_2e from electric stoves, 2.3 Mt CO_2e from biogas stoves, and 0.6 Mt CO_2e from LPG stoves.

Abatement costs have been calculated with significant differences between stove types:

- **Stove cost**. Stove cost varies by model and has been calculated using average prices taken from a variety of price quotes by disseminating agencies (e.g., MoWE, GIZ, and World Vision). The stove cost is accounted for as a capital expenditure and amortised over the stove's average service life, depending on the model as well. Costs and service life were calculated as follows:
  - Fuelwood efficient stoves: USD 4 – 8 (depending on stove type); with an average service life of 2.5 (cooking stoves) or 4.5 years (baking stoves)
  - LPG stoves: USD 107; with an average service life of 7 years
  - Biogas stove (including digester infrastructure): USD 912; with an average service life of 20 years
  - Electric stove and electric mitad: USD 20 – 63; with an average service life of 7 years.
- **Fuel cost savings**. In order to determine fuel cost savings, the team compared average fuel expenditure before and after a technology change. The savings have been accounted for as (negative) cost.

Without accounting for the potential benefits for users of efficient stoves, the pure economic cost of implementing the stove scale-up would be positive, e.g., around 8.46 USD/t CO_2e for efficient stoves. Including the benefits, however, they become negative (save money) for most stoves types, with the savings ranging from USD -21.33 to USD -13.69. The only notable exception is the abatement cost for LPG stoves, which stays positive at USD 120 due to the more expensive fuel.