

# **Annual Planning 2014 Update**

on

## **Energising Development – Phase 2**

Partnership between

**The Netherlands Ministry of Foreign Affairs**

**The Norwegian Ministry of Foreign Affairs**

**The Australian Department of Foreign Affairs and Trade**

**The UK Department for International Development**

**The Swiss Agency for Development and Cooperation and**

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Eschborn, Germany, May 2014

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## **A. Introduction**

The main purpose of this interim Annual Planning Document (update to the already submitted Annual Planning 2014) is to ask the Governing Board for approval of the second tranche of Result Based Financing (RBF) measures. In addition to the RBF measures, this Annual Planning also presents three urgent up-scaling proposals (Bangladesh, Ghana and Malawi) under the traditional EnDev modality. The objective of the up-scaling of EnDev Bangladesh is to support the dissemination of improved cookstoves in close co-operation with the government. The purpose of the EnDev Ghana proposal is to extend grid electrification of industrial zones. The Malawi up-scaling is intended to enhance the dynamic market development for improved stoves. In addition to the RBF measures and up-scaling, this Annual Planning also presents a new concept for EnDev Uganda, which became necessary as a result of the disapproval of the project proposal presented to the EU energy facility.

As the RBF approaches are an integral part of the EnDev portfolio, they are not presented as new projects but as up-scaling proposals. In the overview tables the total numbers for budget and outcome (incl. traditional EnDev and RBF) are given. However, the RBF modality has some special features. Therefore the RBF approaches are presented in sub-chapters with a slightly different structure. These sub-chapters constitute updated versions of the originally presented concept notes. As background information, the much more detailed and elaborated full proposals (ca. 50 pages) for each RBF project are included as annexes to this Annual Planning.

## B. Status of the RBF facility

Activities under EnDev's RBF facility have continued to intensify strongly with the transition from start-up to initial implementation of the selected projects under the first tranche in parallel with the launch and management of the 2<sup>nd</sup> round for RBF projects in 2013.

### Progress of the first tranche

The projects selected under the first tranche have defined the exact terms of the RBF scheme and the details for the contractual arrangements with implementing partners, financial institutions and the private sector. While some countries advance as planned, in other countries processes are delayed by difficult contractual set-ups, limited capacity of actors involved or the worsening political situation in the countries.

After initial delays and in-depth analysis and development of basic (yet often tailor made) RBF requirements like better market understanding, incentive structures, legal documents, M&E structures, the process is now finally well underway with calls for private companies published in Tanzania, Vietnam and Benin and the remaining to follow during the first half of 2014. Results in terms of Key Performance Indicators, learning topics and impact observations have been included in a dedicated RBF section for each project in the regular EnDev reporting. EnDev will continue to report RBF progress to the Governing Board in this format on a semi-annual basis. Brief information on the progress of the individual countries and projects since the EnDev progress report 2013 is provided in the table below.

<b>Bangladesh, picoPV</b>
For the contract negotiations between EnDev and IDCOL, the central player in the RBF, EnDev has presented a set of quality standards for picoPV systems to define the framework for financial incentives and monitoring of results. IDCOL is currently reviewing the quality standards. The call for proposals for companies is expected to be launched shortly, pending feedback by IDCOL. Potential partner organisations are ready to participate
<b>Benin, picoPV, water pumping, street lighting</b>
The project continues to focus on picoPV first to ensure quick progress. The other components will be developed on a step-by-step basis. For picoPV negotiations on tax exemptions for RBF contracted companies with ABERME are concluded. The call for private sector companies to participate in the RBF has been launched. The contract format has been approved by GIZ legal and contractual departments. Contracting of the first private sector companies will happen in due course. A new project manager has started work in Benin.
<b>Ethiopia, cookstoves</b>
The baseline study to deepen understanding of the market is completed. Findings have been analysed and recommendations integrated into the setup of the implementation of the RBF. The project experienced some delays in the process of defining the exact contract format with the FI which has been concluded. Complementary to the contract format a detailed RBF manual to guide the FI through the call for proposals has been prepared. The call will be put out to the private sector during the 1st half of 2014.
<b>Rwanda, mini-grids and picoPV</b>
Negotiations with UOB (Urwego Opportunity Bank) have been concluded. The grant agreement with UOB is about to be signed with the incentives for the private sector being published in parallel.
<b>Tanzania, picoPV</b>
The first call for private sector applications is closed. Five firms have been selected to participate in the first round. The evaluation of applications has been carried out involving UOB, SNV, World Bank Lighting Africa and the Tanzania Renewable Energy Association (TAREA). DFID Tanzania has been invited as well, but chose not to participate. The RBF incentive payments have entered the market on 1 May 2014. There is an ongoing discussion between DFID Tanzania and SNV on the project and potentials for scaling up.

## Vietnam, domestic biogas

Implementation already started in June 2012 continuing the existing approach in Vietnam. In January 2014 the revised RBF scheme was introduced in six pilot provinces. The call for private sector companies to participate in the scheme has been published in March 2014. Companies have started to sign up and can continue to do so on a continuous basis. The project had decided to postpone the first RBF training for companies as initially only a limited number of Independent Quality Controllers (IQC) could be identified. After additional efforts another 17 IQC applications have been received out of which 15 were selected for the training.

### Progress of the second tranche

A second round for RBF concepts and full proposals was initiated in September 2013 in order to complete the portfolio of the EnDev RBF Facility. A call for ideas was launched to GIZ offices in EnDev countries as well as to a limited number of potential partner organisations (Netherlands Development Organisation [SNV], Practical Action [PA], Hivos and Global Village Energy Partnership [GVEP]). The initial list of 28 project ideas was eventually reduced to 10 project concept notes. After review by the selection committee comprised of EnDev HQ, DFID, DGIS, NORAD and two external members (ESMAP and former GPOBA), nine project concept notes (PCN) were shortlisted and asked to prepare full proposals. One proposal from Mali “Refitting thermal mini-grids by solar energy and RBF tools in Mali” was referred to other funding mechanisms.

Similar to the first round, because of the significant requirements for these full proposals and the novelty of the RBF concept, the selected countries were intensively (considerably more than regular EnDev proposals) supported by EnDev management and consultants specialised in RBF. The support put strong emphasis on providing guidance on how to best incorporate the feedback from the evaluation committee on the PCN, as well as demonstrating feasibility with regards to:

- RBF incentive structure/design and price finding mechanism
- Market analysis and enabling environment
- Expected private sector investment and participation
- Verification strategy
- Value for Money and Theory of Change
- Learning objectives and innovation.

As a result, out of the nine shortlisted PCN, a total of eight were selected for full proposal development. The “Domestic cooking and lighting market facilitation in far western Nepal” proposal was withdrawn before completion to avoid that considerable (but in vain) efforts were made. The sector environment in Nepal characterised by heavy government subsidies left little to no space for this specific market-driven RBF approach.

The 2<sup>nd</sup> tranche portfolio is characterised by a balanced spread of technologies and a number of creative and innovative proposals in terms of

- RBF approaches (e.g. RBF research and development (Peru stoves component), RBF with focus on financial sector (Kenya picoPV))
- Technologies (e.g. hoodstoves (Nepal), 3<sup>rd</sup> generation cookstoves (Kenya) or even combined technologies delivering the entire energy service package (Nepal))
- Geographic outreach with concept notes from Africa, Asia and Latin America.

The portfolio combines (a) risky but innovative concept notes with a strong focus on learning (e.g. Kenya private sector mini-grid) and (b) concepts notes that apply already piloted models that are very likely to perform well (e.g. Peru solar water heater component). The total portfolio is described in chapter C and the respective up-scaling proposals.

## **Progress on learning and evaluation**

Good progress has been achieved with regards to following up on the RBF learning agenda with its structure of internal exchange and analysis of lessons. A knowledge exchange workshop between round 1 and round 2 RBF projects has taken place in Nairobi in May 2014. An international tender for a 4.5 year accompanying external evaluation of EnDev's RBF facility has been launched. The reference group members for the evaluation study have been identified and invited.

## C. General decisions on the RBF facility

The table below contains an overview of all RBF measures already approved in the Annual Planning Update 2013 Update and the new measures presented in this Annual Planning. In combination, these constitute the entire **portfolio of the EnDev RBF facility** (see Table C.1).

Table C.1: EnDev RBF portfolio in two tranches and their budgets

Country	Title	RBF Budget
<b>Tranche 1 (already approved)</b>		
Benin	Three Off-grid PV Market Segments to the next level	EUR 3,060,000
Ethiopia	Improved Cookstoves	EUR 1,542,000
Rwanda	Sustainable Market Creation for Solar Lighting	EUR 3,400,000
Rwanda	Sustainable Market Creation for Renewable Energy Village Grids	EUR 1,891,000
Tanzania	Rural Market Development for Solar PicoPV, Lake Zone	EUR 1,541,000
Bangladesh	Output-based PicoPV System Development	EUR 3,214,000
Vietnam	Creating a Market Driven Biogas Sector	EUR 3,740,000
<b>Tranche 2</b>		
Kenya	Building sustainable and affordable credit lines for small systems in rural areas	EUR 2,800,000
Kenya	Market creation for private sector operated mini-grids	EUR 2,075,000
Kenya	Higher Tier Cookstove Market Acceleration Project	EUR 2,060,000
Nepal	Sustainable Hood-stove Market	EUR 1,675,000
Peru	Getting to universal access in thermal energy services in Peru	EUR 2,040,000
<b>Evaluation</b>		
Additional funds reserved for accompanying evaluation of the RBF facility		EUR 500,000
<b>Sum</b>		<b>EUR 29,538,000</b>

The availability of the second tranche funds is still pending sign-off by DFID management and deposit of the promissory note via the Bank of England. First steps of implementation for the second tranche projects will start as soon as the funds are approved by DFID.

The total amount allocated to projects and the accompanying evaluation amounts to EUR 29,538,000. With this amount, the **theoretical gap of 1.2 million EUR in funding mentioned in the Annual Planning 2013 Update is closed**. Given the novelty of RBF and the limited possibilities for GIZ to influence expenditure of projects which is directly tied to private sector performance, it is still likely that projects will not disburse fully. EnDev management and DFID therefore propose to **shift funding between disbursing and non-disbursing projects after the mid-term review of the facility**.

The total portfolio of EUR 29,538,000 falls short of the entire UK contribution to EnDev, amounting to EUR 35,160,000. **It is still to be decided how the remaining EUR 5,622,000 should be used.**

## D. Overview about planned country activities in 2014 under EnDev 2

The total budget of the second phase is currently EUR 202.26 million. Below, an overview of country activities is provided. Table D.1 gives an overview of on-going and unchanged projects (compared to the previous Annual Planning 2014 document). Country activities that are foreseen to be extended without up-scaling are presented in Table D.2. Table D.3 presents the country activities that are proposed to be scaled up. Table D.4 presents the country activities that are proposed to be scaled up and extended. Table D.5 presents the country activities with a fundamentally revised project approach.

Table D.1: On-going country activities under EnDev 2 **without changes**

Country	Activities	Project Duration		Funding	Planned outcomes on HH level
		Start	End	in EUR 1,000	In persons
Benin	grid, solar-RBF	10 / 09	06 / 17	7,160	406,415
Bolivia	grid, solar, stoves	10 / 09	06 / 16	11,400	637,000
Ethiopia	Grid, solar, stoves, RBF	01 / 10	06 / 17	15,467	1,055,000
Indonesia	solar, hydropower	05 / 09	07 / 18	11,960	172,000
Liberia	PicoPV, solar dryer, stoves	05 / 12	03 / 15	990	10,500
Mali	BCS, solar, mini-grid	01 / 13	12 / 17	3,000	100,000
Mozambique	Solar, hydropower, stoves	01 / 10	12 / 15	10,800	321,000
Rwanda	hydropower, biogas, solar-RBF, mini-grid-RBF	10 / 09	12 / 17	15,490	1,028,634
Tanzania	stoves, solar-RBF	12 / 12	06 / 17	2,041	226,970
Vietnam	biogas	07/13	06 / 17	3,740	275,000

Table D.2: Country activities intended to **be extended** without up-scaling

Country	Activities	Project Duration			Funding	Planned outcomes on HH level
		Start	Old end	New end	In EUR	In persons
Benin	stoves	10/09	12/14	12/17	4,000	800,000
Burkina Faso	stoves	05/09	12/14	06/15	3,500	500,000
Burundi	solar, stoves	09/10	12/14	06/15	1,500	131,000
Cambodia	biogas	12/12	12/14	03/15	2,000	58,515
Honduras	Solar, hydropower, stoves	10/09	12/14	12/16	5,630	174,300 <sup>1</sup>
Indonesia	biogas	12/12	12/14	06/15	1,150	20,000
Madagascar	stoves	12/12	03/14	03/15	300	47,500
Nicaragua	Grid, solar, stoves	10/09	12/14	12/16	5,640	174,000 <sup>1</sup>
Senegal	Mini-grid, Solar, stoves	04/09	12/14	06/15	8,500	559,700

<sup>1</sup> Includes planned outcome of 125,000 of regional cookstove activities Honduras/Nicaragua

Table D.3: Country activities intended to be scaled up

Country	Activities	Project Duration		Funding in EUR 1,000		Planned outcomes on HH level in persons	
		Start	End	Old funding	New funding	Old target	New target
Bangladesh	stoves, solar, solar-RBF	06/09	06/17	14,064	18,064 <sup>2</sup>	2,656,000	5,000,000

Table D.4: Country activities intended to be scaled up and extended

Country	Activities	Project Duration			Funding in EUR 1,000		Planned outcomes on HH level in persons	
		Start	Old end	New end	Old funding	New funding	Old target	New target
Ghana	grid	01/10	12/14	05/16	1,650	3,150 <sup>2</sup>	(600 SMEs)	(1180 SMEs)
Kenya	PicoPV, stoves, mini-grids	07/09	12/15	06/18	7,800	14,735	3,940,000	4,708,500
Malawi	stoves	12/12	12/14	12/16	500	3,000 <sup>2,3</sup>	125,000	725,000
Nepal	grid, hydropower	05/09	06/15	06/18	4,740	6,415	240,637	389,137
Peru	grid, SHS, stoves, SWH	06/09	12/15	06/18	11,350	13,390	485,000	956,500

Table D.5: Country activities with a fundamentally revised project approach

Country	Activities	Project Duration			Funding in EUR 1,000		Planned outcomes on HH level in persons	
		Start	Old end	New end	Old funding	New funding	Old target	New target
Uganda	r.e., stoves	04/09	12/14	03/16	6,000	8,000	612,500	534,000

<sup>2</sup> currently only EUR 500,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds

<sup>3</sup> including EUR 500,000 pending Irish Aid proposal for the 2015 budget

## **E. Forecast for Annual Planning 2015**

This Annual Planning 2014 Update focuses on the second round of the RBF facility. The next general round of up-scaling proposals will be prepared for the Annual Planning 2015, due in September 2014. Based on current and expected results achieved, expenditures realised and taking into account the currently approved project periods, we expect that for the following list of projects up-scaling proposals or at least extensions will be presented to the Governing Board as part of the Annual Planning 2015:

- Bolivia
- Burundi
- Indonesia biogas
- Liberia
- Nepal
- Peru
- Senegal
- Kenya

In urgent cases, EnDev will circulate up-scaling proposals to the Governing Board before the regular Annual Planning and ask for approval by email.

## **F. Up-scaling proposals**

## Bangladesh

<b>Promoted technology</b>	stoves			
<b>Project period</b>	06.2009 – 06.2017	<b>Budget (EUR)</b>	old	14,064,000
			new	18,064,000 <sup>4</sup>
<b>Target groups</b>	Rural population of Bangladesh			
<b>Lead political partner</b>	Power Division, Ministry of Power, Energy and Mineral Resources			
<b>Implementing organisation</b>	GIZ			
<b>Implementing partner</b>	ICS project: 5900 private, rural entrepreneurs, community local government boards			
<b>Coordination with other programmes</b>	ICS Project: Ministry of Environment and Forests			
<b>Summary of key interventions and outputs</b>	<ul style="list-style-type: none"> <li>• Organisation and coordination of awareness-raising activities</li> <li>• Training producers of improved cookstoves</li> <li>• Capacity building of stakeholders relevant for management of cookstove projects</li> <li>• Capacity building of governmental institutions in the cooking energy sector</li> <li>• Drive and steer development of new stoves and stove innovation</li> <li>• Ensure product quality</li> </ul>			
<b>Targets</b>	<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>	1,478,225	1,500,000	people	
<b>Cooking / thermal energy for households</b>	680,000	3,500,000	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>	0	0	institutions	
<b>Energy for productive use / income generation</b>	0	0	SMEs	
<b>Project manager</b>	Name: David Peter Hancock    Mail: David.Hancock@giz.de			

### 1. Situation analysis

The last Household Income and Expenditure Survey in 2010 classified 32% of the country's population as "poor" (i.e. incomes below the upper national poverty line). In rural areas this rate is even higher: 35% of the rural population qualify as poor. 17% of the population is considered "extremely poor" (rural: 21%), living below the lower regional poverty lines. Lack of access to modern energy services is one of the reasons for poverty and low economic development. Almost 75% of Bangladesh's 148 million citizens live in rural areas.

<sup>4</sup> only EUR 500,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds

### 1.1. Energy situation

About three quarters of the population of Bangladesh live in rural areas. Due to the lack of alternatives the rural population depends mainly on biomass and kerosene as sources of energy for cooking and lighting. Over 70% of the total primary energy supply is biomass, mainly agricultural waste and wood. This represents around 50% of Bangladesh's total energy demand.

Over 90% of all Bangladeshi households use biomass such as wood, cow dung, jute sticks or other agricultural residues for cooking. Inefficient and poorly ventilated clay stoves produce fine particles, polycyclic aromatic hydrocarbons, carbon monoxide, dioxins and other carcinogens. Housewives are exposed to high levels of these toxins between three and seven hours a day. This indoor air pollution occurs not only in the kitchen, but also in the living area with only slightly lower concentrations, therewith affecting also other family members such as children. The World Health Organisation states that IAP accounts for 4% of all diseases and 46,000 deaths in Bangladesh alone.

### 1.2. Policy framework, laws and regulations

All problems mentioned above relate to inefficient biomass use and indoor air pollution, and are addressed in the Bangladesh Poverty Reduction Strategy Paper (PRSP), chapters 5.H.1 'Conservation of Nature' and 5.H.2 'Combating Pollution':

The introduction of energy efficient cookstoves is one of the key targets of the Government to control air pollution in rural settings:

*"Building coalitions with NGOs for wider dissemination of fuel-efficient cooking stoves" and "Promote R&D to change building and construction standards and designs for pollution-free kitchens" were the respective planned actions on the policy agenda for the fiscal year 2005/06 (p. 301).*

The Ministry of Environment and Forests has announced the ambitious plan to cover 100% of all households in BGD with improved cookstoves or other modern cooking technologies. This would require the dissemination of roughly 30 million stoves over the next 10 years.

EnDev activities are consistent with the national policies and plans mentioned since they will contribute to (1) a reduction of forest degradation, (2) an improvement of rural livelihoods and (3) a better health situation in rural homes.

### 1.3. Institutional set-up in the ICS sector

Governmental sector: The Bangladesh Council for Scientific Industrial Research (BCSIR) is the institution that came up with the original design of the stove that is now promoted in a modified version by EnDev. Currently BCSIR was not very active in the field of stoves, but has been involved in related discussions and was represented in the meeting on ISO standards for ICS.

The Bangladesh Standards and Testing Institution (BSTI) joined the international discussion on ISO standards for improved stoves representing Bangladesh. The primary activities of BSTI are: standardisation of services and products; introduction of the international unit system of weights and measures and promotion of metrology services; promotion of quality assurance activities; rendering testing facilities for services and products; preparation, promotion and adoption of national standards. The Institution is also empowered with some regulatory measures in these fields.

The Ministry of Environment and Forests (MoEF) entered into a partnership with ENDEV to scale up the improved cooking promotion through provision of a subsidy.

Private sector (enterprises, NGOs): Grameen Shakti (GS) is the largest NGO involved in the dissemination of renewable energy technologies in Bangladesh. GS has installed around 620,000 ICS so far and is one of the two project participants under JP Morgan's CDM program for ICS dissemination.

SZ Consultancy Services Ltd. (SZ) is a private consultancy and participant of the ICS CDM project under JP Morgan. SZ monitors the distribution of stoves, assists in capacity building and bundles the distribution of many small enterprises to provide them with access to CER revenues.

Rural Services Foundation (RSF) is engaged in the dissemination of renewable energy technologies.

Palli Karma Sahayak Foundation (PKSF) was created by the Government of Bangladesh as a not-for-profit organisation and is undertaking nationwide programs for poverty alleviation through employment generation.

Since June 2008 the Village Education Resource Center (VERC) is implementing a project entitled "Development of an Improved Cookstoves Project to Secure Carbon Finance for its Long-term Sustainability". The project is covering five sub-districts in Rajshahi division, three sub-districts in Rangpur division and one sub-district under Dhaka division of Bangladesh.

In December 2012 the government-owned Infrastructure Development Company Limited (IDCOL) has become active in the field of improved cooking besides their other energy-related projects. IDCOL established a testing lab in their office to test and certify stoves and provides financial incentives for the promotion of ICS.

#### **1.4. Major donor activities**

SNV is active in the field of biogas technology dissemination and is showing interest in improved cookstoves.

The Urban Partnership for Poverty Reduction (UPPR) (initiated by UNDP) is collaborating with EnDev in the cookstove sector and is also open for cooperation in biogas plants in urban settings.

The U.S. Agency for International Development (USAID) has been supporting rural electrification programs in Bangladesh for the last 35 years. Currently, USAID supports the implementation of the project "Integrated Protected Area Co-management" (IPAC). This project and EnDev are collaborating in the promotion of improved cookstoves.

Practical Action (PA) is mostly active in infrastructure and livelihood improvement in poor urban areas. As part of their efforts to provide energy access to the poor, they are interested to cooperate with EnDev in the promotion of improved cookstove as well as related monitoring and evaluation activities.

Swedish International Development Agency (SIDA) is planning to start improved cookstove activities in Bangladesh. It is not yet decided whether this will happen in cooperation with EnDev.

UK Department for International Development (DFID) has made tremendous funds available for electrification projects. They have indicated strong interest in SHS/SSHS, PicoPV as well as improved cookstove activities. Also they will be active in the field of political advisory, e.g. they are working on the topic of reallocation of subsidies for energy services and fuels.

The Global Alliance for Clean Cookstoves (GACC) assisted Bangladesh in developing a Country Action Plan (CAP) for clean cookstoves that will provide all ICS sector participants with a common platform. In collaboration with Accenture Development Partnerships and USAID, GACC has recently conducted a larger ICS market sector study and wants to get involved in future activities in the country.

The Partnership for Clean Indoor Air (PCIA) has made Bangladesh a priority country for their interventions.

The Sustainable Energy for All (SE4All) partnership is beginning to become active in the Bangladesh energy sector and sees improved cooking as a potential area of intervention.

## **2. Project approach**

EnDev started promotion of improved cookstoves in December 2005 using a clay stove. The major focus of the intervention was on the establishment of a self-sustaining supply chain for stoves; this included massive training of stove builders (more than 10,000 persons were trained). Dissemination of the ICS was quite rapid but monitoring showed that the quality of the stoves built was not always according to design standards – as each clay stove was built in situ, the margin for error was quite high. To overcome the quality problem EnDev introduced concrete as the material of choice for manufacturing improved stoves in 2010. This allowed mass production and significantly better compliance with quality standards. Since 2010 all stoves supported by EnDev and its partners are pre-fabricated stoves and currently built from concrete. There is a strong push for innovation in this field. In the future the Project wants to encourage stove innovation and improvements and allow for a wider variety of stove types and materials to be developed and tested locally.

Direct financial support for stove installations from EnDev has been phased out and the MoEF is now providing this incentive from own funding through the Bangladesh Climate Change Trust Fund (BCCTF), thus showing how prominent and important the topic of improved cooking is seen in the government. EnDev supports capacity building, marketing and awareness activities and incentives for stove innovation. The goal is to spread and foster knowledge on improved stoves, their benefits and stove developments among the people of Bangladesh and to encourage and enable entrepreneurs to take up development, production and sales of fuel saving stoves.

The next steps toward a sustainable open market for improved cookstoves involve the establishment of an institutional and regulatory framework, marketing intelligence and developing drivers for product innovation to increase the influx of new stove models to the local (or even international) market. Besides these efforts, marketing, user trainings and awareness creation will remain EnDev's priorities.

While it has been a declared target of EnDev to support the setting up of a stove testing and certifying institution, this is now not deemed necessary anymore as IDCOL has taken up these activities with World Bank support. EnDev will identify promising stove models and have them tested under nationally accepted regulations and standards. If appropriate stoves can be identified, these will be promoted under the EnDev program and appropriate dissemination channels will be identified to support the building of "last mile" distribution networks for stove producers. It should be noted as well that IDCOL has no experience with improved cookstoves so far. EnDev will contribute to capacity building for the relevant stakeholders if seen necessary.

The Project will build on past successes and experiences, and open the approach to new models and materials to add diversity, quality and sustainability to the ICS market in Bangladesh through a wider range of products and providers while reducing its direct involvement in the market and reducing running costs of the programme over time. The stove sector is still highly dependent on financial support but the Project will introduce a gradual change, moving towards a more facilitating role. On the one hand, this is because entrepreneurs and promoters need to be trained in marketing and need some support to make their stoves known in the region and create a demand. On the other hand, the targeted customers are poor households and are not always willing or able to pay the full price of a stove. Therefore, the approach will work with carefully targeted marketing incentives and capacity building measures until a self-sustaining market is in place.

### **2.1. Energy technologies and services promoted by the EnDev project**

EnDev-Bangladesh is promoting Improved Cook Stoves, Solar Home Systems, Small Solar Home Systems, and PicoPV systems. The present upscaling is only referring to cooking energy. Therefore, only the approach in this sector is described here.

### **2.2. Cooking / thermal energy for households**

Under the “Mission 21” the Government intends to cover 100% of all households in Bangladesh with improved ICS and other modern cooking technologies. EnDev supports the government in building local capacities and promoting the stoves. The project will focus on support of awareness raising, marketing and monitoring activities, as well as capacity development activities in the stove sector in order to build a sustainable market for improved cooking appliances.

In Bangladeshi households a variety of cooking facilities and different stove models are being used for different purposes/preferences. Further understanding in regards to Bangladeshi households and their cooking behaviour has to be generated among the donor community and GoB. EnDev, therefore, intends to increase its market intelligence efforts and to contribute to this international learning process.

The Project will support a larger variety of products so that a fitting stove can be found for different purposes and users. Rocket stove designs with even higher fuel efficiency or other forms of mobile stoves, as well as stoves for variable pot sizes and stoves optimised for different fuel types will be taken into account. Development and spreading of new designs - still lacking in the local market - will be supported in cooperation with other donors and partner organisations active in this field.

In this regard, supporting independent testing facilities and training on testing and design of stoves may provide a lever for innovators and new product developers to enter the stove market in Bangladesh. IDCOL/World Bank are currently establishing a test centre in order to ensure quality for customers through a regulatory framework for stove quality and performance parameters. The BSTI represents Bangladesh in the international discussion on ISO standards for ICS. In addition, the Institute for Fuel Research and Development (IFRD), BCSIR and IDCOL are stakeholders in this process and EnDev will work with these organisations to build their capacities and foster the generation of expertise on cooking technologies at the national level and increase the sector capacities to adjust products quickly to local needs and take qualified decisions to build and protect the stove market in the long run.

EnDev will put its effort toward better alignment with and harmonisation of donor funds and interventions of actors on the market. The increasing number of actors in the cookstove sector underlines the importance of assistance in this field. Excessive and scattered subsidies can be counterproductive and harmful for an emerging market and there is a need for a regulatory framework to align donor efforts. To counteract market distorting activities EnDev established a partnership with the Ministry of Environment and Forests (MoEF) and formed a project management unit to align and coordinate ICS activities in the country and scale up successful approaches. The idea is to form an institutional framework in cooperation with the government to ensure and foster better harmonisation and knowledge exchange between the actors and to give new donors direction for market development and entrepreneurial promotion and use of funds for these purposes.

Since 2010 the Project focuses on the promotion of a stove model made of concrete. While the use of concrete implies higher material costs compared to the previously used mud, these costs are offset through the reduction of time required for the installation of the stove in the household. Mud stoves took a week to be installed in the household and to dry properly. The concrete stoves can be installed within a day. Concrete stoves can thus be sold for about the same price as the mud stoves and are more convenient for the customers, who can now use the new cooking device one day after installation. A further benefit of prefabricated stoves and the introduction of moulds is easier quality control in the production, as the relevant measurements of the stoves are less dependent on the skills of an individual producer. As a result of this learning process the project will only support pre-fabricated stoves, where quality checks can be made on site of the production or before large-scale import, besides physical verification in the field.

While in the past, cooperation was mostly envisaged with NGOs in the field, the Project now aims to involve small private businesses from the relevant sectors. A further advantage of this approach is that ICS are being added to an existing product variety of already established small scale enterprises (so-called 'sanitary shops') that are familiar with production of concrete items. Thus, these shops are very likely to stay in business in the long run as they are not only depending on the stoves as a single product. The sanitary shops themselves are a result of a long passed World Bank initiative where a similar approach was applied to make sanitary products available in local markets. Thus, the shops are known to supply household appliances and are already established players in the local markets. By now the Project is working with over 5900 partners. On average this means that there are already more than two partners in every sub-district (about 2,200 Upazilas) which were or are being trained in manufacturing/selling concrete ICS.

Although ICS are simple technical devices, the users still need training on proper use and maintenance. During the Project period, EnDev will encourage and support entrepreneurs to conduct user training and maintenance services. This training will ensure the proper functioning of ICS; a user manual will also be provided to every ICS household. At the Project end, the entrepreneurs will be skilled enough to conduct the user training on their own.

The following training contents will be provided:

- training of trainers
  - training of trainers on ICS & chimney production and installation
  - training of trainers on marketing/promotional activities
  - training on stove design principles and stove testing

- training of entrepreneurs
  - production of ICS
  - installation of ICS
  - how to conduct user training
  - business skills (bookkeeping, procurement, etc.)
  - marketing/promotional activities
  - monitoring of ICS dissemination

This way the capacity of the small entrepreneurs will be created / enhanced so that they can sell ICS in a professional and financially viable manner. The training will incorporate both development of business skills and technical know-how on ICS production, installation, maintenance, monitoring, etc. The ICS entrepreneurs have to provide necessary after-sales services, as part of their business. To ensure after-sales services, a service card indicating service warranty will be prepared. Furthermore, a system of communication between entrepreneur and customer will be developed. Another aspect of training is to provide the users with know-how on ICS use and maintenance, so that minor defects can be repaired by the users themselves.

The local governments - upazila parishad (Sub-district Council) und union parishad (Union Council) - are public representatives. For successful implementation of any project, the participation of the local governments is of utmost importance. However, the local governments are still mostly unaware about ICS and the benefits of their usage. To sensitise the local government members and to seek their support, stove promoters ('Champions') will organise two coordination meetings with each upazila parishad and each union parishad. In order to motivate the people to become ICS entrepreneurs, information sessions and awareness building campaigns will be conducted among potential professional groups e.g. associations of masons, associations of sanitary shops.

About 500 dedicated managing staff and promoters ("Champions") are constantly active in assigned regions to seek local government cooperation and support, as well as to conduct user trainings and awareness activities and to find new partner businesses. Although the situation of women in Bangladesh does not allow for far travels or work after dawn, the project will gradually increase the quota of female agents in the management, steering and implementation of ICS activities and carefully scope options to involve women more in different stages and levels of the project and promote gender equality. Overall the project currently involves 43 women in the management of the project, 35 of which are active in field-based activities

EnDev involves women as partially-paid volunteers to increase female participation and feedback loops to women groups in the communities. Although these women are locally referred to as "promotional volunteers", they receive a reimbursement of 2000tk per month as compensation for their time and effort, as well as for their travel costs. Additionally, the volunteers can earn additional 50tk per stove after each 15 stoves sold as commission. Young women are thus encouraged to invest some of their limited free time to hold meetings with stove users or potential stove users in their respective unions. This more gender-inclusive approach has been gradually tried and introduced in early 2013 and has proven to have great benefits in Bangladesh. By early 2014, 1000 Women have received a 2 day course on ICS advertisement and how to conduct user trainings.

### 3. Expected impacts of the project intervention

Impact	Possible indicators
<b>Environment</b>	Less wood burned in households and reduced deforestation; reduced CO2 and black carbon emissions
<b>Health</b>	Reduced indoor air pollution
<b>Poverty / livelihood</b>	Better living and working conditions in the household; monetary and/or time savings due to less fuel consumption; jobs and income created in rural areas
<b>Education</b>	The people in the Project area will become aware about ICS and their benefits and the negative aspects of indoor air pollution and traditional stoves.
<b>Governance</b>	An institutional arrangement is in place that allows better harmonisation of ICS interventions and steering of the sector.

### 4. Possible risks and potential ways to mitigate them

Main risks for the project are:

a) Other organisations start providing support to OCS based on large subsidies, which could disturb the fragile development of private markets, supported under EnDev.

This risk can be addressed through active donor coordination and by providing advice to the national government.

b) The quality of the ICS cannot be assured resulting in a loss of consumer interest in these items.

Quality assurance is one of the main activities of EnDev Bangladesh. Thus, the risk is considered as relatively low.

c) Natural disasters or other unforeseeable events affect the income of poor households making a commercial pro-poor market approach for stove dissemination impossible.

This risk cannot be avoided but in case disasters happen, EnDev will change its approach and focus on a partly subsidised market development.

d) Income generation through sales of stoves may not be attractive enough to motivate stove producers to stay in business.

EnDev will analyse the profitability of the stove business and promote different business concepts for stove production and marketing.

### 5. Budget

	EUR
<b>1 Human resources and travelling</b>	122,000
<b>2 Equipment and supplies</b>	45,000
<b>3 Funding financing agreements / local subsidies</b>	3,500,000
<b>4 Other direct costs</b>	97,803
<b>5 Total direct costs (sub-total)</b>	3,764,803
<b>6 Mark up costs / administrative overheads / imputed profit</b>	235,197
<b>7 Cost price</b>	<b>4,000,000</b>

## Ghana

<b>Promoted technology</b>		Grid densification, PV pumping systems, cookstoves for productive use			
<b>Project period</b>	old	01.2010 – 12.2014	<b>Budget (EUR)</b>	old	1,650,000
	new	01.2010 – 05.2016		new	3,150,000 <sup>5</sup>
<b>Target groups</b>		Small-scale farmers and processors of agricultural produce			
<b>Lead political partner</b>		Ministry of Energy and Petroleum (MoEP)			
<b>Implementing organisation</b>		GIZ in cooperation with SNV			
<b>Implementing partners</b>		Electricity Company of Ghana (ECG), Northern Electricity Distribution Company (NEDCo), Ministry of Food and Agriculture (MoFA) and their Agricultural Extension Service, Local Governments, Association of Ghana Solar Industries (AGSI), National Board for Small Scale Industries (NBSSI), Ministry of Trade and Industry (MOTI)			
<b>Coordination with other programmes</b>		Capacity for a Successful Implementation of the Renewable Energy Act (C-SIREA), Market-Oriented Agriculture Programme (MOAP), Powering Agriculture – all BMZ/GIZ, Ghana Energy Development and Access Project (GEDAP) – World Bank and others, Rural Enterprises Programme (REP) – IFAD, Energy Poverty and Gender in Agro Processing (DGIS/SNV), Developing Sustainable Energy Value Chains in Fish Smoking Markets in Ghana (DGIS/SNV)			
<b>Summary of key interventions and outputs</b>		<ul style="list-style-type: none"> <li>- Support 250 small-scale farmers to access and use grid electricity for irrigation purposes through incentives and capacity development for farmers (electrification-plus approach).</li> <li>- Support 30 small-scale farmers to access and use solar PV-pumps for irrigation purposes through market incentives and capacity development for solar companies and farmers (market development approach).</li> <li>- Support 300 small-scale processors of agricultural produce to access and use improved institutional cookstoves (ICS) through an incentive scheme and capacity development for stove builders and users (market development approach).</li> <li>- Increase the number of connected SMEs in the industrial zones established during the first phase from 408 to 600, provide follow-up support and conduct monitoring (this target is expected to be achievable with minimal additional investments).</li> </ul>			
<b>Targets</b>		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		300	1200	people	
<b>Cooking / thermal energy for households</b>		0	0	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		6	6	institutions	
<b>Energy for productive use / income generation</b>		600	1180	SMEs	
<b>Project manager</b>		Steffen Behrle (steffen.behrle@giz.de)			

<sup>5</sup> only EUR 500,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds

## **1. Situation analysis**

The Republic of Ghana is home to 25 million people and among the well developing countries in West Africa. It is characterised by a stable presidential democracy, strong population growth (about 2.5% p.a.) and economic growth (real GDP growth > 7% p.a.). These developments are accompanied by a rather high inflation (13.8% p.a. in 2013), increasing social disparities, especially between urban and rural areas and continuing unemployment of the younger population. The Government of Ghana (GoG) has identified inclusive growth and broader wealth creation as key challenges to sustain stability and development.

Universal access to modern energy and the promotion of productive uses of energy (PUE) are considered instrumental for achieving these goals and have been anchored in the Ghana's National Sustainable Energy for All (SE4ALL) Action Plan in 2012.

The demand for food commodities is growing strongly due to the current economic development and urbanisation. The economic development also increases the pressure on natural resources, especially forest stocks and calls for more cautious resource utilisation in the future. Addressing the "water-energy-food security NEXUS" through the promotion of productive uses of energy in small-scale agricultural production and agro-processing holds a vast development potential for those parts of the population that benefitted less from the country's economic developments in recent years.

### **1.1. Energy situation**

The installed dependable generation capacity of hydro-electric and thermal power plants is 2,135 MW. The current demand is 2,016 MW and growing at a rate of 10% per annum. Despite this small reserve capacity, Ghana is still exporting electricity to Togo, Benin, and Burkina Faso. The rapidly growing demand will require capacity additions of about 200 MW annually in the medium term. To cope with the challenges, Ghana has licensed independent power producers to build, own and operate power plants which are at various stages of project development. Furthermore Ghana is increasing its domestic production of crude oil and natural gas.

Ghana has an extensive transmission system which covers all the regions of the country and has seen substantial progress in electrification over the past two decades. When the first "Electrification Master Plan" was commissioned in 1990/91, only 25% of Ghana's population had access to electricity and only 4% of all rural dwellers. Until 2006 major efforts focused on the electrification of district capitals before the GoG set out the goal to achieve universal energy access by 2020 and drastically increased efforts in rural electrification. The overall electrification rate rose to 72% and 45% for rural areas respectively in 2011. Despite these achievements in rural electrification, the goal of universal access remains ambitious and requires further investments, good energy governance as well as continuously strong underpinning economic development.

The efforts in improving rural energy supply have so far concentrated on the electrification of households which predominantly utilise small amounts of electricity for consumptive purposes and benefit from the subsidised lifeline tariff. Thus, progress in rural electrification paradoxically burdens the cash-flow and financial viability of the state-owned distribution service providers and does not necessarily translate into economic development, e.g. through productive uses of energy. Due to the fact of increasing fuel costs for thermal

generation and in the absence of any tariff adjustments for over two years, residential and commercial tariffs were raised by more than two-thirds in October 2013.

Ghanaian agriculture is overwhelmingly dominated by smallholders; many commodities—including cocoa, maize, cassava and vegetables—are produced predominantly on small farms. More than 70% of Ghanaian farms are 3 hectares (ha) or smaller in size. Considerable opportunities in the electrification and mechanisation of agricultural activities remain insufficiently tapped. At the same time, growing demand for food commodities, e.g. fresh vegetables and fruits on domestic and international markets, provide attractive economic opportunities for rural farmers. While rain-fed agriculture for livelihoods is the prevailing form of agricultural production and accounts for about 97% of all cultivated arable land, a growing number of smallholders engage in intensive agriculture using small-scale irrigation systems referred to as “informal irrigation”.

A large share of small-scale agricultural processing is based on thermal energy, using biomass fuels and traditional cookstoves, mainly in small scale industries. LPG has been promoted by the GoG to replace biomass fuels in households and agro-processing MSMEs, however only with limited success. Since the withdrawal of LPG subsidies in March 2013, the price rose by more than 100%. Many thermal agro-processors are therefore reverting to traditional biofuels, mainly firewood and charcoal, of which 90% are obtained directly from natural forests and only 10% from wood waste, agricultural by-products or residues. From 2005 to 2010, Ghana's forest area declined at a rate of 2.19% p.a. representing globally the highest deforestation rate after Togo and Nigeria.

## **1.2. Policy framework, laws and regulations**

The National Energy Policy (NEP) of 2010 includes the objective to achieve universal access to modern energy by 2020, to increase generation capacities to meet the rapidly growing demand, and to promote the use of LPG for heat applications. Another objective of the NEP is to ensure good governance of the country's oil and natural gas reserves as well as related revenues. It furthermore recognises the need for low-carbon development to contribute to international efforts to mitigate climate change as well as the role of modern energy for gender-balanced development. In the same year, Ghana adopted the Energy Sector Strategy and Development Plan which also includes the objective that renewable energies (excluding hydro above 100MW) represent ten percent of installed capacity by 2020. Furthermore, the GoG defined the promotion of productive use of energy in rural areas a priority area in the Energy Sector Strategy and Development Plan of 2010.

Ghana was the first SE4ALL 'opt-in country' that has developed a national SE4ALL Action Plan in 2012. This plan reiterates the goal to achieve universal access to modern energy by 2020. The Action Plan focuses on the following three areas: (i) promotion of productive use of energy, (ii) improving access to LPG for cooking and (iii) improving access to improved cookstoves. The subsequent SE4ALL “Investment Prospectus” (2013), which identifies investment requirements to implement the Action Plan also highlights the promotion of productive use of energy as an important tool for enhancing the financial and economic feasibility of on- and off-grid energy investments. Investments in irrigation to increase agricultural productivity and agro-processing take first and second priority in the respective chapter.

The National Electrification Scheme (NES) was instituted in 1989 as the principal instrument to achieve the policy goal of universal access to energy over a thirty-year period (1990-

2020). The main goals of the NES are (1) creating small-to-medium-scale industries in rural areas, (2) creating employment and wealth in the rural areas and thus reducing the rate of rural to urban migration, and (3) enhancing activities in other sectors of the economy, such as agriculture, health, education and tourism. The Ministry of Energy and Petroleum (MoEP) is responsible for planning rural electrification and implementing of the NES in cooperation with the transmission and distribution utilities.

The Self-Help Electrification Programme (SHEP) is a complementary electrification programme to support the NES, with the rationale of accelerating the connection of rural communities to the national electricity grid. Under the SHEP, communities that are within 20 km from an existing 33 kV or 11 kV sub-transmission line can bring forward their electrification projects provided they procure all the poles required for the LV network and have a minimum of 30% of the houses within the community wired. Once these conditions are met by the community, the obligation of the government is to provide the conductors, pole-top arrangements, transformers and other installation costs needed to provide supply to the community.

The Renewable Energy Act, 2011 (Act 832) has recently been enacted to support the development, utilisation and efficient management of renewable energy sources. The Act seeks to increase the proportion of various forms of renewable energy including solar, wind, biomass, geothermal, landfill and sewage gas in the national energy supply mix and to contribute to the mitigation of climate change. The Act establishes a feed-in tariff system, regulates licensing, ministerial and institutional responsibilities and calls for the establishment of a Renewable Energy Authority. Until the time the Authority is established, the Renewable Energy Directorate under the Ministry of Energy is to perform the above functions. The Act furthermore foresees the creation of a Renewable Energy Fund, which – among other purposes – shall promote the implementation of mini-grids.

The National Irrigation Policy (2008) outlines strategies and regulatory measures to address the structural and often chronic problems and constraints in the operation and management of large-scale irrigation schemes. For the first time, it acknowledges the importance of 'informal irrigation' (privately owned small-scale irrigation systems) and includes a policy shift towards decentralisation and subsidiarity.

### **1.3. Institutional set-up in the energy sector**

The function of the Ministry of Energy and Petroleum (MoEP) is to formulate, implement, monitor and evaluate energy sector policies. It comprises the Directorates of (1) Petroleum, (2) Power and (3) Renewable Energies.

The Energy Commission (EC) assumes functions relating to the regulation, management, development and utilisation of energy resources in Ghana. The EC is the technical regulator of Ghana's electricity, natural gas and renewable energy industries, and the advisor to Government on energy matters. It has also been mandated to coordinate the implementation of the SE4ALL Action Plan and to support the further development of the regulatory and legislative framework for renewable energy.

The Public Utilities Regulatory Commission (PURC) is an independent agency responsible for the economic regulation of the water and power sectors with the mandate to approve rates for electricity sold by electricity distribution utilities. The PURC is furthermore responsible for developing appropriate feed-in tariffs for renewable energy.

The National Interconnected Transmission System (NITS) for electricity is owned and operated by the Ghana Grid Company (GRIDCO), a state-owned company. The distribution of electricity is done by the Electricity Company of Ghana (ECG), a state-owned company that supplies approx. 90% of electricity customers in Ghana, and the Northern Electricity Distribution Company (NEDCo), a subsidiary of the Volta River Authority (VRA). Electricity generation is undertaken by the state-owned VRA and the private energy company TAQA, in which VRA holds shares.

The Ministry of Food & Agriculture (MoFA) is the lead agency responsible for developing and executing policies and strategies for the agriculture sector. MoFA's Agricultural Extension Service which has offices in all districts has recently been integrated into the district local government structures.

MoFA was part of the Multi-Stakeholder Consultative Group for the development of the SE4ALL Action Plan and is a key partner to the SE4ALL coordinator for the cross-sectorial activities on irrigation and food-processing. MoFA has a designated role under SE4ALL regarding the implementation of activities on solar pumping, wind pumps and reservoir irrigation, solar drying, multifunctional platforms for grinding and milling and cold storage.

The Ghana Irrigation Development Authority (GIDA) is a subsidiary of the MoFA and executes plans to promote the development of land and water resources in Ghana for crop production and livestock watering. Its mission includes the development of irrigation infrastructure, the provision of public irrigation facilities, technical and managerial services for their operation and dissemination of irrigation technology. It has a focus on larger-scale, government-run irrigation schemes (so-called 'formal irrigation').

#### **1.4. Major donor activities**

The Ghana Energy Development and Access Project (GEDAP) is a large multi-donor funded project supporting Ghana to improve the operational efficiency in the power sector and to increase the population's access to on- and off-grid electricity. The project supports the development of renewable energy for the expansion of access to electricity. The main development partners funding the project are the World Bank's International Development Association (IDA) and Africa Catalytic Growth Fund (ACGF), the Global Environment Facility (GEF), the African Development Bank (AfDB), the World Bank-administered Global Partnership on Output-Based Aid (GPOBA), and the Swiss Agency for Economic Affairs (SECO). It comprises four principal components, including energy sector and institutional development, electricity distribution system improvement, transmission system upgrade, and electricity access expansion and renewable energy development. GEDAP also promotes small-scale off-grid solar PV systems through grants and loans. It is currently in the development of its third phase which is likely to include PUE promotion activities. These are both potential areas of cooperation with EnDev Ghana.

The National Electrification Scheme is also supported by the Japan International Cooperation Agency (JICA), Danish International Development Agency (DANIDA), The World Bank, the Dutch Development-Related Export Transactions (ORET) programme, the Swedish International Development Cooperation Agency (SIDA) through grants and soft-loans. The Self-Help Electrification Programme receives financial support from the Export-Import Bank of India, the Export-Import Bank of the United States, the Export-Import Bank of China, SIDA and the South African government through soft-loans.

The Agriculture Project of the Millennium Development Authority (MiDA) supported by the United States of America comprised services for establishing and running farmer-based organisations (FBOs) with a total budget of USD 208.8 million. It focused on the ability to grow successfully a wide diversity of tropical and sub-tropical crops to support Ghana's competitive advantage as a supplier of horticultural products and on improving national food security by expanding the use of arable lands for maize, yam, rice, cassava and other traditional crops. Main activities were the extension of technical and commercial training FBOs, training in irrigation activities and the support of more secure land tenures. The project was completed in 2012; however the FBOs that have been supported by the project represent promising entry points for the future EnDev activities focussing on PUE in agricultural value chains.

The Market Orientated Agriculture Programme (MOAP) implemented by GIZ with funding from the German Federal Ministry for Economic Cooperation and Development (BMZ) supports the promotion of selected agricultural value chains and – among other activities – the Outgrower and Value Chain Fund in cooperation with MoFA.

Food processing in small-scale enterprises is promoted by the Directorate-General for International Cooperation (DGIS) of the Dutch Government which commissioned the “Energy Poverty and Gender in Agro Processing” project focussing on improved cookstoves for shea butter, pito and parboiled rice production and the establishment of woodlots for these industries (2014-2015). Furthermore in the “Developing Sustainable Energy Value Chains in Fish Smoking Markets in Ghana” project which promotes improved Cookstoves for fish smoking and the sustainable management of mangrove forests (2014-2015). Both programmes are being implemented by SNV.

The Global Alliance for Clean Cookstoves supports the establishment of a testing facility for cookstoves at the Council for Scientific and Industrial Research (CSIR). This includes support for mobile testing of cookstoves for productive use. The Energy Commission of Ghana with funding from UNDP supports the establishment of another testing facility at the Technology Consultancy Centre of Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi.

There is apparently no running support scheme or programme in place that promotes productive use of electricity by small-scale farmers or for “informal irrigation”. This brings EnDev in the position to play a pivotal role in supporting the GoG in their efforts to implement the productive use component of the SE4ALL Action Plan, which has a strong focus on energy in agricultural value chains and electricity for irrigation.

## **2. Project approach**

The proposed interventions under EnDev 2 will build on the experiences from the first phase in the promotion of productive uses, which focused on the establishment of light industrial zones as well as the provision of reliable access to grid electricity and complementary services to the micro, small and medium enterprises (MSMEs) located in these zones. In phase 1 EnDev Ghana gained valuable experience in working with the electricity distribution companies, private sector associations, local governments and BDS providers. The holistic project approach and the BDS capacities developed via the Competency-based Economies through the Formation of Enterprise (CEFE) methodology for productive use interventions will be of great benefit for the new interventions outlined in this up-scaling proposal.

In line with priorities set by the GoG in Ghana National SE4ALL Action Plan, the proposed interventions focus on the use of grid electricity and solar PV for irrigation as well as improved stoves for agro-processing. Ghana is the first EnDev country programme to concentrate on a "Nexus" approach combining water, energy and agriculture. The project will provide business development services as well as technical advice and training to both, providers and users of (solar) irrigation systems and institutional stoves. Similarly to the past EnDev activities in Ghana, each intervention will be accompanied by intensive monitoring (using an adapted version of the databases developed during the first phase) and rigorous impact evaluations. The project will continue to support the grid connection of MSMEs, but additionally contribute to the emergence of a market for solar irrigation systems and institutional stoves for agro-processing.

The focus is set on small-scale, but cash-based agriculture as well as agro-processing. The project will enable i) small-scale vegetable farmers to increase their yields by practicing grid-based or solar-powered irrigation and ii) support small-scale agro-processors to lower their operational costs and improve product quality by using energy-efficient institutional stoves. Experiences from the first phase, studies of partner organisations, national policies and strategies point out that investments in these technologies can pay back in relatively short time frames. Hence, the project approach builds on a cross-sectorial approach combining access to modern energy with accompanying activities to enhance agricultural productivity. For the promotion of improved cookstoves for agro-processing, EnDev will closely cooperate with SNV who have already gained significant experience with the dissemination of improved cookstoves for productive use in Ghana.

### **2.1. Energy technologies and services promoted by the EnDev project**

The project encompasses the following three new components: (1) Productive use of grid-electricity for small-scale irrigation, (2) Productive use of PV-pumps for small-scale irrigation and (3) Productive use of thermal energy in agro-processing. In addition, component (4) will ensure follow-up activities and monitoring of productive use of energy in the industrial zones supported by EnDev.

### **2.2. Energy for lighting / electrical appliances in households**

The electrification of households is not an intended result of the new components.

The investments in electrification of light industrial zones under EnDev 1 and EnDev 2 have resulted in a number of households being electrified as a windfall profit. This number is expected to increase further over the next period when all industrial zones get connected. In addition, a small number of households might be electrified under component 1 (grid-electricity for irrigation) if there are unconnected homes near the farms that will be provided with access to grid electricity. This cannot be quantified at the current planning stage. However, it is assumed that in total EnDev Ghana will achieve an outcome of 1,200 people gaining access to electricity in households.

### **2.3. Energy for productive use / income generation**

Component 1: Productive use of grid-electricity for small-scale irrigation: Most arable land in Ghana is traditionally cultivated through rain-fed agriculture. Growing national and international demand for fresh vegetables however creates strong incentives for intensifying the cultivation of cash crops through irrigation where access to markets is given. Specific circumstances in many regions of Ghana with access to promising markets, e.g. the Volta

Region as well as parts of Greater Accra (e.g. the Accra Plains), allow the deployment of low-cost irrigation systems. This includes shallow tube well irrigation systems with a depth of between 6-9 meters and the use of surface water. Small-scale or micro-irrigation by private farmers is referred to as 'informal irrigation' and often carried out by very simple means, e.g. by using cans, buckets, increasingly diesel pumps and where feasible electric pumps.

The approach is characterised by 'low input, little sophistication, high economic impact'. Focussing on cash crops and deferring yields outside seasonal harvesting times of rain-fed agriculture can increase revenues by three to four times. Already to date, informal irrigation outperforms formal, public and private, large-scale irrigation schemes in terms of irrigated land (informal: 20-30,000 ha, formal 9,000 ha: private 10,000 ha) and likely in terms of agricultural output. In the absence of access to modern energy services, agricultural productivity is constrained by the workforce of family members or labourers while operational costs for petrol or diesel pumps are often prohibitive. The latter also have high maintenance and operational costs as well as significant wear-and-tear. Access to fuel in rural areas is time-consuming. Electric pumps are a convenient and clean alternative with significantly lower operating costs. Women farmers can also easily remove and fix electric pumps which are lighter compared with petrol and diesel pumps.

Agricultural plots with an average size of 0.1 to 0.3 ha, which are utilised for intensive agriculture and horticulture by smallholders, are usually located in the close surroundings of villages but outside the coverage area of the low-voltage (LV) distribution system. While domestic users who were connected under the National Electrification Scheme benefit from subsidised connection fees, there is no support for potential productive users in the vicinity of an existing LV line. In the absence of a support mechanism, farmers who want to engage in informal irrigation need to bear the full cost of grid connection including poles, cables, isolators, brackets and service line. Additionally, land tenure insecurities in the medium-term undermine the willingness of informal irrigators to invest in grid extensions.

Assuming levelised cost per kWh for a diesel pump of GHS 1.10 (approx. EUR 0.30) and mean average electricity tariffs of GHS 0.55 per kWh (approx. EUR 0.15) for 'commercial users' with an average consumption of 150 kWh per month as well as nine month of irrigation activities per year, the total cost savings of an electrical pump accumulates to GHS 742 (EUR 214) annually. However, establishing a connection for the last 'last mile' requires an average investment cost of approx. EUR 1,000 (assumption: 2 additional poles and 30 meters of service line). The high up-front investment combined with land tenure insecurities prevent many smallholders from engaging in grid-based informal irrigation.

EnDev will mobilise farmers who are interested in engaging in grid-based irrigation through the Agricultural Extension Officers based at the district local government offices and local vegetable growers associations. The feasibility of connecting potential beneficiaries will be assessed by the distribution utility ECG, who will also provide cost estimates for new connections and implement small grid intensification projects. Interested farmers will be supported in making an informed decision about the investment in a grid connection and additional irrigation assets through business trainings. The business trainings will include inputs on the basics of irrigation schemes using grid-electricity (development cost, required equipment and operation cost) and agricultural know-how on irrigated small-scale farming. It will result in a simple business plan which together with the farms' proximity to the existing electricity grid will be criteria for the selection of beneficiaries.

The average total investment per farmer is estimated to be EUR 2,000, which includes the grid-connection (EUR 1,000), the electric pump (EUR 500) and the water distribution system (EUR 500). On average 35%, but no more than a maximum of 50% of the overall investment costs will be granted by the project. The support scheme will focus on the grid-connection (financing 70%) as the immobile component of the investment to reduce the risk of land tenure insecurity for the farmer and to facilitate investments. The maximum support per connection will be EUR 1,000 which is in coherence with the utilities' policy to limit locally managed grid densification to a maximum of 3 poles. Business development services, technical advice for micro irrigation systems and training in outgrowing of high value vegetables will be continued after the initial implementation of the scheme by the Agricultural Extension Services and the Rural Enterprise Promotion as project partners.

The component targets 250 small-scale farmers for access to the electricity grid for irrigation. To scale up the intervention beyond the proposed numbers, cooperation with Local Finance Institution (LFIs) will be sought. However, as commercial interest rates and the maximum duration of existing loan products appear so far inadequate to finance grid densifications, no leverage based on loan agreements is initially assumed. Cooperation with the Sinapi Aba bank, which focuses on agricultural loans and was recently supported by KfW, appears however to be a promising option.

Component 2: Photovoltaic pumps for small-scale irrigation: The component will promote the use of photovoltaic pumps for small-scale irrigation. It focuses on farmers whose plots are either located too far from the electricity grid to connect them or on those who seek access to sustainable energy supply with lower long-term operational cost. The respective target group for PV-pumping systems is smaller due to higher required up-front investment. PV-pumping for irrigation is also a relatively new technology in Ghana and irrigation technologies and agricultural techniques need to be slightly more sophisticated when solar pumps are used.

Nevertheless, there are a number of pump suppliers, RE-system integrators and suppliers of agricultural equipment who are offering solar pumping solutions and are eager to develop the market (e.g. DENG, Pumptech, FAM). Recently the EU has financed the installation of 18 PV-pumps for drinking water supply around the city of Tamale in the north of Ghana. Excess water is being utilised for irrigation purposes and positive experiences were reported in terms of reliability and durability. Furthermore the multi-donor funded GEDAP programme has supported a small number of PV-pumps with a 50% grant share. The development of a market for solar pumps in Ghana will furthermore be promoted by an integrated expert (CIM) in the near future financed by a regional study and expert fund of GIZ.

Although private sector actors are increasingly engaging in the PV-pump market, lacking awareness about the benefits of the technology for small-scale irrigation, scepticism about the long term reliability and high capital costs in Ghana makes further market introduction support necessary. EnDev will support the wider dissemination of the technology in different regions of Ghana to increase awareness among the potential target group and to support the engagement of the private sector. Both are considered as the next crucial steps for a wider application of PV-pumps in the future. While the business case for PV-irrigation is furthered by increasing costs for fossil fuels due to fluctuating oil prices and high inflation rates and relatively high electricity tariffs for commercial users (up to EUR 0.21/kWh), additional support is still required as the following example illustrates.

A small-scale farm with a 5 meter deep shallow-tube well and a required output of 15 m<sup>3</sup> water per day will be recommended to install a direct-current surface pump powered by a PV

system with a capacity of 1,200 Wp. The system operates about 5 hours per day and irrigates the crops directly (no storage). Assuming EUR 0.70 per installed PV Wp and cost for the direct current pump of EUR 1,600 as well as further installation cost of EUR 560 for the mounting structure, cabling and labour, the total cost for the solar irrigation system is EUR 3,000. To provide the same amount of irrigation water over a period of nine months (dry season) of irrigation activities per year with a diesel pump generates operational costs of EUR 466 assuming EUR 0.35 cost per kWh generated in remote off-grid regions. While the internal rate of return is strongly positive for solar pumping systems, the amortisation period of 6-7 years together with a lack of experience with handling PV-pumps will increase the perceived risk and will likely undermine the willingness to invest by farmers.

To allow the market entry of PV-pumps, the component will shorten the amortisation period by providing a partial subsidy of 40% for the first batch of systems. At this first stage having to invest EUR 1,800 upfront compared to about EUR 500-700 for a low-quality diesel pump, and achieving savings on the fuel of EUR 466 per year, the investment will be reasonable when considering a timeframe of little more than three years. Taking into account that a PV-pumping system has an estimated lifetime of about 10 years substantial savings can be accumulated. Once the cost and time saving potential of PV-pumps are demonstrated, the interest in the technology is expected to increase. Additionally reduced cost of planning and installation, decreasing cost for PV generation capacities and potentially suitable loan products or fee-for-service options will increase the market demand for PV-pumps, too. Furthermore, other programmes, e.g. GEDAP 3, will increasingly scale-up successful productive use approaches and may provide further opportunities to accelerate the market penetration.

Since the investment timeframes for most small-scale farmers are less than 5 years and due to the high interest rates in formal and informal agricultural finance, a grant scheme to promote the further dissemination of the technology will be introduced. The project will extend this support through interested private sector companies in Ghana. These companies will be responsible for identifying and mobilizing clients and will receive support in form of business trainings, capacity development and through a Results Based Financing (RBF) scheme for systems that are purchased by farmers who meet the project's selection criteria.

In a first phase, EnDev will provide 10 RBF incentives of 40% (or a maximum of EUR 1,600) on the cost for the water supply system (excluding the water distribution system, which has to be entirely financed by the farmer). In the second phase the grant share will be reduced to 30% (or a maximum of EUR 1,400 per system) for additional 20 solar pumping systems. The RBF incentives will be provided to the supplier after successful commissioning of the systems according to agreed designs. Accompanying studies, BDS and targeted capacity development for the private sector companies will further help to overcome existing economic hurdles and increase the market demand.

### Component 3: Productive use of thermal energy in agro-processing (implemented by SNV):

A large variety of traditional agricultural produce which are major contributors to food-security and livelihoods in rural areas, including Shea nuts, palm kernels, peanut seeds and cassava are processed using thermal energy before these are consumed or traded. Traditionally and due to the recent increase of the price of LPG, the vast majority of thermal agro-processing is done with firewood. Processing is mainly done in small-scale industries using inefficient traditional three-stone fires or inefficient ovens. This results in high production cost,

unhealthy working environments and negative impacts on the environment, mainly in terms of deforestation. Gari production is typically done by women.

More efficient stoves and ovens are only available in very small numbers. The main reasons for the limited market penetration of improved institutional cookstoves and ovens for small and medium scale industries are: (i) limited awareness about availability as well as costs and benefits of the technology, (ii) few suppliers of improved institutional fuelwood stoves with weak entrepreneurial skills, and (iii) limited access to adequate financing and cost based charging for processing services.

Among the various traditional produce, cassava production is by far the largest agricultural commodity produced in Ghana amounting to 14.2 million tons (2011). It is estimated that 25% of all cassava is processed to 'Gari', which is storable fermented flour. The production of Gari includes an energy-intensive roasting process. In total 740,000 tons of Gari are produced per year in Ghana creating a market potential for up to 50,000 improved institutional Gari cookstoves. In 2013 SNV carried out a Gari production process characterisation study in Sisipe in the Northern Region to assess the energy intensity of the thermal process. To produce one ton of Gari, 1.27 tons of fuelwood are required at a fuel cost of GHS 254 (EUR 73). The selling price of Gari is GHS 1,170 (EUR 336) per ton. Thus cost of fuelwood accounts for 22% of the final selling price and an estimated 47% of the margin. An improved cookstove for Gari processing can reduce fuelwood consumption by 30% and induce cost savings of GHS 62.4 per month (based upon 52 kg daily combustion of fuelwood) which leads even at the very high commercial interest rates (5% per month) to short amortisation periods below 11 months.

The component will promote the production and marketing of improved institutional cookstoves for Gari production. The target group will be reached and mobilised through partner organisations such as The Hunger Project Ghana and the Mafi-Kumase Gari Processors Union. These organisations have established relations with the target group, but do not yet promote improved institutional cookstoves. Furthermore, the component will cooperate with the local representatives of the National Board for Small Scale Industries (NBSSI) and the MoFA staff implementing the Root and Tuber Improvement and Marketing Programme (RTIMP).

Geographically, the component will be implemented nationwide. In order to allow quick outreach and efficient operations, a focus is proposed on the Northern Region (Yendi Municipality or East Gonja District), the Volta Region (North Tongu and Kpando Districts) and the Eastern Region (Birim South District) due to the number of agro processing industries and partner networks located in these regions. In the beginning the component will conduct a mapping of Gari processing groups ('industry mapping reports') and further process characterisation studies will be carried out for three selected groups (both serving as a baseline). Gari processing groups will be selected and the first 30 improved cookstoves will be installed with a high level of subsidy to introduce and demonstrate the technology. Two types of institutional cookstoves with different technical performance and cost attributes will be introduced for different target groups: The 'Morrison Improved Cookstove' which costs about GHS 500 (EUR 145) and the 'Appro-Earth cookstove' for about GHS 2,100 (EUR 600).

The component will support 30 improved institutional cookstoves for Gari with a high level of subsidy (80%) to support the market entry and demonstration of the stove in selected areas. In this phase the agro industries are expected to provide only a 20% cost-share. Energy audits of five improved cookstoves will be conducted to confirm the biomass fuel saving

potential. The results, together with information from the process characterisation studies, will be utilised to prepare promotion and awareness creation materials. Awareness creation will target 10,000 small-scale agro processing industries out of which approx. 80% are expected to be women. To increase the understanding of the financial attractiveness of the investment among financial institutions, the component will cooperate with the Ghana Association of Microfinance Companies (GAMC) and Amuga Rural Bank (Volta Region) which have partnered with SNV in comparable projects.

Entrepreneurs building improved cookstoves will be offered business training in which the business case of commercial Gari-stove production is analysed, a business plan developed and further technical and BDS support is provided. This will be the basis for the roll-out phase (270 cookstoves) in which an incentive of 20% (or a maximum of EUR 50) per sold and installed Gari-cookstove will be paid directly to the stove builder after verification of conformity with standards through testing protocols. The testing protocols will be provided by the Council for Scientific and Industrial Research (CSIR). The component targets the dissemination of 270 improved institutional cookstoves by this mechanism.

At the end of the project, it is expected that a sufficient number of agro-processing industries are familiar with the financial and health benefits of improved cookstoves. To sustain the impacts of the project, the component cooperates with the National Board for Small Scale Industries (NBSSI) and documents the project experiences in monitoring and evaluation reports as well as in two project videos.

#### Component 4: Follow-up on grid-based electricity for productive use in light industrial areas:

During the first phase of the project 18 light industrial zones (IZs) were supported between 2007 and 2014. They are located in five regions - Brong Ahafo, Western, Ashanti, Central and Eastern Region. The major objective of the intervention was to improve the business environment for small enterprises by providing - in cooperation with local partners - a service package including improved electricity supply as well as road access, water supply and sanitary facilities. Systematically offered Business and Environmental Management Trainings complemented the intervention. Besides the supply of improved infrastructure and business trainings, the IZs are formed to create clusters that should enable enterprises to benefit from cooperation with other enterprises and provide an integrated service for customers.

While already 12 light industrial zones have been completed, the commissioning of 8 can be achieved within short timeframes and at reasonable cost. The component will follow-up on the past EnDev activities and aim to ensure that the expected outcomes will be fully achieved. It will furthermore ensure that the approach of sustainable light industrial area management will be fully owned by the Ministry of Trade and Industry (MOTI) and thus be integrated into the Rural Enterprise Project III (co-financed by IFAD and AfDB). It is expected that in the future Rural Technology Facilities are sited within light industrial zones to enhance skills training and technology dissemination.

In line with the exit strategy for this component, the CEFE (Competency-based Economies through the Formation of Enterprise) and PREMA (Profitable Environmental Management) training approaches will be handed over to Ghana Skills Development Initiative (GSDI) and the National Board for Small Scale Industries (NBSSI).

EnDev Ghana will accompany the finalisation of the physical infrastructure in the zones in Agona Swedru, Asankragwa, Axim, Suhum, Nsuaem, Obuasi, Kumasi and Asamankese. The monitoring system will be kept in place to accompany the location of enterprises and

their development in all zones. EnDev will also ensure that PREMA and CEFE are implemented in the industrial areas most recently established under the programme once a critical mass of enterprises has located there.

### 3. Expected impacts of the project intervention

Impact	Possible indicators
<b>Environment</b>	The dissemination of improved institutional cookstoves will reduce demand for firewood and thus decrease pressure on forest stocks.
<b>Health</b>	Increasing the production of fresh vegetables supports balanced diets of smallholder families and increases affordable access to off-seasonal vegetables on local markets. Reduced indoor air pollution through improved institutional cookstoves reduces respiratory diseases and eye irritations.
<b>Poverty / livelihood</b>	Increased informal irrigation increases agricultural production and thus cash revenues of smallholder farmers and has a positive effect on food security especially in the dry season. Improved income for small-scale processors of Gari, mainly women.
<b>Governance</b>	The promotion of the 'informal' irrigation sector, which is recognised on the policy level but frequently neglected in support schemes, is expected to contribute to increased support by the Ministry of Food and Agriculture (MoFA) and the Ghana Irrigation Development Authority (GIDA) as well as the state-owned distribution utilities ECG and NEDCo. Promoting PV-pumps for small-scale irrigation will increase awareness about the benefits of the technology among policy makers and can support the emergence further promotion schemes.
<b>Climate change</b>	Avoided CO <sub>2</sub> and 'black carbon' emissions through the avoided utilisation of diesel and petrol for irrigation. Reduced CO <sub>2</sub> emissions as well as substantially reduced emissions of 'black carbon' by reduced and improved combustion of biomass.

### 4. Possible risks and potential ways to mitigate them

Technology	Risk	Impact	Risk level	Action for risk mitigation
Grid-densification, PV-pumps	Water scarcity or overuse	Depletion of aquifers, lost investments and potential conflict	Low/moderate	Focussing on areas with a high water table fed by nearby surface waters which recover quickly.
Grid-densification	Hazardous installations of electrical pumps and exposure to water	Electric shocks, interrupted operations	Moderate	Close cooperation with ECG and NEDCo to promote safety aspects. Awareness raising
Grid-	Subsidised	Lost subsidy	Low/	Engaging the local

densification	electrical connections are misused for electrification of households		moderate	governments in the selection process as well as follow-up
Grid densification, improved cookstoves	Expectations of partners for support too high (e.g. local governments)	Lacking support of interventions	Moderate	Clear expectation management. Providing subsidies after the investment by the beneficiary
PV-pumps	Lacking maintenance capacities or service availability	Early degradation or breakdown	Moderate	Assessment of the suppliers' service capabilities and including warranty as well as maintenance obligations in contracts
Grid-densification, PV-pumps	Theft or vandalism	Lost investments	Moderate	Install systems in the vicinity of housings, PV potentially on roof top, utilise specific frames, screws and locks
PV-pumps, improved cookstoves	Lacking interest of farmers due to low purchasing power	Slow implementation	Low/moderate	Develop suitable financing models (e.g. loans for stoves or leasing models for PV-pumps).
Improved cookstoves	Cookstove building entrepreneurs cannot meet demand	Slow implementation	Low/moderate	Support additional cookstove builders if demand is high.

## 5. Budget

	EUR
<b>1 Human resources and travelling</b>	628,138
<b>2 Equipment and supplies</b>	143,360
<b>3 Funding financing agreements / local subsidies</b>	517,400
<b>4 Other direct costs</b>	50,000
<b>5 Total direct costs (sub-total)</b>	<b>1,338,898</b>
<b>6 Mark up costs / administrative overheads / imputed profit</b>	161,102
<b>7 Cost price</b>	<b>1,500,000</b>

## Kenya

<b>Promoted technology</b>		solar / stoves / mini-grids			
<b>Project period</b>	old	07.2009 – 12.2015	<b>Budget (EUR)</b>	old	7,800,000
	new	07.2009 – 06.2018		new	14,735,000
<b>Target groups</b>		Rural population (households, social institutions and SMEs)			
<b>Lead political partner</b>		Ministry of Energy and Petroleum, Rural Electrification Authority			
<b>Implementing organisation</b>		GIZ in cooperation with SNV			
<b>Implementing partner</b>		Ministry of Agriculture, Aphia Plus (US funded), Kenya Tea Development Authority, German Agro Action, Financial Institutions			
<b>Coordination with other programmes</b>		GIZ projects Adaptation to Climate Change, Water Sector Reform, Health Sector Reform, Promotion of Private Sector Development in Agriculture, PPP response in Climate Change in Tea Sector; Clean Cookstove Association, Promotion of Solar-Hybrid Mini-Grid Programme (ProSolar)			
<b>Summary of key interventions and outputs</b>		Commercial approach to increase access to clean cookstoves and small solar PV; market creation for hybrid mini-grids			
<b>Targets</b>		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		40,000	308,500	people	
<b>Cooking / thermal energy for households</b>		3,900,000	4,400,000	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		750	750	institutions	
<b>Energy for productive use / income generation</b>		750	1420	SMEs	
<b>Project manager</b>		Reimund Hoffmann			

## RBF for picoPV “Building sustainable and affordable credit lines for small systems in rural areas”

RBF Key Performance Indicators (KPI)	Target
People gaining access (EnDev counting method)	246,000 people
EUR per person gaining access	11
T CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	22,378
EUR per t CO <sub>2</sub> e emissions avoided	125.12
Private sector leverage ratio	2.2
Jobs created	Not quantified
Enterprises created	600
Technologies deployed	120,000

### 1. Country and project area context

Kenya has a population of over 40 million with about 7 million households lacking access to grid electricity. Only about 5% of the rural population has access to the national grid. It is estimated that 70% of Kenyans rely on kerosene as the predominant source of energy for lighting. The distribution of kerosene use also varies from region to region with rural areas recording much higher usage of kerosene for lighting with 83% of households. The use of kerosene for lighting has been shown to provide poor quality lighting, to be expensive and to have negative impacts on health & the environment. On-going efforts to replace kerosene as an energy source with other alternative technologies, particularly solar, will therefore have great economic, health and social benefits.

### 2. Sub-sector and technology focus and rationale

The availability of small solar systems with capability of providing basic electricity services can be a viable solution. The access to solar products (mainly solar home and picoPV systems) is primarily through the private sector with minimal support from the government. Kenya’s Rural Electrification Authority (REA) is focusing on the installation of larger solar systems in a few villages, schools and government institutions in off-grid areas. Development partners such as GIZ (EnDev-K, ProSolar), World Bank / International Finance Cooperation (Lighting Africa Programme), SolarAid, among other organisations are also supporting market development and awareness creation / consumer education interventions for solar-powered energy technology.

A total of 396,000 households (i.e. 5%) used solar for lighting and basic electricity services in 2009. This number has since increased significantly mainly because of the efforts of the Lighting Africa Programme which started around 2007. The current penetration of solar products in Kenya is estimated to be 11% of the total number of households and 14% of the total number of households without electricity. This implies that about 6 million Kenyans are still relying on kerosene as their main energy source for lighting.

### 3. Outline RBF incentive design

The RBF incentive targets financial institutions (FI) operating in rural areas to offer flexible and affordable financing for end-users interested in acquiring small solar products. The interventions focus on overcoming the access to finance barrier especially for: (1) last mile

entrepreneurs (LMEs), and (2) potential end-users in rural areas. The RBF will focus on the partnership of picoPV distributors with FI (banks, savings and cooperatives societies (SACCOs), Micro Finance Institutions (MFIs) or mobile banking solutions) and distributors, with a primary focus in rural areas.

The RBF incentives will be provided as ex-post payments to lending agents to, (a) reduce the (perceived) high risk of the initial investment into new credit lines, which can reduce the interest rates and collateral, and (b) reduce the costs associated with marketing, logistics and scaling up of existing solar credit lines. The dispersed RBF incentives can be used by the beneficiaries towards either a risk fund or working capital investment. It will be at the discretion of the beneficiary to determine how to best allocate these funds in order to introduce and/or increase the number of affordable credit lines provided to LMEs and low-income end-users for the purchase of picoPV systems.

To ensure the development of a sustainable market, only products sold that have passed proven quality standards will be counted toward the RBF incentive. Products must either be Lighting Africa approved, or, if independently quality tested, the testing lab must be recognised by either Lighting Africa or GIZ, and the product must meet the Lighting Africa Minimum Quality Standards.

#### **4. Impacts on people and the environment**

The RBF interventions will provide an opportunity for poor people in rural areas to access good quality solar products in a flexible and affordable manner, in line with their income levels and patterns. The use of good quality solar products will **improve the wellbeing** of end-users and enable children to improved performance in school (**education**). The solar products will also save the households money (which would have otherwise been used to purchase kerosene and/or radio batteries and mobile phone charging), which can be used toward the repayment of the solar loan (**available income**).

The adoption of solar in rural areas will furthermore, reduce the dangers of fire outbreaks and burns, as well as, improve the **health** of end-users by reducing the harmful emissions from kerosene lamps. In addition, the use of solar products will contribute to **environmental benefits** since it replaces kerosene (a fossil fuel which contributes to global warming). EnDev-K will also enhance solar entrepreneurship in rural areas complementing RBF interventions i.e. existing entrepreneurs will grow and new entrepreneurs will emerge as a result of an enabling financial environment. In effect, this can enhance **income generation and job creation** for the rural population. The RBF interventions are also expected to encourage new customers to join rural financing institutions.

The RBF interventions are therefore expected to improve access to finance for both end-users and entrepreneurs hence increasing demand for the products by consumers as well as increasing the availability of products in rural areas through new entrepreneurs. The interventions are also expected to shift the market from the low cost-minimal service picoPV products to more costly-multifunctional devices providing better quality lighting and basic electricity services.

#### **5. Strategic fit and alignment with national policies**

Kenya's guiding document for strategic development is the Vision 2030 stressing energy access as a priority area. In addition, the final draft Energy Policy 2014 commits the government to providing electricity access to people currently using kerosene in rural, peri-

urban and urban areas, through interventions that will promote the use of solar lanterns and solar home systems. The RBF therefore fits well in the Ministry of Energy and Petroleum (MoEP) strategic orientation to increase access to modern energy especially in the rural areas and for the poor.

## **6. Market analysis of technology and sector closeness to commercial viability**

The increase in acquisition and use of solar products in recent years is mainly driven by the private sector. This success to bring the picoPV market to its initial stages of commercialisation is attributed to the efforts of the Lighting Africa Programme, which ended in 2013. Although the growth of the market is steady, there are several key barriers, which prevent the market to mature. These barriers include: lack of access to finance, distribution challenges (especially in rural areas), inadequate consumer awareness/education and lack of after-sales service in rural areas.

Out of the 700,000 sold picoPV systems, over 60% are low-cost products (less than 15 EUR), which provide minimal services to end-users and are mainly acquired on cash basis. There is low uptake of more expensive multi-functional picoPV products, which provide better quality lighting and basic electricity services (e.g. mobile phone charging). Multi-functional picoPV products costing above 30 EUR constitute about 8% of the total products sold in the Kenyan market by 2013. The low uptake is mainly attributed to high cost vis-à-vis low and erratic income patterns. On supply side, the uptake of more expensive picoPV products by most LMEs is low because most suppliers require them to purchase the products in advance on cash basis and they lack the access to capital for larger upfront payments.

The objective of the RBF intervention is to accelerate the uptake of more expensive multi-functional picoPV products, hence increasing their proportion from 8% (2013) to about 20% (2018).

## **7. Analysis of the enabling environment of sector capacity, knowledge, acceptable policy gaps / barriers**

At national policy level, there are no major barriers that would hinder the development of the picoPV market in Kenya. The government is committed to increase and improve access to high quality, reliable and affordable energy services. Solar PV regulations were gazetted by the Energy Regulatory Commission (ERC) in 2012 for regulating the solar market also in regard to consumer protection. The regulations require manufacturers, vendors, contractors and technicians to be licensed. The Kenya Bureau of Standards (KEBS) is also developing standards for picoPV systems with modules of less than 15W capacity. These standards will help in streamlining the quality assurance for small solar systems in the Kenyan market which is still a concern. Until October 2013, solar PV products/components were Value Added Tax (VAT) exempt but the exemption has since been reversed, therefore increasing the cost of solar products by 16%. This may have a negative impact in the uptake of the market.

The picoPV market is mainly driven by the private sector with minimal support from the government. Currently there are 17 main companies distributing Lighting Africa approved products, while others focus on non-Lighting Africa products. The private sector is organised in the Kenya Renewable Energy Association (KEREAA), which was formed in 2002 and is dedicated to facilitate the growth and development of renewable energy business through awareness creation/promotion, training and capacity building, lobbying and advocacy, research and networking.

EnDev-K activities complement these efforts and the RBF interventions by supporting the private sector in promotion and awareness creation, as well as, developing rural distribution channels. Training and capacity building on solar entrepreneurship occurs at two levels i.e. by the relevant private sector actors (solar distributors) or donor funded programmes such as EnDev-K programme (through GIZ and SNV).

There are only a low number of financial institutions or organisations offering credit/financing schemes for solar products especially for end-users. Based on the EnDev-K preliminary assessment, about 50 financial institutions and organisations (i.e. banks, SACCOs, MFIs, private companies, NGOs, CBOs, FBOs) are offering renewable energy specific financing schemes (mainly end-user finance for solar products and improved cookstoves).

## **8. Expected private investment and participation in the RBF**

The rural financial institutions and distributors (beneficiaries) will initially use their own funds to finance upfront loans to LMEs and end-users. The beneficiaries will either establish a risk guarantee fund and/or provide initial capital investments for a credit lending scheme. There will be general guidelines that outline how the funds can and cannot be used.

Over the 4 years RBF project period, the expected private sector investment is about 8.2 EUR million for risk cover and working capital. FI, MFIs, SACCOs and distributors have all shown support of the RBF proposal and substantial interest in receiving RBF funds.

## **9. Implementation strategy and partnerships**

The RBF interventions will be anchored in the ongoing EnDev-K programme, which will be responsible for overall coordination, management and oversight of the RBF intervention and reporting the overall progress to EnDev HQ/DFID. The funds will be managed by a suitable financial institution (FI) and responsibilities entail setting up the RBF scheme and disbursements, operationalizing procedures and monitoring framework, identification and selection of beneficiaries. An external verifier will check on actual final beneficiaries (end-users of picoPV systems) and an independent auditor will audit the activities of the FI.

## **10. Sustainability and risk mitigation**

The RBF incentives are designed to decrease gradually over time to prepare the financial institutions for the withdrawal of the RBF after the subsidy period expires. The depreciating facilitation of risk guarantee funds at the level of rural financial institutions enables these to mitigate lending risks in the long-run.

The main risks in the financial sector is that benefiting FI might be reluctant to share specific data with another FI (e.g. commercial banks) implementing the overall RBF intervention. In this case the FI will have to outsource the verification responsibility to an independent agency.

The disbursement of funds into the risk guarantee fund follows the agreement that the funds remain in place with the same purpose after the RBF project period. In case the interest rate remains at a prohibitive level for end-users, SACCOs are a valid alternative beneficiary to FIs and MFIs.

The RBF interventions could create an incentive to beneficiaries to issue as many solar loans as possible without rigorous due diligence. This is prevented by having a cap on the RBF incentive paid and ensuring thereby that the risk is shared between the beneficiary and the

project. An independent verifier will check the quality of the loan-financed picoPV systems to ensure that only good quality products are facilitated with the RBF.

## 11. Summary of expected outcomes and impacts

The RBF interventions are expected to increase the number of people with access to basic energy services in rural areas not connected to the national grid. The RBF will also improve the access to financing mechanisms for solar products for both the end-users and entrepreneurs therefore increasing uptake and availability of products in rural areas. The solar products acquired will provide lighting and basic electricity services hence reducing household expenditure on kerosene and mobile phone charging. The solar systems will also reduce the amount of greenhouse gases by displacing kerosene lamps. Furthermore, the RBF initiative will encourage the lending institutions to invest and provide innovative financing schemes for increasing the uptake of solar products.

The specific expected outcomes are:

- 246,00 people gaining access to improved energy services
- 22,378 tCO<sub>2</sub>e avoided emissions
- 600 enterprises created.

## 12. RBF budget

	EUR
1 Human resources and travelling	507,229
2 Equipment and supplies	15,000
3 Funding financing agreements / local subsidies	2,062,950
4 Other direct costs	12,526
5 Total direct costs	2,597,705
6 Mark up costs / administrative overheads / imputed profit	202,295
7 Cost price	2,800,000

## RBF for mini-grids “Market creation for private sector operated mini-grids”

RBF Key Performance Indicators (KPI)	Target
People gaining access (EnDev counting method)	22,500 people
EUR per person gaining access	92
T CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	5,106
EUR per t CO <sub>2</sub> e emissions avoided	406.38
Private sector leverage ratio	1.0
Jobs created	Not quantified
Enterprises created	10
Technologies deployed	20

### 1. Country and project area context

The Kenyan power sector suffers from inadequate generation capacities and power infrastructure. The national installed generation capacity was about 1.7GW in June 2013 while peak demand reached 1.4GW. As half of the generation capacity is hydro power with high seasonal variations, demand often outstrips supply. Load shedding is frequent. The Government of Kenya (GoK) places a high priority on providing more citizens with electricity access. Policy and regulatory frameworks focus in particular on the development of power generation capacities, as well as improvement and extension of the national grid.

Despite these efforts, a large share of the rural population remains without access to electricity services. The national electrification rate was at 29% in June 2013, while in rural areas only 5% have access to grid electricity. Grid extension, densification and grid access support programmes for low income households that cannot afford the connection fee (approx. 400 USD) are therefore the core strategy of the GoK to increase the connection rate.

### 2. Sub-sector and technology focus and rationale

A significant share of the Kenyan population lives far away from the grid or in sparsely populated areas. Extending the grid to these remote areas is often too costly both in terms of total investment and cost per kWh provided. The national power grid is therefore complemented by currently 15 mini-grids - additional 11 are under construction. These mini-grids have a scale of 150 – 1800 kW with medium voltage networks and are operated by the distribution utility Kenya Power as the regulatory framework does currently not attract private concessions.

While the existing mini-grids used to operate on costly diesel generation only, they are in process to be retrofitted with wind and solar generation in the context of a multi-donor supported Scaling Up Renewable Energy Programme (SREP) of GoK. The same programme plans to install an additional 44 mini-grids in the coming years. Furthermore, there is a number of community owned and operated mini-grids in the scale of 10-100 kW, in most cases with low voltage distribution only.

While there has been considerable progress in regards to cost reduction of renewable energies, new and innovative approaches for technical management, tariff models and fee collection for mini-grids are still lacking.

### 3. Outline RBF incentive design

Within a mini-grid set-up a commercial operator would normally prefer to supply a large amount of electricity to relatively few (commercial) customers, while the connection of households with limited demand profiles is often neglected. In order to trigger investment and incentivise household connections, RBF payments will be disbursed against the fulfilment of two indicators: (1) 'amount of electricity delivered' (premium paid per kWh supplied over the last quarter), and (2) 'new connection made' (premium paid per household connected and maintained over a predefined period of time).

The RBF incentive design is set-up in a flexible way to anticipate potential changes in the regulatory framework in Kenya. For each realistic future scenario a suitable business model has been developed with a complementary RBF incentive design. The subsidies combine a connection and production-based approach. The production-based subsidy targets the delivered service while the connection-based absorbs the capital need for building sustainable infrastructure. The latter subsidy is to decline over time as the end-user revenues increase proportional to the connections.

The RBF intervention will be implemented in cooperation with a financing institution (FI). Due to the high demand for technical knowledge to prepare tender for mini-grids projects the Regional Technical Assistance Programme (RTAP) implemented by the Kenyan Association of Manufacturers (KAM) on behalf of AFD will assist the FI in developing bankable projects.

### 4. Impacts on people and the environment

The benefits of a sustainable mini-grid market in Kenya would be substantial for households, SMEs, the national economy, as well as the local and global environment. On the supply side, the RBF will enhance ongoing efforts to strengthen the private sector to install further generation capacities. On the demand side, it will address the needs of communities to access electricity and foster social-economic rural transformation.

For **individual households**, the main advantage is the shift from traditional to modern lighting systems, typically from kerosene lamps to superior quality. Access to electricity will enhance the quality of life of the rural population and contribute to **entrepreneurial activities**, leading to **job creation**. Enterprises will have the opportunity to increase productivity and improve functionality, through both diversification of products and services and increased efficiency. Applications of end-use energy technologies, such as food preservation and processing for e.g. fish, electric appliances for grinding and milling, and local craft production will encourage the establishment of women enterprises. Good light quality will enable children to study conveniently and therefore improve their performance in school (**education**). Community members will benefit indirectly from the power provided to schools, health centres, and water-supply systems. Rural health centres can provide more reliable access to vaccination and refrigeration. Access to electricity is therefore a driving force in improving the **health and living conditions** for especially children and women. It will further lead to gender equality in rural communities. Emphasis will also be given to inclusive mechanisms that enable also poor households to connect to the mini-grid via subsidised or loan paid connections.

Switching from fuel-based lighting to electricity reduces indoor air pollution and associated **health** costs both for households and the public health system. Improved lighting and use of communication technologies contributes to improved **education** and **access to information**. Replacing dry cells and diesel use by solar energy reduces the occurrence of toxic waste (empty dry cells, spillage of diesel) in the village as well as use of fossil fuels and related **GHG emissions**.

The RBF programme will accumulate experiences in private sector mini-grid electrification, create awareness of the feasibility and attractiveness at public and private level and stimulate multistakeholder discussions. Up to 20 private sector driven mini-grids in operation will demonstrate the viability of the various business models. It may also have an influence on the **national policy and regulatory environment** and trigger change processes.

## **5. Strategic fit and alignment with national policies**

The proposed RBF intervention is in line with the national economic development blueprint, the Vision 2030, in which Kenya commits itself to universal energy access by 2030. General strategies aim to accelerate access through public and private initiatives. In 2009, the Rural Master Electrification Plan (REMP) was published which sketches out the national rural electrification strategy for the period 2008-2018 and proposes 23 additional sites for mini-grids. MoEP is currently offering retrofitting of the existing mini-grids to the private sector which indicates certain openness to private sector involvement. The Kenyan Privatisation Commission is currently preparing a study and recommendations on future business models for these mini-grids. While SREP is targeting mini-grids in the scale of 150 kW to 1 MW, the proposed RBF intervention focuses on the so far neglected market segment of below 50 kW. The RBF intervention is therefore complementing the SREP.

## **6. Market analysis of technology and sector closeness to commercial viability**

The economic potential for mini-grid electrification is estimated at 23% or 10.2 million of Kenya's total population of about 40 million. Acknowledging the current efforts and speed of grid extension, this number may be halved. In any case, off-grid electrification will remain one of the most cost-efficient solutions for a significant share of the population living in rural areas. The highest potential for mini-grids is currently in the Northern region of Kenya (Turkana, Marsabit, Wajir) and on islands along the coast of and on Lake Victoria. The current difficulty is the unpredictability of grid extension, which is most likely to expand further given the increased influence of County Governments in electrification activities. REA sets the minimum distance of a newly planned mini-grid project to a minimum of 60km away from the current national grid.

Even though the ability to pay is low for most of rural households, average spending on energy is relatively high. There is a certain potential of better-off households and small businesses that could provide the base for a village electrification scheme. GIZ ProSolar has so far identified about 17 potential sites between 20-50 kW. The list is expected to grow within the next months.

Private sector engagement has become more and more visible over the past years, there are currently about five Kenyan companies active in the PV off-grid market (suppliers and project developers) and seven have stated interest in venturing into the mini-grid market. The Kenyan market is also considered as an entry point into the African market by many international companies. During private sector consultations, local as well as international

qualified companies and utilities have already expressed their readiness to step into the market, once supporting mechanisms such as the RBF intervention are in place.

## **7. Analysis of the enabling environment of sector capacity, knowledge, acceptable policy gaps / barriers**

Looking at the enabling environment for developing a mini-grid market, one main and crucial bottleneck can be identified hindering private investors from venturing into the new market: the lack of a supporting regulatory environment. In particular, the existing feed-in-tariff (FIT) targeting solar PV starting from 500kWp and creating uncertainty for investors interested in smaller system with regards to the legal framework. In addition, the off-grid FIT for PV has not yet been applied in practice and the existing (on-grid) standard power purchase agreement (PPA) would need some adaptations, especially if used in an off-grid PV-diesel hybrid generation setting. The issuance of a distribution license to other than to Kenya Power has not happened before.

## **8. Expected private investment and participation in the RBF**

Attracting private sector into power generation on a sustainable basis has been a continuous challenge for the GoK and international organisations. The key parameter for winning interest of private sector is the profitability of the project. Several private sector firms are active in Kenya in (a) the grid connected renewable energy market and (b) the picoPV and solar home system market. Both sides have expressed keen interest in the mini-grids retrofit and greenfield market, but shun market entry to date due to the reasons which this project proposes to address.

## **9. Implementation strategy and partnership**

Three key stakeholders will be involved in the implementation of the RBF intervention: GIZ/EnDev, financial institutions (FIs), and private project developers. GIZ is responsible for the design, advertising, and monitoring of the RBF incentive. This includes the contracting and oversight of FIs and independent auditors who will verify the outcomes of the project. The FI will market, acquire, conclude and monitor contracts with private sector actors. The private sector project developers will develop and implement the projects benefiting from the RBF incentives.

During the project preparation phase, GIZ will work together with the GoK and REA to finalise the project pipeline of potential mini-grid sites. GIZ will commission pre-feasibility studies for all sites, which will be made available to the private sector. A partnering FI will be chosen through a competitive call for proposals. Together with GIZ, incentive packages will be designed, utilizing the principle that incentives would focus to off-set investment costs and would only be paid upon proven results. The RBF would be operated as a challenge fund requesting project developers to participate in competitive bidding. The project sites in geographical vicinity will be clustered to allow for economies of scale and ease of implementation (implementation phase). During the project impact evaluation phase GIZ, together with an external consultant will assess the project and the impact of market development for mini-grids in Kenya.

## **10. Sustainability and risk mitigation**

**Corruption and fraud:** Corruption and fraud may negatively affect the project at competition and bidding stage, performance reporting stage, and fund releasing stage. The risk will be mitigated by involving the GoK, following transparent and competitive tender procedures and

applying objective criteria. In addition, claims are verified by independent consultants and GIZ will conduct random cross-checks on verified claims.

**Policy risks:** The success of the RBF intervention is highly depending on changes in the existing policy and regulatory framework. While the RBF intervention has been endorsed by the MoEP, only the implementation will show in how far this support materialises and regulatory barriers like obtaining distribution licenses can be solved. To mitigate this risk, three business models were developed in close discussion with the private sector. All models require different levels of policy commitment. This way, the risk of a total stand-still can be reduced, but not completely eliminated.

**Tariff risks:** All business models will depend on the possibility to set tariffs above the existing uniform tariff scheme. During stakeholder consultations, ERC confirmed that off-grid tariffs above the uniform tariff are possible. At the same time, ERC sees its responsibility to protect customer interests, especially of rural households, resultant in the tendency to keep tariff levels low. To mitigate this risk, GIZ will start negotiations with communities during the pre-feasibility phase to assess ability and willingness to pay.

**Potential mini-grid sites:** REA requested GIZ to only select sites for mini-grid development which have a minimum distance of 60km from the national grid. This requirement reduces the number of potential sites as the commercial viability and presence of potential anchor customers decreases with increasing remoteness of the settlement. This risk will be mitigated (a) due to decreasing costs, (b) as second movers will benefit from the RBF demonstration effect, and (c) by GIZ selecting possible sites together with REA. Private sector could request for guarantees that specific sites will not be connected within a time period of at least ten years. Once formal distribution licenses can be obtained, mini-grids could be developed in closer proximity to the grid and transformed into grid-connected micro-utilities once the national grid arrives.

**Capacity of private sector:** Some national companies may not have the capacity or seed capital to respond to the requirements of the planned tender (complex business plan, etc.). This risk is mitigated by the fact, that a number of national/international consortia expressed interest to participate. GIZ could potentially offer some limited support or connect applicants to existing business development services (BDS).

**Load development:** Some customers may want to stretch their demand to levels that cannot be sustained by the local generation. This may result in social tensions. Risk mitigation will involve clear communication of system limitations, active load management and solid tariff schemes at the beginning of project implementation which take into account the nature of a solar energy resource.

**Access to finance:** Gaining access to finance for off-grid investments is cumbersome, especially as revenue projections include much higher uncertainties than on-grid investments. This risk is mitigated by the participation of international companies that usually bring own equity or have better access to soft loans or venture capital. The RBF incentive contract is also expected to increase bankability of the mini-grid investments.

**Climate and environmental risks:** By promoting energy technology solutions based on locally available renewable energies, the action will reduce harmful emissions from conventional energy sources such as kerosene, diesel and dry cells. Although the mini-grids may have a diesel generation component incorporated, the use of the diesel generation will be limited. Size, quality and professional operation of the diesel generator can reduce

emissions. The use of solar energy and increased efficiency of power generation and electrical lighting will also contribute to the reduction of greenhouse gas emissions. The avoided local environmental damage can be observed in reduced emissions of CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub> and particulates. Potential environmental concerns may arise from the use of batteries. A risk mitigation plan for the specific treatment such as batteries or damaged inverters will be part of an Environmental Impact Assessment (EIA). The environmental review will be completed at the level required and specified by the National Environment Management Authority (NEMA). Large solar power plants occupying vast surfaces may also lead to a modification of the micro-flora due to decreased infiltration of rain waters. However, the size and the capacity of the power plants targeted by the RBF intervention are not of a scale to cause any damage to the eco-system.

**Sustainability and exit strategy** The RBF intervention will facilitate market entry of up to ten private companies into the mini-grid market in Kenya, creating crucial experiences at both project development and operator level as well as within the banking sector. Key risks remain: operators could stop further investments and reduce service levels once the RBF tariff top-up ends. These risks, however, are partially mitigated by the fact that detailed business plans are required which will provide transparency to all sides about possible financial bottlenecks. Furthermore, GIZ will use the experiences generated during the RBF implementation to improve the policy and regulatory framework together with the GoK. Policy changes could open up the SREP pipeline of 44 medium size mini-grids to private sector and enable at least partially cost reflective tariff setting. The availability of distribution licenses would have the biggest impact on the long-term market potential, as private sector could start working in commercially more active areas nearby the grid. Without such a regulatory change, the commercial mini-grid market will only grow at a slow pace together with the general rural economic development that will gradually make remote settlements more attractive for mini-grid electrification.

## **11. Summary of expected outcomes and impacts**

The RBF is expected to generate the following impacts:

- the off-grid electrification rate will accelerate faster than during the business-as-usual scenario;
- awareness is created of the feasibility and attractiveness of mini-grid electrification at public and private level;
- structural change is triggered in the market through the proven viability of mini-grid electrification;
- private sector will increasingly gain interest as loans from commercial banks can be accessed;
- positive environmental impact through the fuel switch from diesel to solar during power generation;
- the targeted communities will have access to affordable, reliable and eco-friendly electricity, which will significantly improve their living conditions;
- income generating activities and job creation opportunities will emerge which contribute to the inclusive development of the target area;
- the proposed intervention will demonstrate one or more specific examples how to set RBF incentives to trigger market development on short to long term.

At outcome level, anchor clients and village users in 20 rural settlements will be provided with access to electricity through private sector operated mini-grids. Key expected outcome indicators are:

- 22,500 people with improved access to energy services;
- ten sustainable energy enterprises are created or expanded;
- 5,106 tCO<sub>2</sub>e reduced or avoided.

## 12.RBF budget

	EUR
1 Human resources and travelling	224,750
2 Equipment and supplies	35,000
3 Funding financing agreements / local subsidies	1,653,600
4 Other direct costs	36,532
5 Total direct costs	1,939,882
6 Mark up costs / administrative overheads / imputed profit	135,118
7 Cost price	2,075,000

## RBF for stoves “Higher tier cookstove market acceleration project”

RBF Key Performance Indicators (KPI)	Target
People gaining access (EnDev counting method)	500,000 people
EUR per person gaining access	4
T CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	41,188
EUR per t CO <sub>2</sub> e emissions avoided	50.01
Private sector leverage ratio	1.7
Jobs created	50
Enterprises created	60
Technologies deployed	100,000

### 1. Country and project area context

The Kenyan population is about 40 million people with almost 80% living in rural areas and a population growth rate of 2.4% and urbanisation at 22%. In 2013, biomass energy provided 69% of the country’s overall energy requirements. Studies on biomass energy point to a widening gap between supply and demand for wood-fuel in various parts of the country. At the same time, in spite of past efforts to promote wood-fuel substitutes, the number of people relying on wood-fuel is not decreasing. The subsistence nature of the rural economy in Kenya means that biomass energy will remain the primary energy source among the rural and urban poor communities, until the transformation into a modern, productive and monetised economy is achieved, enabling the transition to high efficiency improved cookstoves. The proposed RBF intervention is part of the necessary market transformation tools.

### 2. Sub-sector and technology focus and rationale

Although the improved cookstove (ICS) sector in Kenya has been growing over the last 30 years with successful uptake realised for entry level tier<sup>6</sup> ICS, estimated at between 1.5 million and 3.1 million cookstoves, currently less than 37% of households use a form of improved cookstove. Estimations indicate that most of the ICS in Kenya fall below tier 2 (well below our higher tier definition). Higher tiers with better efficiency ratios and reduced negative health impacts and long lifespans are only just emerging on the market. Over 80% of rural and 10% of urban households regularly use firewood, while about 7% of rural households, and over 30% of urban, use charcoal. Kerosene is also prevalent in the urban areas at over 44%.

Several developments in the clean cookstoves market in Kenya point towards a vibrant growing sector (e.g. several companies present or are planning to expand to Kenya). Studies by the GACC show that between 94% and 99% of households indicate willingness to purchase an ICS. The main motivation quoted is “to save money on fuel”. Higher tier stoves use less fuel and the customer could reduce fuel costs by 50-70%. More than half (52%) of

<sup>6</sup> Currently there are no definitive standards for what constitutes a true “clean cookstove”, but the GACC is working towards developing globally recognised and accepted standards. During the ISO International Workshop Agreement on Clean and Efficient Cookstoves (February 2012), a preliminary step towards a formal ISO standard was reached. The Agreement uses “Tiers of Performance” to categorise stove performance levels for efficiency, safety, and emissions. This forms the basis for “tiers” mentioned in this RBF proposal.

those willing to purchase an ICS would prefer to pay in monthly installments of 3 EUR and above, indicating an inherent demand for upfront financing.

### 3. Outline RBF incentive design

As described above, studies commissioned by the GACC indicate a need for innovative financing mechanisms for end-users to purchase higher tier improved cookstoves. A detailed market potential survey focused on the impact of new micro finance schemes for small scale energy technologies and “revealed a large potential market for solar lamps, small solar panels, solar light and mobile charging technologies, efficient cookstoves and water filters.”

Without the RBF intervention targeting this specific market barrier, the higher tier cookstoves would not gain a stable market presence until much longer into the future. Currently the “real” interest rate in the rural and peri-urban area for a new product (like a higher tier cookstove) and for a new customer would be over 160% (with a default rate of 30%, very high overhead costs due to a low volume and an unknown product). Hence, the low volume (market entry barrier) and the lack of evidence (defaults) prevent rural market take-off.

The RBF incentive design consists of three different RBF incentives targeting various barriers identified. Two RBF incentives directly target the benefiting MFIs/SACCOs and incentivise the issuance of ICS loans to end-users. The first RBF aims at reducing the “perceived” risk to reduce the risk surcharges incorporated into the interest rate by enabling the beneficiary to set up a risk fund. The second RBF aims at further reducing the initial interest rate by covering additional overheads incurring from setting up a new financial product for rural customers. Otherwise MFIs/SACCOs will initially calculate with very high “loan unit costs” into their interest rates based on expected small initial demand and unknown market. The third RBF incentive targets the market from a slightly different angle focusing on the access to adequate fuel for the ICS – in the present case the pellet market. Gasifier stoves, which are fired with pellets, are also a higher tier stove on the higher price end, which will be included into the RBF intervention. SNV is supporting the pellet market development and is in contact with manufacturers who want to venture into the Kenyan market. The RBF incentive will be given to pellet manufacturers in form of vouchers, which will be passed on to the end-user when purchasing a gasifier stove.

### 4. Impacts on people and the environment

The use of clean, safe and efficient higher tier cookstoves will dramatically reduce fuel consumption and exposure to harmful cookstove smoke, provide economic opportunities for Kenyans, and help reduce environmental degradations through the abatement of deforestation. Reliance on inefficient cookstoves leads to negative health and environmental impacts and rising demand for biomass energy resources is increasing pressure on forestlands, leading to an increase in greenhouse gas emissions and deterioration of ecosystem services.

The uptake of an additional 100,000 improved cookstoves will lead to several impacts, notable ones being on **health**, women and children who spend the most time near fires while cooking is taking place, the results of this intervention can reduce the exposure of indoor air pollution (IAP) to an estimated 500,000 people from toxic fumes, as well as, reduce burn rates from open fires. Families spending more than 30% of their income on purchasing fuel can reduce this expenditure half, translating to **savings** of up to 200 EUR per year per household, this can be used to start or scale up **income** generating household activities. There are other community benefits associated with higher tier cookstoves, examples include

women coming together to form self-help groups, the benefits are not just the obvious economic opportunity, but the chance to meet and socialise.

In Kenya the forest cover has been reducing over time, now standing at a mere 1.7%. The forestlands have been stripped to support charcoal production, where in Kenya's urban areas, 83% of the households use charcoal for cooking. In addition to the impact on **deforestation**, the emissions from cookstoves use contribute significantly to outdoor air pollution and exacerbate already compromising pollution levels. The burning of solid fuels produces significant quantities of emissions that impact the **climate** in the short-term. The uptake of an additional 100,000 high efficiency ICS over the 4-year RBF intervention period will reduce a total amount of 41,000 tCO<sub>2</sub>e.

The **economic opportunities** brought by this project could be transformational. The cookstove supply chain has the ability to be a great source of economic opportunity and **job creation** at the level of financial institutions, distributors and at the local dealer level. As a result of the RBF intervention, projected outcomes estimate that 1,000 last mile entrepreneur (LME) loans will be given by MFIs and SACCOs combined, 50 new small and micro entrepreneurs will be operating in rural areas, and 120 rural financial institutions will be trained on ICS technology.

## **5. Strategic fit and alignment with national policies**

According to the Global Alliance for Clean Cookstoves (GACC), "Kenya is a catalytic force in the global clean cooking sector's efforts to ensure that cooking does not kill. From supporting new cookstove standards to participating in ground breaking research to hosting entrepreneurs who are meeting market needs and improving livelihoods, the public and private sectors in Kenya are critical to the achievement of the Global Alliance for Clean Cookstoves' mission and goals."

Kenya's Energy Bill 2014 and Energy Policy 2014 are in the final stages of formulation. The Energy Bill 2014 requires "The Government...to facilitate the provision of affordable energy services to all in all areas," and to adopt measures that provide for access to appropriate forms of energy or energy services for all the people of Kenya at affordable prices. The measures contemplated must take into account the safety, health and environmental suitability of such energy and its affordability by poor households. Capacity building in biomass energy technologies is also prioritised as one of the short-term measures to be implemented in the 2014- 2017 period. The formation of the Clean Cookstoves Association of Kenya in 2013 was a milestone for the sector, giving direction for standards, ethical private sector activity and capacity building for the sector.

## **6. Market analysis of technology and sector closeness to commercial viability**

The improved cookstove market in Kenya has been analysed by various stakeholders like the GACC, Global Village Energy Partnership (GVEP), and co2Balance, which form a solid basis of information for the development of the concept for this RBF intervention. Some findings are enforced by information provided by manufacturers, e.g. the challenge of affordability. As the current uptake for higher tier cookstoves is slow, the business-as-usual scenario would see marginal changes in the demand for these cookstoves, without the RBF intervention.

The Kenyan cookstove market is relatively developed – but not entirely mature – with numerous stakeholders being active. But it has yet to reach commercial scale. Low

appreciation for quality amongst some producers and consumers is a challenge. Decades of activity in the sector has helped to create a relatively supportive environment. The emergence of the Kenyan Ceramic Jiko (KCJ) stove and training of countless artisanal producers, led to ICS penetration in urban and peri-urban areas. Rural adoption is widely recognised to be much lower. Many cookstove initiatives have taken place in the country but often lacked a commercial focus and have not been sustained. Opportunities exist to develop stronger, more coordinated, interventions, such as the proposed RBF.

The differences in quality of cookstoves in the market goes hand in hand with the wide range of producers from the local artisans, to women groups, to carbon developers, large national players, and multinationals. Production of components is often done separately by micro, small and medium scale enterprises and many middlemen exist to transport and retail cookstoves countrywide. Actors often lack working capital to purchase materials in bulk and ensure continuous production, as well as capital to expand their market outreach.

Consumers appear extremely price sensitive and unwilling to pay for the more expensive cookstoves which can exert pressure on some producers to focus on lowering the price rather than improving quality. The information that is available has shown that thermal efficiencies across the major players can range from 20% to 40%, implying that many consumers do not see the full benefit of the potential fuel savings. Moreover, the current official standards only enforce quality across a small fraction of the market. Increasing urbanisation and rising charcoal prices are likely to increase demand for efficient cookstoves in areas where people pay for fuel.

The last two years have seen the emergence of many of the new generation of improved cookstoves in the Kenyan market. This is an indication that the private sector has seen the opportunity and is seeking to position, segment and target the market appropriately. The fact that two of the biggest international manufacturers have set up plants in Kenya attests to this fact. Market competition is moving towards a platform where the value proposition, stove performance, warranties and price points take priority.

While the product-related issues may be solved fairly easily, the greatest challenges are related to distribution logistics and access to finance. Many of the smaller companies that make up the distribution network, struggle to access the finance necessary to purchase stock and transport them cost-effectively to new markets.

## **7. Analysis of the enabling environment of sector capacity, knowledge, acceptable policy gaps / barriers**

There are no structural or insurmountable barriers to market creation in the Kenyan improved cookstove sector. The main market failures include very low level of awareness on the specific benefits of the higher tier cookstoves, limited access to finance, and modest experience with higher tier cookstove financing among financial institutions. The proposed RBF intervention not only takes cognizance of these; it goes further to incorporate necessary partnerships that play a supportive role to either produce or maintain the conducive RBF environment.

**Enabling environment:** The programme will keep track of the impending new Energy Policy 2014 and Energy Act 2014. The current drafts indicate positivity towards the improved cookstoves sector and express a need for financing instruments. These public sector actions are hosted by the Ministry of Energy and Petroleum, which has already expressed support for the proposed RBF intervention.

**Sector capacity:** The RBF intervention will be implemented complementary to the ongoing EnDev activities in the energy sector e.g. in regard to general awareness-raising campaigns, capacity building of entrepreneurs, value chain development and promotion/marketing support.

**Micro-finance provision:** The RBF intervention cannot provide up-front loans and investments, and therefore needs to be implemented in an environment where MFIs and SACCOs are willing to provide this capital. An adequate number of leading MFIs and the Kenya Union of Savings & Credit Co-operatives (KUSCCO) have expressed interest in the RBF.

## **8. Expected private investment and participation in the RBF**

The MFIs and SACCOs are expected to mobilise in advance capital outlay for the credit facility in the range of 3 million EUR over the whole RBF project period. Additionally, an estimated 260,000 EUR will be fronted by them for overhead costs associated with loan development and marketing.

MFIs, SACCOs and distributors have all shown support of the RBF proposal and substantial interest in receiving RBF funds including first ideas on how they would make best-use of the funds received. A number of the leading private sector companies in the sub-sector fully support the RBF intervention, specifically with the hope that it will translate to volume growth of their resellers and lead to economies of scale and eventually lower prices and end-user interest costs in the market.

## **9. Implementation strategy and partnerships**

The RBF intervention will be anchored in the ongoing EnDev-K activities. SNV Kenya will be responsible for overall coordination, management and supervision as well as reporting overall progress to EnDev HQ/DFID. A financial institution (FI) will act as custodian for the RBF funds, while a fund manager will be responsible for the management, monitoring and reporting within Kenya. Direct beneficiaries are rural FIs (i.e. commercial banks and MFIs), distributors and SACCOs. There will be a special facility for pellet manufacturers as direct beneficiaries. An external verifier will audit and verify the activities, performance and results of the fund manager and the beneficiaries. Indirect beneficiaries are end-users and retailers/last mile entrepreneurs.

During the preparation phase, a suitable FI to host the RBF fund is being selected on the basis of i) present financial standing, network/accessibility, and value for money in RBF operation, ii) capability to provide RBF services, and iii) commitment as post-RBF market player.

The implementation phase will see application and selection of beneficiaries to receive RBF funds, setting up of the payment modalities and RBF payments upon verification of results. The performance of the host FI will be assessed by external auditors.

The whole implementation will be accompanied by reporting and evaluation activities starting with a baseline study, data collection and compilation of final beneficiaries and last mile distributors, bi-annual summary reporting, a reconciliation of statements-audits from the FI, and MFI and SACCO due diligence reports. Mid-term and concluding evaluations will address a full due diligence and field inspection of all parties engaged in the programme.

## **10. Sustainability and risk mitigation**

This RBF intervention does not pose any notable climate and environment risks; on the contrary, it saves trees and biomass in general through market development of more clean and efficient cookstoves. However, there are valid concerns related to existing and new cookstoves technology that uses non-biodegradable material in the manufacture of cookstoves and disposal of used stoves.

In addition, the RFB intervention as a credit enhancement instrument carries both inherent and external risks, which in turn are either subsector related or of a macro level nature. All risks are targeted with individual risk mitigation measures. The main risks and mitigation measures are described below:

**Corruption/fraud:** Unethical behaviour, bribe-taking and falsification of claims and information are real risks given that RBFs involves the payment of cash incentives to private firms via a tiered structure. The risks that exist are: false/double claims by firms to financial institutions and false/double claims by financial institutions to GIZ/EnDev country offices, and transactions within GIZ/EnDev. These risks are mitigated through separation of roles and a robust independent verification and auditing mechanism which includes on site sampling as well as direct verification done by the GIZ/EnDev team. Suspension, disqualification and recourse clauses in agreements will also act as a deterrent to corruption.

**Collusion:** Some MFIs or SACCOs may collude to set high RBF reward prices, leading to rent seeking through prior price agreements in the bidding process. Bidders could collude to set a price or price range within which to tender. This may hamper efforts to avoid over-incentivizing through the use of tendering. Price justification requirement will be applied linked to audited financial records. Setting a cap on the RBF incentive offered, or setting criteria for determination of incentive that minimises rent seeking, but attracts sufficient number of participants and level of interest serve as risk mitigation measures as well. Annual review of incentive based on realised business and market fundamentals will provide information for price adjustments over time.

**Policy and regulation:** The risk emanates from two sectors – energy and finance. Currently the policy and regulatory risk is seen to be low and the environment is conducive and encouraging to innovation and therefore ripe for the introduction of the RBF. Constant review of policy and regulation developments will keep the RBF intervention up to date of changes and therefore able to apply counter strategies for any negative impacts of changes in the operating environment.

**Market distortion and spoilage:** While MFIs will be given broad guidelines on how to make best use of the RBF funds, the specific strategies will not be prescribed. It is expected that MFIs will come up with innovative or tried-and-tested methods to increase lending for ICS in general. Certain allocation though may lead to aggressive marketing behaviors leading to end-users who cannot afford the tier 2 and 3 ICS being targeted. The RBF will be structured to reward properly assigned loans and will be disbursed upon completion of repayment or a greater portion of the repayment of the loan. Overly aggressive sales behavior will be checked via sample verification, audits and complaints channels and would reduce RBF payments.

**RBF Rejection:** If advertised RBFs are not taken up by the target beneficiaries, or are taken up and later dropped, this would have the impact of failure of the RBF proposition. Reasons could range from unattractiveness of terms, to perceived ineffectiveness of the RBF, to data disclosure clauses and perceived heavy-handed M&E requirements. The most effective way

to avoid RBF rejection is consultation of stakeholders in the RBF refinement process. This is as important as the consultative process during RBF definition and validation during RBF proposal.

## 11. Summary of expected outcomes and impacts

It is expected that the project will reach more than 500,000 people with clean cookstoves during the project period; this is calculated based on the 100,000 cookstoves being bought by 100,000 households. ICS reduce about 1-3 tCO<sub>2</sub>e relative to a non-ICS baseline. However there are opportunities to achieve even higher reduction potential based on the type of technology adopted. For the following calculation, a conservative estimate has been applied resulting in a reduction of 41,811 tCO<sub>2</sub>e at the end of the project period.

As a result of the stimulated market more entrants in the form of dealers, cookstove manufacturers, MFIs and SACCOs will enter the higher tier cookstove segment contributing to building of a stable supply chain and tackling of financial barriers. The private sector will leverage own financing equivalent to 3.26 million EUR, creation of an additional 50 new jobs and expansion of 60 MFIs and SACCOs either through opening of new branches or new products. The prices of cookstoves are expected to come down by at least 20% by the end of the project period as a result of economies of scale.

## 12. RBF budget

### 12.1. GIZ budget

	EUR
1 Human resources and travelling	0
2 Equipment and supplies	0
3 Funding financing agreements / local subsidies	1,888,840
4 Other direct costs	52,947
5 Total direct costs	1,941,787
6 Mark up costs / administrative overheads / imputed profit	118,213
7 Cost price	2,060,000

### 12.2. SNV budget

	EUR
1 Staff costs	150,000
2 Programme support	34,200
3 RBF incentives and FI fees	1,643,760
4 Independent verification	60,880
5 Total costs	1,888,840

## Malawi

<b>Promoted technology</b>		solar / stoves			
<b>Project period</b>	old	12.2012 – 12.2014	<b>Budget (EUR)</b>	old	500,000
	new	12.2012 – 12.2016		new	2,500,000 <sup>7</sup> plus 500,000 pending Irish Aid proposal for 2015 budget
<b>Target groups</b>		Urban, peri-urban and rural firewood using households, peri-urban and rural households without access to electricity			
<b>Lead political partner</b>		Ministry of Energy			
<b>Implementing organisation</b>		GIZ in cooperation with the local non-profit organisation "MAEVE"			
<b>Implementing partner</b>		Stove producers, private sector, PR and marketing specialist, a national network of NGOs active in stove producer training (Concern Universal and others)			
<b>Coordination with other programmes</b>		National Improved Cookstoves Task Force (NCT), Presidential Initiative '2 million stoves for Malawi by 2020' DISCOVER programme (UK aid, Irish Aid and Norway funded), IRTICP (Irish Aid funded), COOPI (EU funded), Mbaula Network			
<b>Summary of key interventions and outputs</b>		<p>Component A1: Support the National Cookstove Taskforce</p> <p>Component A2: Ensure sustainable nationwide supply of the energy efficient cookstove "Chitetezo Mbaula"</p> <p>Component A3: Scale up the established distribution system and sales in urban and peri-urban areas</p> <p>Component B: Implement a national marketing and awareness campaign for Lighting Africa-certified picoPV products</p>			
<b>Targets</b>		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		0	100,000	people	
<b>Cooking / thermal energy for households</b>		125,000	625,000	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		0	0	institutions	
<b>Energy for productive use / income generation</b>		0	0	SMEs	
<b>Project manager</b>		Marco Hüls, email: marco.huels@giz.de			

### 1. Situation analysis

Given its relatively small land-mass, large (and growing) population and heavy dependence on fuel wood, Malawi is an increasingly energy-stressed country. The National Energy Policy

<sup>7</sup> only EUR 500,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds

estimates that 93% of total energy demand is met by biomass energy. Households consume 84% of the total primary energy. A staggering 99% of household energy is supplied by biomass. This, with increasing population growth, is exerting significant pressure on the country's forest resources, leading to forest degradation and deforestation at a rate of 2.6% per year. 87% of the population uses firewood and 8% charcoal to satisfy their thermal energy needs. Less than 2.3% of the total national energy demand is met by electricity, 3.5% by liquid fuels and gas, and 1% by coal.<sup>8</sup>

Firewood and charcoal are the major cooking fuels, even in the urban areas. Most of the charcoal is consumed in urban areas – representing 46% of total demand. Unlike in many neighbouring countries, firewood is still available in all four major cities of Malawi (Lilongwe, Blantyre, Zomba and Mzuzu) as well as in the district capitals. Firewood provides over 50% of the urban cooking fuel and nearly 100% in the rural areas.

Even in urban areas, firewood is mainly used in open three-stone fires. Therefore there is a potential to introduce convenient affordable portable firewood stoves in urban areas and shift eventually some parts of the cooking activities currently done with charcoal to a less primary-energy intensive fuel source, meaning un-carbonised firewood.

Charcoal in Malawi is mostly unsustainably produced from live trees: over 60% of the charcoal is made from wood originating from protected Forest Reserves and National Parks; even firewood is unsustainably and illegally collected from government and community forests.

Several successful stove projects have already been executed in Malawi, such as those supported by Energising Development (EnDev) through the Programme for Basic Energy and Conservation in Southern Africa (ProBEC) from 2005-2008. However, the lion's share of work in the cookstoves sector has targeted and is targeting rural areas. Urban dwellers are the biggest consumers of non-collected biomass, and their numbers are increasing rapidly. However, the capacity to produce a sufficient quantity of good quality improved cookstoves is still limited in the urban areas. EnDev Malawi has started to enhance stove production and link rural stove producers with distribution and sales structures in the urban areas. This will encourage urban and rural stove producers to grow their businesses and once started, continuing to invest own resources in building up the urban demand for their stoves – building on the successes of EnDev and ProBEC.

Less than 7% of the 14 million people are connected to the national grid. The connected demand far exceeds the supply of 320 MW installed generation capacity. Thus, load shedding is frequent. The unconnected households rely on inefficient lighting products (e.g. kerosene lamps, torches with dry-cell batteries, candles, etc.). Compared to neighbouring countries, the market for picoPV products in Malawi is in a very nascent stage. Private sector and donor agencies have so far paid limited attention to the sector. To date, it is estimated that 62,000 picoPV systems have been sold in the Malawian market, representing only 1% of the potential market share.<sup>9</sup> The Malawian market can be simply characterised by a lack of consumer demand and very limited supply chains extending to poor customers in rural areas.

In a recent stakeholder workshop facilitated by Practical Action, the following main barriers for further development of the picoPV market have been identified:

- Lack of consumer awareness

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<sup>8</sup> Ministry of Energy, [http://mbaula.org/index\\_htm\\_files/2%20-%20BEST%20Presentation.pdf](http://mbaula.org/index_htm_files/2%20-%20BEST%20Presentation.pdf)

<sup>9</sup> Practical Action, Mapping the pico-solar product market in Malawi – Workshop Summary

- Affordability of products
- Access to finance
- Taxation
- Lack of clear regulatory frameworks and quality standards
- Lack of policy focus

### **1.1. Policy framework, laws and regulations**

The Government of Malawi has as of late demonstrated a commitment to scaling up the use of improved cookstoves to address environmental and health issues. President Banda has a keen interest and passion for maternal and child health and committed the Government of Malawi to promote the adoption of energy efficient clean cookstoves in a letter sent to the Global Alliance for Clean Cookstoves on the 18th of June 2012. The Government of Malawi has embarked on an initiative that aims at improving the cooking situation in Malawian homes through promotion of the adoption of up to 2 million energy efficient stoves by 2020.

It was agreed to establish a National Improved Cookstove Task Force (NCT) including the Government, civil society and the development partners. The Task Force was established in March 2013 and is funded by Irish Aid for the first year. MAEVE as EnDev's implementation partner in Malawi has actively participated in the task force.

Led by the Government of Malawi (represented by the Ministry of Energy), the NCT has recently developed a roadmap document, describing how the Government of Malawi and its partners intend to develop the cookstove sector between January 2015 and December 2017 in order to transform the sector and enter a growth path that will eventually enable Malawi to achieve the ambitious target of 2 million cookstoves having entered the market by 2020. This roadmap provides the framework for any cookstove intervention in the country over the next 2 years. The roadmap has identified the following key outputs for the stove sector within this time frame:

1. National Cookstoves Taskforce strengthened & functional
2. Cookstove standards and testing mechanism put in place
3. Relevant policy and regulatory framework reviewed and harmonised
4. Cookstoves technologies promoted on basis of evidence from consistent testing results
5. National capacity of cook stoves players strengthened
6. Delivery models and financial mechanisms for catalysing mass uptake of cookstoves in place

The proposed up-scaling of the EnDev cooking energy activities is fully in line with the NCT roadmap. Although EnDev is usually centred on implementation, acknowledging the importance of the NCT for the sector development, the proposed EnDev programme will cover key output 1 through the more policy advice oriented NCT support component. Further, EnDev will contribute significantly to the other key outputs, with a focus on the delivery models for mass uptake of the Chitetezo Mbaula stove in urban and peri-urban areas, scaling up the activities successfully carried out since 2013.

The policy framework in the field of off-grid lighting is less clearly defined. In fact, recent stakeholder consultation facilitated by Practical Action revealed that market actors see a lack of policy focus as one of the barriers to the development of the sector. Government policies in the energy sector are outdated and do not yet recognise the role of off-grid-lighting in combating energy poverty.

The older policy documents, including the Malawi Energy Policy (2003), are currently under revision. Laws and regulations to certain extent acknowledge the positive effects of solar technology on poverty and the environment by exempting them from duty and excise. However, obtaining the exemption is a bureaucratic challenge in practice.

Despite these shortcomings on the policy end for off-grid lighting, the pilot solar component of EnDev Malawi will not directly address the policy issues. This is in line with EnDev's core mandate of delivering actual energy access and its focus on the development of private sector markets. Same as in the past for the stove component, EnDev will start with a targeted demand side intervention, cooperating with the private sector.

## **1.2. Institutional set-up in the energy sector**

The National Cookstove Taskforce (NCT) is the centre-piece of the Malawian institutional set-up for cooking energy. The NCT reports to the national Renewable Energy Technical Working Group to ensure that its activities are in line with national strategy and policy in the wider field of renewable and sustainable energy. The Task Force is co-chaired by Government (Ministry of Energy and the Ministry of Environment). Other members of the Task Force include donors, NGOs, academia, government and private sector representatives. The EnDev implementation partner MAEVE is one of the two NGO-representatives in the NCT since August 2013. Although the NCT has received initial administrative support from Irish Aid, delivered through Concern Universal, the resources of the NCT both financially and in terms of personnel have been limited. The NCT's work mainly has to rely on time input of its members and a case by case acquisition of funds needed for core activities, such as studies or the recent development of the roadmap.

In future, according to the stakeholder consensus expressed in the cookstove roadmap document, the NCT needs to have management strengthened to ensure it delivers on its mandate. This is envisaged to be fulfilled by recruiting additional human resource as well as providing it with necessary financial resources to make it handle day-to-day activities in a more effective and efficient manner as well as acting as the National Cookstove Secretariat or Steering Committee. Substantive additional activities will include facilitating creation of an environment that enable NCT fulfil its M&E, accountability and compliance mandates through a legal framework.

In the field of picoPV, the institutional setup is less well defined. To a certain extent this reflects the fact that off-grid lighting is an even more private sector centric market than cookstoves. However, some basic regulatory framework is necessary, especially in the field of quality and standards. In Malawi, the procedure and requirements to import picoPV systems is complex and unclear. To attain the necessary licenses and product quality checks an importer must interact with the Malawi Energy Regulatory Authority (MERA), Malawi Bureau of Standards (MBS) and Malawi Revenue Authority (MRA). The roles and responsibilities of each agency and applicable procedures are not well defined.<sup>10</sup> On the private sector end, there is a Cooperation Network for Renewable Energy in Malawi (CONREMA) and a dormant Renewable Energy Industry Association of Malawi (REIAMA). Both could potentially play a role in representing the picoPV sector towards the government, but have not done this so far.

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<sup>10</sup> Practical Action, Mapping the pico-solar product market in Malawi – Workshop Summary

### 1.3. Major donor activities

Prior to the new engagement of the EnDev donor-consortium in April 2013, the major donors for biomass energy interventions in Malawi were (in alphabetical order) European Union, Ireland, Norway, UK, UNDP and USA. Major programmes supported by these donors in Malawi were without exception targeting the rural areas. To date, EnDev Malawi is the only programme specifically targeting the urban markets for improved cookstoves.

The Global Alliance for Clean Cookstoves provides Malawi with additional international experience that will contribute to developing the national cookstove programme. Following a suggestion by GACC, the US supported a market assessment study carried out by GVEP and independent consultants.

So far there has been no engagement of Lighting Africa or similar initiatives to develop the picoPV market in the country.

## 2. Project approach

Component A1: Support the National Cookstove Taskforce

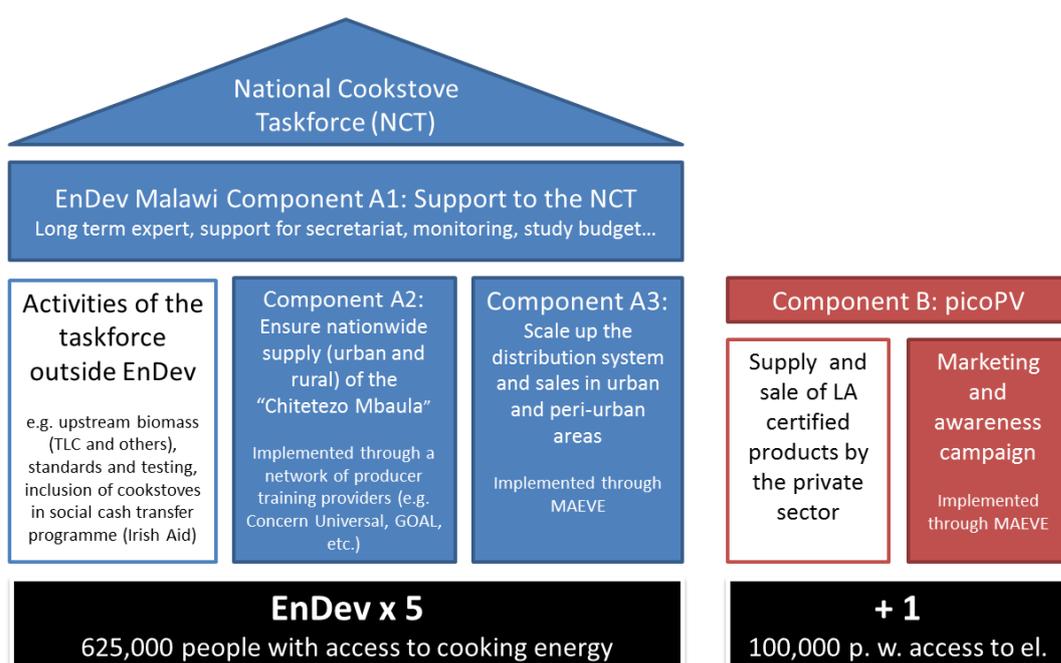
Component A2: Ensure sustainable nationwide supply of the energy efficient cookstove “Chitetezo Mbaula”

Component A3: Scale up the established distribution system and sales in urban and peri-urban areas

Component B: Implement a national marketing and awareness campaign for Lighting Africa-certified picoPV products

The approach and strategy of the future EnDev Malawi country intervention can be described as the “EnDev x 5 + 1” strategy. It intends to upscale the activities and outcome in the cooking energy sector by factor 5, developing the programme further from an originally demand side focussed intervention to a more full-fledged programme covering demand side, supply side and the policy environment. This broadened programme is complemented by a new electricity component, facilitating the dissemination of picoPV appliances through a demand side intervention.

This new project approach is summarised in the chart below:



## **2.1. Energy technologies and services promoted by the EnDev project**

The continued technological focus of the cooking energy component will be Chitetezo Mbaula stove and enhancing its market penetration in the major urban areas of Malawi. In developing a nationwide network of producer training providers, EnDev Malawi also expects positive spill-over effects to availability of the stove in rural markets. A steady demand will be generated through the urban distribution systems.

The Chitetezo Mbaula is a simple stove made of fired ceramic and currently the most affordable and popular portable household-size firewood stove in the country. It can reduce fuel consumption by up to 50%, especially when compared to outside three-stone-fires. As it can also burn other small biomass residues, it can reduce or in some cases even eliminate the need for purchased firewood. The stove has proven to be a suitable technology not only for rural but also for urban households.

In the solar component, EnDev Malawi will focus on picoPV appliances certified by Lighting Africa. The planned national marketing campaign will include all certified products and not favour certain models or manufactures. The choice of models to be disseminated lies exclusively with the private sector actors involved in the programme.

## **2.2. Energy for lighting / electrical appliances in households**

Component B: Implement a national marketing and awareness campaign for Lighting Africa-certified picoPV products: During a recent national workshop on market development for picoPV products, the participating stakeholders discussed their role and perspective of the market, highlighting the key constraints and opportunities for market development. The local implementation partner MAEVE participated on behalf of EnDev. Consumer awareness was identified as one of the six key barriers for market development. Consumers are often unaware of the existence of products or the benefits of quality solar light use, and have not had the opportunity to experience these benefits for themselves. They may have had a bad experience with a fake or low-quality solar product in the past, and are not able to differentiate between good and bad quality. Marketing to disperse rural consumers with little exposure to modern media is expensive. Marketing and awareness campaigns to date have had limited impact.

Marketing of high quality picoPV systems amongst consumers needs to happen to increase the awareness and demand for products. Campaigns could promote the functionality and quality of Lighting Africa-certified picoPV appliances, the economic, health and educational benefits of products, and specific brands and retailers. Radio, print media, roadshows, trade fairs and point-of-sale advertising offer channels to disseminate information.

Under normal market circumstances, marketing clearly is a private sector undertaking as part of the long-term competitive landscape. However, in the very nascent stages of the picoPV market in Malawi, individual companies lack the resources to meet the cost of a widespread campaign that could really kick-start the market at a national scale.

EnDev Malawi through its local implementation partner MAEVE is in a favourable position to fill this gap. MAEVE can build on the experience gained by marketing improved cookstoves on a national level. The successful marketing models developed for this purpose can be transferred and adapted to the picoPV sector.

In implementing the picoPV component, EnDev Malawi will exercise extreme caution to avoid market distortion through favouring individual companies or brands. The marketing campaign

will equally promote all Lighting Africa certified products, leaving the choice of appliance to the customer and the private sector distributors. Any firm active in the Malawian market offering LA-certified systems will be invited to participate in the marketing and awareness campaign. Private sector actors will not have to pay for these firm-neutral marketing services, but will be asked to provide sales data in order to enable effective monitoring of sector development.

### **2.3. Cooking / thermal energy for households**

Component A1: Support the National Cookstove Taskforce: As described above, EnDev Malawi will further develop into a full-fledged stove sector support programme. With the NCT in place and mandated by the government and the cookstove roadmap document developed, there is now a clear national framework for cookstove interventions which justifies EnDev to go beyond its original focus on demand (and increasingly supply) of the Chitetezo Mbaula and also embark on complementary, more policy oriented advisory services to the task force.

Although EnDev will not be able (and would go beyond its mandate) to fund the entire cookstove programme outlined in the roadmap, it can make significant contributions to its output 1 “Cookstove taskforce strengthened and functional”.

EnDev will provide advisory services to strengthen the institutional capacity of the NCT. In addition, EnDev will also provide organisational support to the secretariat in day-to-day activities, which has been identified as a key constraint. Currently the secretariat and the task force activities are driven by individuals alongside their normal jobs. Irish Aid has provided limited finance for a task force coordinator hired by Concern Universal, but this support is ending. Clearly a permanent support structure would help to ensure timely follow-up on decisions and their implementation.

During the implementation of the cookstove roadmap programme, the NCT will require external inputs, conduct studies or commission consultancies. EnDev intends to draw on its experience with cookstove programmes in around 20 other countries when providing capacity development. In addition, a limited budget for studies and consultancies requested by the NCT and commissioned through EnDev will be available.

The roadmap further includes the establishment of a national monitoring system as a key task. Based on its long-standing and global experiences with monitoring cookstove interventions, EnDev would be a good partner to support these efforts. EnDev will assist the taskforce in the development of the monitoring system, offering advice and transferring models and tools developed in other EnDev country programmes. In particular the database system developed and used by the Latin American EnDev project will be a point of reference. Over the long run, all stove activities in Malawi are expected to be covered by a unified monitoring system, in order to assess progress towards the two million cookstove target set by the government. The transfer of monitoring data generated by EnDev Malawi’s own stove dissemination efforts into a more sophisticated system will be the starting point.

A growing national cookstove portfolio will require improved coordination and possibly in future (especially when it comes to the distribution of carbon income) mediation between the different actors in the sector. An outside actor like GIZ who itself is not interested in carbon sales, might be better suited to fulfil that role than one of the NGOs involved in actual implementation of carbon schemes. The expected carbon income generated in the sector bears the potential to close the significant gap between the targets achievable with current funding (125,000 households through EnDev until 2016 plus a yet to be determined number

by other actors) and the ambitious target of 750,000 households until 2017 outlined in the NCT roadmap document. A national consensus on how to use the carbon finance should consider reinvestment of funds generated into sector growth as well as benefits for the communities concerned and targeted support for the poorest strata of the population to improve affordability of cookstoves, e.g. through social cash transfer approaches.

This addition to the project strategy requires a shift in the implementation structure of EnDev Malawi. In addition to the (significantly scaled-up) market development for the Chitetezo Mbaula stove carried out through MAEVE and other NGOs, EnDev intends to place a long-term GIZ advisor in EnDev Malawi.

Component A2: Ensure sustainable nationwide supply of the energy efficient cookstove “Chitetezo Mbaula”: The supply side component for the “Chitetezo Mbaula” stove aims to ensure nationwide supply of high quality stoves in urban and increasingly also in rural areas. The experience under EnDev has shown that while the urban markets created for the stove grow rapidly, ensuring steady supply for the new commercialisation channels opened up remains a challenge. As a quick and successful fix to this situation, MAEVE has since the last up-scaling of the project assisted a few promising stove production groups to expand their production and improve quality in key areas of the country. However, nationwide supply is still not achieved, drawing heavy on the resources for urban commercialisation of wood stoves. Stoves produced have to be collected and transported over long distances to reach the final urban customer, increasing fuel and personnel cost along the line of distribution.

In addition, it has been observed that through the steady urban demand for stoves, availability of the Chitetezo Mbaula in rural markets is also improving. Stove producers can make a living out of the activity, shifting from seasonal production to year round production. However, this effect has so far only benefitted pockets of the rural areas.

Therefore EnDev Malawi intends to take a wider and more systematic approach towards stove supply under this up-scaling proposal.

The aim of component A2 (in close connection with the coordination activities in the NCT under A1) is to build a nationwide network of stove training providers. These training providers could be informed by MAEVE whenever in a certain area of the country supply does not match the demand created through formal sales chains in urban areas. The aim of the component is not to train new production groups, but rather ensure and improve quality of existing groups and reactivate dormant groups that have stopped production because of limited demand.

There are a number of NGOs active in the field of stove producer training, with Concern Universal by far being the largest. However, none of these NGOs does have a nationwide coverage.

Quality control of stoves delivered to the urban sales chains will however still rest with MAEVE, as they have to ensure uniform quality of the product for their wholesale clients and end-customers in order to uphold their quality claim. This should lead to a general lift in quality standards in the market.

Training of stove producers should also include basic bookkeeping and monitoring. This will improve data availability not only on business performance, but will also capture the direct rural sales and thus enable Malawi to properly account for the access to cooking energy

facilitated in rural areas. It will be an important field of observation, whether the intended urban-rural spill-over effects on energy access really become reality.

In order to form the national network of stove training providers and broaden the training base as much as possible, EnDev Malawi will put out a national call, asking all actors interested in stove trainings to submit proposals. The call should give a clear picture which actor can guarantee availability of high quality stoves in which area at which cost. The purpose is therefore rather to determine a suitable division of labour than to create an unhealthy competition between NGOs.

Here is an initial list of possible participants in this call and their coverage area, although the call itself will be open to new actors:

<b>Organisation</b>	<b>Region</b>	<b>Consortium</b>
Concern Universal (CU)	South, Centre	DISCOVER
GOAL Malawi	South	DISCOVER
Cooperazione Internazionale (COOPI)	Centre, North	DISCOVER
AGRET	Centre	ECRP
Emmanual International (EI)	South	ECRP
DETAS (Development Technical Assistance Services)	North, but could operate a training team countrywide	
MuREA (Mulanje Renewable Energy Agency)	South	
National Smallholder Farmer’s Association (NASFAM)	South	
Foundation for community support services (FOCUS)	North	
Mapanga CBO	South	

In addition, MAEVE might also be interested in continuing some of their own training activities started under the initial EnDev financing.

Component A3: Scale up the established distribution system and sales in urban and peri-urban areas: In the demand side component, EnDev will continue with the commercialisation of the Chitetezo Mbaula wood stove in urban areas through the local NGO MAEVE. The project links production and demand by acting as an interface between predominantly rural informal small-scale producers and urban formal sales outlet chains, organising transportation of stoves to urban areas as needed. MAEVE has successfully introduced the stove into urban markets and developed a distribution network, including formal retail chains like Chipiku Supermarkets and PUMA filling stations. Although market levels currently achieved are likely to be sustainable if EnDev pulled out, the large number of households cooking with firewood in urban areas still bears a vast potential for scaling up.

The approach taken is purely commercial. The end-user price of the stove will not be subsidised. The aim is to achieve access to a uniform product at equal prices all over the country.

If the scaling up in urban markets is successful, carbon revenue from voluntary emission reductions will in future not only sustain the mandatory yet costly monitoring of stove adoption but also keep alive the distribution network beyond the availability of EnDev funding. Provided carbon income really materialises, it also bears the potential to scale up

stove dissemination from the 125,000 stoves directly supported through the EnDev interventions towards the 750,000 stoves the NCT considers necessary to reach a tipping point in the market.

**3. Expected impacts of the project intervention**

<b>Impact</b>	<b>Possible indicators</b>
<b>Environment</b>	65,000 tons of firewood saved, reduced deforestation, use of dry-cell batteries and their unsafe disposal avoided in 25,000 households
<b>Health</b>	Smoke exposure reduced for mainly women and children in 140,000 urban households, reduced indoor emissions for lighting and fire hazards in 20,000 rural households.
<b>Poverty / livelihood</b>	Increased stove production results in new income generation activities in rural areas, employment opportunities with stove producers, 2,500 employment opportunities in the stove production business, reduced expenditure for kerosene and dry-cell batteries
<b>Education</b>	Improved lighting for 100,000 people creates the opportunity to increase study and reading hours
<b>Governance</b>	Coordination in the stove sector ensured, through NCT Government improves policy formulation and implementation in the sector, more evidence for policy decisions available through nationwide monitoring of stove and picoPV markets
<b>Climate change</b>	50,000 t of CO2e reduced per year (emissions certificates will be generated and sold on the voluntary market)

**4. Possible risks and potential ways to mitigate them**

The current electoral process in Malawi might lead to change in government and less emphasis on cookstoves in Government policy and targets. This risk is to a certain extent mitigated by working through the private sector and civil society organisations. However, progress in the NCT might be slowed down.

The strong focus on one organisation (MAEVE) in the commercialisation of stoves in urban areas entails a key person (or in this case key organisation) risk. This is slightly mitigated by moving towards a more diverse set of partners in the supply side component.

Another set of risks is related to carbon funding. The prospects for carbon funding flows are unclear, given the uncertainty in the international arena. Although income for VERs has been more stable than CERs in the past, this can change. EnDev is confident however, that reduced carbon prices will only affect the future scaling-up potential, but market levels achieved with the intervention will be sustainable. An additional carbon risk is related to consumer information. Field observations show that end customers do not understand the emission reduction contracts they are signing. This will have to be addressed through improved consumer education in future.

In the picoPV sector, EnDev will be operating in a nascent market. Thus there is a risk that assumptions do not hold and targets are not achieved. Given the rapid growth of picoPV markets in other African countries, this risk is considered to be low. However, this creates questions regarding the attribution of future outcomes to either EnDev or autonomous market growth. This will have to be addressed in baseline collection and monitoring.

## 5. Budget

	<b>EUR</b>
<b>1 Human resources and travelling</b>	487,000
<b>2 Equipment and supplies</b>	66,000
<b>3 Funding financing agreements / local subsidies</b>	1,600,000
<b>4 Other direct costs</b>	128,473
<b>5 Total direct costs (sub-total)</b>	<b>2,281,473</b>
<b>6 Mark up costs / administrative overheads / imputed profit</b>	218,527
<b>7 Cost price</b>	<b>2,500,000</b>

If the Irish Aid funding does not materialise, components A2, A3 and B will be scaled down in budget and targets proportionally to achieve a total cost price of EUR 2,000,000.

## Nepal

<b>Promoted technology</b>		solar / stoves / mini-grids			
<b>Project period</b>	old	05.2009 – 06.2015	<b>Budget (EUR)</b>	old	4,740,000
	new	05.2009 – 06.2018		new	6,415,000
<b>Target groups</b>		Rural population (households, social institutions and SMEs)			
<b>Lead political partner</b>		Ministry of Energy; Ministry of Science, Technology and Environment (MoSTE)			
<b>Implementing organisation</b>		GIZ and Practical Action			
<b>Implementing partner</b>		Nepal Electricity Authority (NEA); National Association of Community Electricity Users Nepal (NACEUN); Alternative Energy Promotion Centre (AEPC); District Advisory Committees (DACs); SNV; NACEUN / HELVETAS Swiss Intercooperation			
<b>Coordination with other programmes</b>		Nepal Energy Efficiency Programme (NEEP), National Rural and Renewable Energy Programme (NORAD / DANIDA / DFID / KFW), Renewable Energy for Rural Livelihood (WB/UNDP), FMO Development Bank, HELVETAS Swiss Intercooperation, SNV			
<b>Summary of key interventions and outputs</b>		Community-based grid extension, community-based small hydro power schemes, commercial approach to build rural markets for hoodstoves			
<b>Targets</b>		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		240,637	240,637	people	
<b>Cooking / thermal energy for households</b>		0	148,500	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		33	33	institutions	
<b>Energy for productive use / income generation</b>		289	1050	SMEs	
<b>Project manager</b>		Bart Jan van Beuzekom			

## RBF for hoodstoves “Sustainable Hood-stove Market”

RBF Key Performance Indicators (KPI)	Target
People gaining access (EnDev counting method)	148,500 people
EUR per person gaining access	11
T CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	268,319
EUR per t CO <sub>2</sub> e emissions avoided	6.24
Private sector leverage ratio	1.3
Jobs created	100
Enterprises created	10
Technologies deployed	30,000

### 1. Country and project area context

Being a land-locked country, Nepal is facing challenges in regard to its energy situation due to over 75% mountainous terrain and very low income levels. The nation is among the poorest countries in the world. It has a population of 26.5 million of which about 83% live in rural areas. The primary energy demand is mostly met with traditional inefficient biomass energy (about 84%) having a serious negative impact on health, and contributing to deforestation and Greenhouse Gas (GHG) emissions

### 2. Sub-sector and technology focus and rationale

Biomass fuels such as animal dung, crop residues and firewood are mostly used by the poor rural population using traditional/rudimentary cookstoves. Over 74% of households in Nepal use traditional biomass energy cookstoves, followed by kerosene and gas stoves (21%) mainly in urban areas; improved biomass cookstoves (ICS) are currently only used by 3% of the population. According to the Fact Sheet of the Ministry of Health and Population, acute lower respiratory infections are the fourth highest disease accounting for 3.6% of cases of morbidity in Nepal.

There are more than 235,000 households in the proposed project districts, of which 81.3% are dependent on biomass energy for cooking. The area is characterised by an adequate supply of wood, with supply meeting demand but households spend an average of 6 hours to collect and transport a bundle of 30kg of wood. Current energy use and availability trends indicate that wood fuel will remain the primary cooking energy source for the foreseeable future.

The best match between the needs of the final beneficiaries and technical options is a hoodstove. They offer a complete-package of a specifically designed smoke-hood and an improved biomass energy cookstove to tackle both issues of inefficient use of biomass fuel and high levels of harmful emissions. Hoodstoves have already been shown to burn biomass more efficiently, whilst removing approximately 84% of household smoke, bringing emissions close to the WHO standard of 24hr mean of 25µg/m<sup>3</sup> for PM<sub>2.5</sub> and 7mg/m<sup>3</sup> for CO. The use of hoodstoves also better suits the local needs and traditional practices of using smoke for various purposes including smoking the timbers of roof structures, drying meat, space heating during cold times, as well as being a more appropriate solution for the local cooking practices and cooking pot sizes. The customer will be able to choose a package of a

„hood+stove“ that ensures best combined efficiency. This will provide greater flexibility to the households to choose the stove that best suits their needs.

### 3. Outline RBF incentive design

The hoodstove market in Nepal is at an early stage of development, but has good potential for up-scaling based on the households' needs and the private sector's readiness to increase their current involvement. The RBF intervention has the potential to take the technology to scale through a number of incentives designed to address and overcome the current market barriers. The interlinked RBF incentives are targeted at village-level cooperatives as the providers of affordable financial services to households, hoodstove entrepreneurs and SMEs taking into account the needs of the demand and supply side.

The first RBF incentive is a premium paid on hoodstove loans to facilitate affordable access to finance to the final beneficiaries. The premium will be paid to local cooperatives for each loan issued. Typically, households have limited income levels not allowing for full upfront payment for a hoodstove. In addition, access to finance at affordable terms is very limited for this target group. An RBF incentive at this level is needed, because cooperatives have no experience in lending for hoodstoves and limited experience in lending for energy products and services in general. Village cooperatives have expressed their willingness to establish long-term credit lines for hoodstoves as a result of the successful RBF intervention.

The second RBF incentive aims at establishing registered hoodstove entrepreneurs by incentive payments for each unit sold. A precondition to receive these payments is that hoodstove builders set up their own SME – otherwise they can only access payments indirectly through the cooperatives. The foundation for a long-term market development is the already established hoodstove SMEs. Additional business development trainings will assist the new entrepreneurs to develop a viable business strategy.

### 4. Impacts on people and the environment

**Reduced Deforestation:** Annual firewood consumption per family with a traditional cookstove is about 3000 kg, whilst after the intervention it will be reduced by 40% to 1800 kg/year/family.

**Improved Health:** Household Air Pollution (HAP) levels with traditional cookstoves are more than 2,127  $\mu\text{g}/\text{m}^3$  24-hour mean compared to the recommended WHO level of 25  $\mu\text{g}/\text{m}^3$ . Emissions from very efficient cookstoves are still significantly above the WHO recommended safe level: the average 24 hours PM<sub>2.5</sub> level in a kitchen with a chimney-attached-ICS promoted by AEPC is around 728  $\text{g}/\text{m}^3$ . The use of smokehoods on the cookstove (the hoodstove) results in significant household smoke reduction with an average of PM<sub>2.5</sub> levels of 118 $\text{g}/\text{m}^3$ .

**Improved Livelihoods:** There will be significant time saving from reduced fuel needs and a reduction in health related expenditures. A family spends on average 6 hours collecting a Bhari (a head load – 30kg) of wood-fuel, a family using traditional cookstoves spends about 600 hours per year on wood-fuel collection; this will be reduced to 360 hours. Hoodstove producers gain additional employment opportunities, more regular and full employment and additional.

**Improved Gender Dynamics:** As mainly women are involved in cooking and fuel collection, hoodstoves will help to save time for women; reducing their drudgery and health problems. The time and energy saved can be spent for care and livelihood improvement. A special

emphasis is on the creation of jobs for women with at least 10% of female hoodstove entrepreneurs.

**Private sector development and economic growth:** In addition, to the existing 24 entrepreneurs, 100 new hoodstove entrepreneurs will be trained. For example 10 SMEs will reach an average annual income of around 6,500 EUR. Additional job creation is expected along the hoodstove supply chain (e.g. at steel producer and distributors) as well as about 50 new jobs within the cooperative system.

**Reduced Emissions:** It is estimated that the use of hoodstoves will result in approximately 1.8 tCO<sub>2</sub> emission reduction per household per year compared to traditional cookstoves. At this rate, the cumulative emission reduction would be about 86,202 tCO<sub>2</sub> for the four-year RBF intervention period and 268,319 tCO<sub>2</sub> for the lifespan of hoodstoves (10 years).

**Improved climate resilience:** A substitution of traditional cookstoves with ICS and hoodstoves will reduce wood-fuel needs and thereby the rate of deforestation in the area. This will in turn help to sustain soil coverage and watershed management so that people, their fields and livestock will improve their resilience to abrupt climate change.

## 5. Strategic fit and alignment with national policies

The Prime Minister of Nepal announced the “Clean Cooking for All by 2017 (CC4All 2017)” initiative in 2013. Nepal is implementing a multi-donor renewable energy programme (2012-17) with ICSs as a key intervention. The Government is subsidising specific biomass energy technologies like metallic ICSs, but there is no direct subsidy for mud ICSs. Local stakeholders are only encouraged to provide financial support to install mud ICS. Despite these efforts, the technical solutions pursued by the government programme are focusing on subsidizing fuel efficient cookstoves rather than approaching the problem systemically for overall Household Air Pollution (HAP) reduction, energy efficiency and sustainable market development.

The RBF intervention is also well aligned with the National Rural Renewable Energy Programme (NRREP). The NRREP objective is to improve the living standards of rural women and men, increase employment and productivity of women and men as well as reducing dependency on traditional energy and attaining sustainable development through integrating alternative energy with the socioeconomic activities of women and men in rural communities. The programmes implementation is based on a subsidy mechanism to stove building companies then selling the stoves to local NGOs and other partner organisations. Comparable to the CC4All, the programmes lacks a long term focus on sustainable market development.

The RBF intervention ensures avoidance of duplication of efforts and double counting by focusing on four cookstove types to be combined with the smokehood that are not eligible under the current subsidy schemes while offering significant benefits to the end-users. In addition, Practical Action will work closely with AEPC to ensure that the RBF incentives are not combined with other existing subsidies.

## 6. Market analysis of technology and sector closeness to commercial viability

To achieve the objectives of the Government of Nepal, about 3.5 million additional ICSs are needed, while the current annual rate of dissemination is around 100,000. If CC4All is to be met, dissemination rates will need to increase almost 10 fold. So far, the government strategy relies merely on the subsidy scheme of the NRREP programme, while its credit

facility is not yet operational. There is thus a large gap in policy aspirations and reality. The RBF intervention serves as a pilot for potentially replacing the current subsidy programmes with credit schemes.

The hoodstove technology to be promoted with the RBF intervention was the outcome of a participatory technology development process from 2001 to 2004. Installed hoodstoves on household level showed great acceptance and further market development activities took place. In a next step the efficiency of the technology was further improved. There are some hoodstove entrepreneurs in place, but are still at a relatively low level of market penetration, scale and maturity, particularly in the more remote areas. With the support of the RBF intervention, it is expected that supply will rise to 7,500 hoodstoves on average sold per year, creating a critical mass of hoodstove users, resulting in the creation of a sustainable hoodstove market for entrepreneurs.

Bridging the gap for affordable finance at the household level will increase demand and ability to pay. At the same time providing monetary incentives for the entrepreneurs for each hoodstove installed will motivate them to build supply and dissemination channels that can cater for higher sales volumes. Two business models have been developed to support market development in a flexible way. The first being the “enterprise business model” with the objective to establish financially sound operating entrepreneurs with the capacity to plan, construct, and market the hoodstove along with necessary after-sales-services. An enterprise will be established following due registration process and creating a physical infrastructure for manufacturing. Enterprises will be largely financed by local financial institutions or cooperatives to arrange for initial investment and later working capital. The second business model takes the cooperatives as a starting point with the objective to create business opportunities by expanding their reserves to finance hoodstove installations. Cooperatives will create new loan portfolios for households and enterprises. The cooperatives initial fund requirement is met through deposits from its members and, if needed, they may also apply for funds from commercial banks.

## **7. Analysis of the enabling environment of sector capacity, knowledge, acceptable policy gaps / barriers**

From the Government side, the Alternative Energy Promotion Centre (AEPC) is the focal agency for promotion and development of renewable/alternative energy technologies in the country. AEPC is currently implementing the National Rural and Renewable Energy Programme (NRREP) as a national framework programme engaging a number of national and international actors. Although hoodstoves are not included in the existing subsidy schemes, the technology was already accepted by AEPC as an appropriate technology solution to reach national objectives.

The RBF intervention can build upon AEPCs large scale awareness programme on negative impacts of Household Air Pollution (HAP) and benefits of ICSs. While basic awareness has been created, more efforts are still needed to improve understanding of immediate and long-term positive impacts of ICS and hoodstoves. Once demand materialises, households in many cases face the challenge of high upfront costs of ICS, preferring to pay in smaller monthly instalments. However, their access to affordable finance is limited. On supply side current demand levels don't allow for bulk orders of material leading for higher input costs and delays in service delivery. In addition, stove sales can only provide a contribution to the overall income, hence, remaining a side business for now.

In terms of support services, the sub-sector is well established, providing for facilities for lab and field testing of stoves, a good network of cooperatives providing access to finance in rural areas and training institutions to build capacity on various topics. On the other hand, access to motorable roads is limited and leads to high transportation costs. This barrier is targeted by the proposed RBF intervention.

## **8. Expected private investment and participation in the RBF**

It is assumed that the RBF incentives paid will at least partially be re-invested by the private sector into consolidating the hoodstove business. Entrepreneurs are expected to use the RBF incentives to carry out promotion/awareness campaigns, purchase of tools/machinery, set-up of long-term distribution channels and supply relations, quality control measures and tools, and payment of interest to working capital loans. By investing in improved production and distribution facilities, entrepreneurs will be able to increase their sales volume and reduce cost of production which is expected to be reflected in the retail price on consumer level.

Cooperatives are expected to use the RBF incentives to establish a new credit line for hoodstove end-users, expanding their outreach to new customers, to finance reporting and marketing costs, and to provide soft loans for working capital needs of individual entrepreneurs and hoodstove SMEs.

Households are expected to re-invest the saved money from reduced wood-fuel needs into maintenance and repair of hoodstoves and other livelihood improvements.

## **9. Implementation strategy and partnerships**

The Alternative Energy Promotion Centre (AEPCC) has a general coordination role of all donor activities in the renewable energy sector and will provide its support to the RBF intervention with monitoring visits to sample project sites to inspect hoodstove installations, to maintain coordination with the national programme and ensure quality. On district level a District Advisory Committee (DAC) closely monitors the intervention and will provide suggestion and support for the sustainability.

Practical Action will implement the RBF intervention, select eligible beneficiaries of the RBF incentives, as well as coordinate the RBF incentive disbursement and verification. In addition, it will facilitate support in market development and capacity building for the companies to overcome distribution and retail challenges. Until the nascent private sector is able to full size ICS commercialisation as a pure business activity, local NGOs are key stakeholders for implementation during the transformation phase. While being the lead implementers in past activities, their role will be downscaled significantly and limited to coordination and steering at district level, awareness raising activities and technical trainings of new hoodstove entrepreneurs.

Village level cooperatives are organised in district-level associations which have a coordinating function. They will bundle RBF pay-out requests by the village-level cooperatives and organise monitoring and reporting towards the financial institution (FI). The financial institution (FI) will disburse RBF payments to the beneficiaries, who will be chosen through a competitive process to ensure best value for money and quality of performance.

Each year an independent verification of technical results, crosschecking of paper trail at the FI level with all involved cooperatives' associations, and sample on-spot verification of results at village cooperatives, village level hoodstove entrepreneurs, and hoodstove SMEs.

## 10. Sustainability and risk mitigation

**Corruption and fraud:** The main risks identified are (1) false or double claims, and (2) collusion. Based on the geographic focus cooperatives are only able to claim payments for loans issued to their members. Thereby, verification is eased and can be cross-checked with members' lists. Collusion generally is unlikely due to the simple RBF incentive design, independent verification and geographic separation as well as competition of and between stakeholders.

**Effectiveness of the RBF:** On political level there is a risk of a changing political environment in the biomass energy sector, but the current policy framework runs up to 2017 and therefore covers almost the whole implementation period. In addition, Practical Action will ensure close cooperation with AEPC to react flexible to any changes. Another risk can be identified in regard to the regulatory framework currently strongly dominated by subsidy-driven ICS dissemination. The niche for market competition is small, but well identified for the hoodstoves. Practical Action has been assigned all ICS implementation activities under the AEPC in the target areas, thereby having a strong coordinating role to prevent any overlaps or distortion. A specific risk is that the NRREP revises the subsidy scheme to cookstoves every two years – next revision is due in 2015. Based on available information the risk for the four stove types involved in the RBF intervention to be included into the subsidy scheme is low.

**Demand:** Currently willingness to pay for hoodstoves is limited as the specific health benefits are not yet widely known – but awareness is increasing slowly, and additional promotion will further support this positive trend.

**Capacity of cooperatives and hoodstove entrepreneurs:** The private sector in the hoodstove sub-sector is nascent. Pilot projects provided capacity development for hoodstove craftsmen as bases for the RBF intervention. Practical Action will offer additional support to hoodstove SMEs in developing business plans, building their marketing capacity and setting up their organisational structure. Some village-level cooperatives may not have effective management capacity. The risk of drop-outs will be limited by capacity development support.

**Economic risk:** Hoodstove entrepreneurs might opt-out of the business, if other more attractive economic opportunities arise. The risk is mitigated by establishing a long-term option to generate additional income. Another risk is potentially rising steel prices affecting the production cost of the hoodstove and reducing the expected hoodstove cost and price reduction due to economies of scale.

**Institutional risk:** Capacity of financial institutions may not be sufficient for the management of the RBF fund. Risk is mitigated by competitive selection process of FIs based on predefined selection and evaluation criteria.

**Climate and environmental risks:** There are no environmental risks in the production and use of hoodstoves beside the general impact of the steel industry, which does not occur within the project area nor can be influenced by the project. On the other hand future deforestation can be reduced by having more people in the target area using ICSs.

Continued provision of RBF incentives is not a sustainable solution and therefore a clear **exit strategy** is in place. In contrast to ongoing subsidy programmes, the RBF incentives are gradually reduced over the implementation period. The presentation of a long-term business plan by hoodstove SMEs and cooperatives is an eligibility criteria for receiving RBF

payments. In addition, entrepreneurs will be encouraged to diversify their ICS portfolio to other types of ICSs and expand operation areas.

The proposed RBF intervention is piloting credit-financed ICS dissemination for the sub-segment of hoodstoves in a small target area. The long-term vision is to demonstrate the feasibility of a private sector driven and credit-supported ICS dissemination approach, in contrast to the current subsidy driven approach.

## 11. Summary of expected outcomes and impacts

The RBF intervention aims to achieve a hoodstove market penetration of 13% in the intervention area within the implementation period, expecting continuing market growth afterwards. The immediate expected impacts are improvements in health and livelihoods, especially of women as their burden of drudgery is reduced. In addition, the pressure on forest resources is alleviated. In summary the following main outcomes and impacts are expected:

- 30,000 households gain access to improved cooking
- 8 new hoodstove SMEs created
- 125 new jobs created
- 86,202 tCO<sub>2</sub> reduced or avoided
- 80% reduction of Household Air Pollution (HAP) in 30,000 households.

## 12. RBF budget

### 12.1. GIZ budget

	EUR
1 Human resources and travelling	0
2 Equipment and supplies	0
3 Funding financing agreements / local subsidies	1,527,974
4 Other direct costs	50,258
5 Total direct costs	1,578,232
6 Mark up costs / administrative overheads / imputed profit	96,768
7 Cost price	1,675,000

### 12.2. Practical Action budget

	EUR
1 Personnel, TA, Overheads	244,025
2 Capacity building activities	27,093
3 RBF incentives	1,146,392
4 Monitoring and evaluation	37,106
5 Total costs	1,527,974

## Peru

<b>Promoted technology</b>		solar / stove / grid / others			
<b>Project period</b>	old	06.2009 – 12.2015	<b>Budget (EUR)</b>	old	11,350,000
	new	06.2009 – 06.2018		new	13,390,000
<b>Target groups</b>		Rural population (households, social institutions and SMEs)			
<b>Lead political partner</b>		Peruvian Agency for International Cooperation (APCI)			
<b>Implementing organisation</b>		GIZ			
<b>Implementing partner</b>		Ministry of Energy and Mines (MINEM); Ministry of Agriculture; Ministry of Health; Ministry of Development and Social Inclusion; governments of regions and provinces, private sector companies; Micro Finance Institutions: ADA, MEI; General Direction for Energy Efficiency (DGEE); UNSA			
<b>Coordination with other programmes</b>		Program for Competitiveness – AGROIDEAS from the Ministry of Agriculture; Project for the improvement of the rural grid through a grant fund - FONER; MFIs: Fondesurco, Caja Huancayo; Cooperation Fund for Social Development (Foncodes); "Cocina Perú" of the Ministry of Energy and Mines (MINEM)			
<b>Summary of key interventions and outputs</b>		Support to households for safe in-house installations in preparation for grid connections; support to government in implementing solar programmes in regard to quality assurance, consumer awareness and protection and creation of distribution channels; support to building commercial market structures to for improved cookstoves and other thermal energy technologies.			
<b>Targets</b>		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		175,000	175,000	people	
<b>Cooking / thermal energy for households</b>		310,000	781,500	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		4,800	4,800	institutions	
<b>Energy for productive use / income generation</b>		2,600	7,160	SMEs	
<b>Project manager</b>		Peter Pfaumann			

## RBF for picoPV “Building sustainable and affordable credit lines for small systems in rural areas”

RBF Key Performance Indicators (KPI)	Target
People gaining access (EnDev counting method)	130,000 people
EUR per person gaining access	15.69
T CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	195,875
EUR per t CO <sub>2</sub> e emissions avoided	10.41
Private sector leverage ratio	3.5
Jobs created	7
Enterprises created	21
Technologies deployed	30,000

### 1. Country and project area context

Despite the positive economic development in the past years, about 35% of the population of Peru still lives in poverty, with an even higher share in rural areas of more than 60%. Poor rural households typically use coal and/or wood as their main energy source for cooking and thermal energy needs, as only 56% have access to electricity. As biomass energy is usually used in an inefficient manner, households have to bear high expenses, indoor air pollution and depletion of natural resources like forest reserves.

On the other hand, the weather and climate conditions in Peru are optimal for taking advantage of solar energy to meet the needs for water heating, while improved cookstoves can better the situation in regard to food cooking needs significantly. To target both thermal energy market sub-segments, the proposal comprises two components.

### 2. Sub-sector and technology focus and rationale

Component 1: “Solar Water Heaters”: Due to the special climatic conditions in Peru, hot water is a key energy service for households. Water is often heated in an inefficient way, mainly by using stoves that burn with charcoal, wood or other biomass energy. While the solar water heater market has been constantly growing since the 1980s, it is concentrated in Southern Peru (town of Arequipa) and has failed to reach out into rural areas. The Solar Energy Atlas developed by the Peruvian Ministry of Energy and Mines maps the solar radiation throughout the country proving the high market potential. Apart from this nascent market and high technical potential, the business environment in Peru is conducive especially in terms of microfinance, but service coverage in rural areas is very limited.

A pilot project initiated in 2013 on introducing solar water heaters to rural markets has demonstrated the willingness of rural households to purchase the product if they have access to financing, knowledge and confidence in the technology and the retailer.

The proposed RBF intervention promotes the use of solar water heaters in households and small businesses in rural areas with the aim to (1) improve quality of life, (2) trigger market development in rural areas, and (3) ensure high quality and reliable after-sales-service.

Component 2: “Portable Stove Contest”: The Peruvian improved cookstove market is well developed with 35 certified models being sold. All cookstove types are energy efficient and are characterised by low emissions of harmful gases (CO and pm2.5) – but only two ICS

models are portable. All other 33 models are so-called in-situ and have to be built on site in the household. Adjustments to the existing in-situ models to develop portable models would affect their efficiency in a negative way and hence is not an option. Existing portable ICSs types from other regions, e.g. Africa, cannot be transferred easily to the Peruvian context as cooking habits are different and require two pots for cooking staple food and side dishes at the same time.

The market development of in-situ ICSs is hindered by the lack of industrial production and low competition, high input of funds and time required to train stove builders as well as stove construction, challenges in quality control, local availability of materials and – last but not least – the difficulty to reach clients in remote areas (particularly in the Amazon area). Therefore, these types of ICS face greater challenges in rural areas and may not be the ideal product for these markets.

Peru invests approximately 380 million USD, representing 0.15% of its Gross Domestic Product (GDP) in research and development (R&D). This percentage is very low compared to countries with similar levels of development and resources but sector R&D on ICS quality metrics and health impacts has lately made internationally recognised contributions, on which this proposal builds. Therefore, this project will bring together the RBF rationale with an innovative approach in the promotion of R&D. The project output are portable cookstoves that respond better to rural needs and are adapted for mass-production. It will ensure lower prices that allow for competition among companies and promote endogenous development, i.e. create a market where the demand is satisfied by national small and medium enterprises (SME) for improved portable stoves.

### **3. Outline RBF incentive design**

Component 1: “Solar Water Heaters”: The main partners to reach out into rural areas are local MFIs and solar water heater retailers, where the network of MFIs is used to link rural clients with the retailers. The RBF incentive design consists of three components:

- an ex-post business development grant to retailers (RBF1);
- an ex-post grant for a micro-finance institution (MFI) for each loan commissioned (RBF2);
- an ex-post grant for service-providing retailers for each functioning SWH (RBF3).

The RBF incentive levels are calculated based on the experience with the pilot project mentioned above, as well as a market study conducted and the baseline. The RBF intervention particularly includes attractive incentive levels for early movers at the very beginning to initiate aggressive promotion towards rural clients. The incentive level is reduced over time and a cap of the number of SWH to be incentivised with the RBF is pre-defined.

Component 2: “Portable Stove Contest”: A competition will be launched for innovating biomass-fired portable cookstoves. Entrepreneurs investing in R&D will be motivated by a set of attractive prizes in various categories. The incentives will kick-start research activities and develop marketable portable cookstoves that reach rural and remote areas. The RBF incentive design consists of three components:

- monetary prize paid for the winning stove in each category (RBF1);
- voucher for business development services for the winning stove in each category (RBF2);

- ex-post payments for each portable stove sold after the R&D contest (RBF3).

To participate in the contest entrepreneurs will submit a prototype of their new stove which will be tested at the national laboratory in regard to five categories: efficiency, weight, safety, emission and complementary uses. The RBF incentive is given at two stages: at a first stage the first two incentives are triggered to the winning companies. Both incentives contribute to the further development of the winning portable stoves and strengthening of the companies which will commercialise these stoves. The RBF3 at the second stage ensures the subsequent initial market introduction of the new stove models.

#### 4. Impacts on people and the environment

Component 1: “Solar Water Heaters”: The beneficial impact of Solar Water Heaters (SWH) on people in Peru can be divided into three different categories: a) **economic benefits for consumers**, b) **improved health**, and c) **economic benefits for entrepreneurs**.

The SWHs will replace firewood stoves and to some extent electric showers in rural and urban areas. As a result, a reduction of household expenses for heating water is expected. In cases where firewood is collected and not purchased, significant time savings can be achieved which benefits mostly women and girls.

The use of SWH will improve the hygiene on household level as it becomes easier and more comfortable to wash oneself regularly. This will result in a higher quality of life and a better health status. The regular use of hot water will significantly reduce stomach and respiratory diseases from which particularly children will benefit. By experiencing a generally better health, the use of hot water for daily hygiene will then indirectly also lead to a lower incidence of children’s diseases as well as to better maternal health and consequently to a lower incidence of infant mortality.

The RBF sets an incentive for the SMEs to scale up their business and expand areas of operation. Market growth and establishment of new distribution channels will leverage more income, revenues and has potential to create new jobs.

Apart from impacts on the people, the increased use of SWHs positively affects the **environment**. The use of biomass fuel puts significant pressure on forests and scrubland, emits greenhouse gases (GHGs) and black carbon. The number of SWHs sold in the context of the RBF intervention will lead to reduced or avoided emissions of between 54,974 – 102,095 tCO<sub>2</sub>e. Furthermore, the increased installation of SWHs reduces deforestation due to the decreased need for biomass fuel for heating purposes. As a result, a larger area will remain covered with vegetation so that the land is less vulnerable to land degradation and thus exhibits a higher resilience to climate change.

Component 2: “Portable Stove Contest”: The beneficial impact of improved portable cookstoves (ICS) on people in Peru can be divided into five categories: a) **accessibility**, b) **benefits for consumers**, c) **improved health**, d) **economic benefits for entrepreneurs**, and d) **benefits on macro-level**.

The cookstoves developed in the contest will not only be portable, but more importantly reduced in weight, enabling transport to remote and isolated areas by road and boat.

Consumers who buy firewood will experience direct monetary benefit through reducing expenditures on fuel. However, also families who collect firewood and dung will benefit from time savings. The saved time will especially benefit women and girls as these are mostly

entrusted with firewood collection and will then have more time for productive/income-producing work or home care activities, or for studying and attending school, respectively.

Indoor air pollution (IAP) from open fires and smoky stoves clearly is a major health hazard for the people. In 2002, the WHO attributed more than 1,500 deaths per year to IAP related diseases in Peru. Moreover, there will be fewer accidents, burning injuries and residential fires with an ICS because security is an integral quality criterion in their production.

By facilitating entrepreneurs to focus on scale, sales are increased and eligibility for governmental programmes such as “Cocina Perú” enabled. An additional positive effect of the scaled up production is a good potential for new job creation in local manufacturing. The vouchers for business development services will increase the enterprise’s capacity for business and strategic planning thereby strengthening its future perspective on the market.

On a macro level, the development contest will induce a more competitive environment in the sub-sector resulting in price reduction for consumers as well as government social programmes.

Apart from the impacts on the people, the development and dissemination of ICS has positive impacts on the **environment**. The general impacts are the same as for SWH and are described in detail above. Based on CO<sub>2</sub> emissions of 17.89 kg per day when using a traditional cookstove, the development contest with the resulting improved cookstoves will lead to lower emissions of between 82,138 – 152,542 tCO<sub>2</sub>e.

## **5. Strategic fit and alignment with national policies**

Component 1 “Solar Water Heaters”: The market for solar water heaters constitutes a niche in the national policy and current donor activities that is highly neglected by both. The “Plan referencial del uso eficiente de la energía 2009 – 2018” (PRUEE) is the only policy document that relates to this technology. The Peruvian Government seeks to promote the replacement of 100,000 electric water heaters with SWH until 2018, but current progress is slow.

Within the Ministry for Energy and Mines, the General Direction for Energy Efficiency (DGEE) is responsible for policies and programmes concerning SWH. DGEE supports the RBF intervention and sees it as well-aligned with the national policy, while complementing the national programme’s focus on urban areas with its emphasis on rural markets.

The RBF intervention will be open for all market actors certified by UNSA.

Component 2: “Portable Stove Contest”: The Peruvian Government provides improved cookstoves through different social programmes such as the “Cocina Perú” of the Ministry of Energy and Mines (MINEM), “My Farm Enterprise - Haku Wiñay” of the Cooperation Fund for Social Development (Foncodes) of the Ministry of Development and Social Inclusion (MIDIS) and the Joint Nutrition Programme (PAN). Based on the various stakeholder consultations held in the preparation process of this RBF intervention, it can be concluded that the proposal is well aligned with national policies and is backed up by various governmental institutions.

## **6. Market analysis of technology and sector closeness to commercial viability**

Component 1: “Solar Water Heaters”: With a population of almost 30 million people, good solar radiation and only 1% of the population currently using SWHs, the market potential is extensive.

The market for SWH is the oldest of all renewable energy product markets in Peru and has started to develop more than 40 years ago. Today the private sector sells about 40,000 SWH annually countrywide. But the enterprises are mostly concentrated in and around Arequipa town, where they find up to 95% of their market. On the other hand markets in other towns or rural areas throughout the country are mostly neglected.

Instead of creating competition, the market growth lead to market separation, having certain areas only served by one service provider – and creating the typical adverse effects of monopolies. Established retailers are struggling to expand into new operation areas due to high risk and limited experience with market expansion strategies. Currently, there are slightly more than 50 SWH retailers in Peru. Most of them are based in the core business region of Arequipa where around 40 businesses are located. In order to scale up the SWH market, a sales structure has to be put into place which considers two different sales modalities: i) sales with a microcredit, and ii) sales in cash. For both scenarios, the retailers which operate from Lima or Arequipa will need to establish a nation-wide sales network. This network with local branches and local distributors has to be established according to economic and climatic criteria and will then allow the retailers to supply their SWHs at national level.

Concerning microfinance, Peru has one of the best business environments worldwide as shown in the “Global microscope on the microfinance business environment 2013” published by The Economist. The report particular highlights “[h]igh levels of transparency around effective interest rates“. Currently, MFIs with existing rural networks are looking for ways to connect a loan with other needs of the rural population.

Component 2: “Portable Stove Contest”: About 2.5 million households (31%) in Peru frequently use biomass energy as fuel for cooking. In rural areas this figure is substantially higher with around 70%. Assuming that the potential demand are all rural households using biomass fuel for cooking and a price of 150 EUR per ICS the potential market for cookstoves is 459 million EUR. While being a theoretic calculation, it still gives an idea of the market to be created.

In Peru, the demand for portable ICS will be most pronounced in the jungle, as it is extremely difficult to deliver the supplies and labour force needed for the construction of an in-situ cookstove to these very remote areas. According to stakeholder estimations, the demand for portable cookstoves in the Peruvian jungle amounts to at least 300,000 units. Furthermore, there will also be a demand for portable ICS in the Altiplano and in urban and peri-urban areas although the magnitude of this demand is more difficult to determine.

The commitment to produce portable cookstoves that require higher investment in R&D and production processes is not high; hence most available ICS are in-situ. However, some companies have announced their interest in the technological upgrading and modernisation of their products. Academic level R&D departments as well as field and test laboratories specialised on improved cookstoves are in place.

## **7. Analysis of the enabling environment of sector capacity, knowledge, acceptable policy gaps / barriers**

Component 1: “Solar Water Heaters”: As shown in the market analysis, although the market has been established for years, there are several barriers preventing mass-commercialisation of SWH in urban and rural areas. A significant barrier is the high cost of SWH, especially for the poor and low access to affordable finance. In addition, potential

clients are not aware about the benefits of the technology and prejudices do exist that SWH do not work. The RBF intervention addresses these challenges by providing incentives for the MFIs to offer SWH loans and invest in promotion in rural areas. Through the loans customers can translate high upfront payments into lower monthly instalments.

On the level of MFIs there are almost no incentives for sales agents to promote loans for SWH due to relatively small loan volumes translating into low commissions to the agent. The innovative approach of the RBF intervention includes the MFIs into the value chain of SWH distribution; hence, establishing incentives to overcome this barrier. For tackling the MFI's capacity challenges a partnership with the ADA's Energy Inclusion Initiative (EII) is foreseen to assist them to develop their energy portfolio.

Despite the fact that most of the technology providers import the technology from China, there are still provider-sided barriers in place that hinder a quick dissemination of technology in rural areas and at national level. One key barrier is the high transaction costs caused by opening new branches in new operation areas. In addition, trained technicians in rural areas are scarce.

Component 2: "Portable Stove Contest": There are no structural barriers for R&D in improved portable cookstoves in Peru. On the contrary, the existence of technical standards and well-established research institutions create a very favourable environment for R&D and market development. The only barrier is the required high upfront investment in R&D with unclear return on investment. The development of a new cookstove model implies not only costs for staff and material, but also the opportunity cost of doing "business as usual". Mid-sized metal-mechanics companies are therefore hesitant to invest in developing new products, although it is in a field they technically dominate. The combination of monetary prizes and business development service vouchers will lower this barrier.

## **8. Expected private investment and participation in the RBF**

Component 1: "Solar Water Heaters": The market for SWH is rather well developed in urban areas particularly in the Department of Arequipa and in Lima. There are only few infrastructures for the rural commercialisation of SWH throughout the country, but strong and motivated enterprises that want to expand their markets. The RBF seeks to support this development and thereby leverages additional private capital at three levels: MFIs, technology provider, and end-users / costumers.

Component 2: "Portable Stove Contest": Consultations held in Peru in the preparation phase for this proposal have shown high interest in the stove contest from both companies with artisanal (portable) ICS production and medium-sized metal-mechanic companies. Through the promotion of the contest by the Ministry of Production, the number of participants can be leveraged to at least 20 companies. It is estimated that small companies would at least invest between 2,000 – 5,000 USD into the development of new portable stove models. Once the portable ICSs are brought to market readiness further investments by entrepreneurs into market development, promotion and additional R&D is estimated at at least 10,000 EUR. Final customers are expected to pay around 190 EUR per cookstove. With 8 companies that bring their product to the market and an estimated 15,000 sold portable ICS until 2017, the expected private sector investments are 2,8 million EUR.

## 9. Implementation strategy and partnerships

Component 1: “Solar Water Heaters”: The RBF intervention builds upon the pilot project carried out by EnDev Peru and the Energy Inclusion Initiative (EII) in 2013.

A financial institution (FI) will be selected to manage the RBF fund – one option being the state-owned Cooperación Financiera de Desarrollo S.A (COFIDE). The FI will effect incentive payments to SWH retailers and MFIs offering SWH loans to the final beneficiaries. Verification of achieved results will be done by a qualified local NGO ensuring that payment claims and installations or loans correspond. The NGO will visit a randomly selected sample of households; the remaining clients will be consulted via telephone. Thereby, the verification will cover 100% of the final beneficiaries who acquired a SWH. The FI will disburse the RBF incentives based on the reports submitted by the NGO.

In addition, EnDev Peru will be responsible to ensure an independent verification of the findings of the FI/NGO to ensure payments are made against results and to get feedback on customer satisfaction.

Component 2: “Portable Stove Contest”: Taking into account the focus on R&D, the institutional set-up of implementation of this component is different. This is mostly due to the fact that there is no need to engage a financial institution (FI) to manage the RBF fund. Instead Practical Action has been identified to be a suitable organisation to implement the stove contest.

EnDev Peru will provide technical assistance in regard to winning criteria, support testing of improved stove prototypes, as well as strengthen partnerships for long-term sustainability. It will also supervise and verify all activities carried out by Practical Action.

Practical Action (PA) will develop the technical specifications and manage the contest including payment of monetary prize incentives (RBF 1) and vouchers (RBF2) to the winners. In addition, they will channel incentives (RBF3) to firms that have sold portable ICS on the private market. PA will furthermore monitor and verify portable stove sales after the contest.

## 10. Sustainability and risk mitigation

Component 1: “Solar Water Heaters”: The overall **risks** associated with the RBF intervention are relatively low given that a pilot project with a very similar incentive and implementation scheme is already in place. Nevertheless, some critical issues were identified.

There exists the general **risk of fraud**. However, in regard to the organisational set-up of the fund management, this risk is very limited. Only one financial institution (FI) will manage and disburse the RBF funds, while a rigid monitoring of its performance is ensured.

However, there will be a considerable number of retailers and MFIs selling SWH that are eligible for the RBF incentive payments. This bears the risk that beneficiaries might submit **double claims** for one and the same SWH sold/credit provided. This threat will be addressed by a rigorous verification process before any incentive payments are triggered not only on the level of the FI, but as well on the level of the MFIs and retailers involved.

There is a risk that RBF incentives are either **not taken up sufficiently or over-subscribed**. Although the levels of the incentive have been determined based on the experience of the pilot project and the EII where these levels proved to be adequate and thus have a solid market-based foundation, they can be changed in response to the market uptake if required.

The **risk that consumer demand might not translate into effectively increased purchases** of SWH - despite the availability of affordable finance - will be addressed through increased promotional efforts by SWH retailers. EnDev Peru is currently assisting them to improve their ability to plan and implement marketing strategies.

The **risk that poor people do not sufficiently benefit** from the RBF intervention is twofold: First, rural areas could not benefit as much as urban areas, secondly, only the better-off population in rural areas could purchase SWH. In order to receive RBF payments, each retailer has to present rural and urban SWH at a ratio of 1:1 – in other words at least 50% of all installations will be located in rural areas. The pro-poor strategy includes ensuring access to finance in rural areas and awareness creation on the benefits of the technology. Even if better-off households are the first movers in rural areas, they will trigger knowledge and demand among the surrounding population and kick-start a modernisation process in the area.

The **risk of poor quality** SWH is tackled by a predefined minimum quality standard to be verified by the UNSA's testing lab.

Although the RBF intervention is not directly focused on replacing the supply of fossil fuels, it will still have a positive impact on the **environment and global climate** by reducing inefficient use of biomass energy.

The base for the exit strategy of the RBF intervention is the reduction of incentive payments over the years starting with higher incentives in year one to kick-start market development. The design foresees to reduce the incentive level by end of year 4 to zero.

The **sustainability strategy** entails various aspects in regard to implementing an RBF design that does not distort the market and does not focus on subsidising end-user prices. Thereby, the market can continue to grow without the RBF incentives after solid market structures have been established. Another aspect to ensure the development of a sustainable market for SWH is the provision of technical support for the regular maintenance of SWH through the local service points of the SWH retailers, as well as the increase in quality assurance of the SWH products, including their warranty and after-sales-service.

Component 2: "Portable Stove Contest": The overall risks associated with the development contest for ICS are relatively low. The main risks that may occur are related to the effectiveness of the RBF intervention.

The **risk of corruption** in the development contest is very limited as only very few actors are involved in the payment structure. In addition, entrepreneurs only receive the smaller incentives RBF 1 and RBF 3 in cash, whereas RBF 2 is handed out as a non-cashable service voucher.

**Over-subscription of the RBF** is avoided by pre-defining the number of winning categories in the contest. The risk of **lack of uptake of the RBF** by firms is addressed through increased promotion efforts in the publishing process for the contest. This task will be supported by governmental institutions like FINCyT, Concytec, MinProduce or optionally by the chamber of commerce. These institutions are already in contact with a large network of eligible firms.

There is a risk that **not all winning categories are met** by any of the competing firms. In this case, the competition will be re-opened after six months to allow for companies who have already won in another category to re-enter the contest.

The underlying structure of the RBF intervention avoids the **risk of windfall gains**. Ambitious targets that need to be met ensure that the prizes are only disbursed if real progress is achieved. In the event that no competing firm is able to achieve a specific high level target, not all incentive payments are realised.

This **risk of not having sufficient benefit flows to poor consumers** is a hazard to the successful implementation of the contest. The crucial characteristic of the ICS of being a portable cookstove and the associated better transportability will facilitate the accessibility to ICS in remote rural areas for poor consumers. This effect is further reinforced by the expected demand for portable ICS by governmental programmes through which ICS then will reach poor people in remote areas.

There are no significant risks to the **environment** or **climate**.

The **exit strategy** is designed in a very transparent manner. The RBF 1 payment is disbursed to the winners of the different categories and also triggers the disbursement of the RBF 2 voucher incentive. Disbursements of RBF 3 are limited in numbers (up to 2,000 units) and time (up to one year after starting the RBF 3). The payment modalities and timelines of the RBF intervention are transparently communicated.

The approach chosen for the RBF intervention does not only support the R&D of producers to develop a better product, it also enables the entrepreneurs to bring their products to the market and thus ensures **sustainability**. Although a considerable part of the demand will also come from governmental social programmes, this does not represent a threat to sustainability post withdrawal of the RBF intervention as those will create initial awareness and demand and will bring the new technologies into the remote areas.

## 11. Summary of expected outcomes and impacts

Component 1: “Solar Water Heaters”: The overall objective of the RBF intervention is to bring the market for SWH to scale by bridging the gap between urban and rural markets as well as regional and national markets. The expected outcomes and impacts are:

- 30,000 people gain access to improved thermal energy services
- 6,000 solar water heaters sold in rural and urban areas (10% for productive use purposes)
- 30 companies involved in rural markets
- 8,103 tCO<sub>2</sub>e are reduced or avoided

Component 2: “Portable Stove Contest”: The overall objective of the RBF intervention is to facilitate the development of improved portable cookstoves that match the needs of clients in rural and remote areas. Thereby, viable market segments for local stove businesses are fostered bringing stove production to scale. The expected outcomes and impacts are as follows:

- 100,000 people gain access to improved cooking energy services
- 20 cookstove SMEs participate in the contest, 15 pick up the business for portable ICS, and seven establish R&D departments
- 13,527 tCO<sub>2</sub>e are reduced or avoided.

## 12.RBF Budget

	EUR
1 Human resources and travelling	175,158
2 Equipment and supplies	0
3 Funding financing agreements / local subsidies	1,711,500
4 Other direct costs	23,158
5 Total direct costs	1,909,816
6 Mark up costs / administrative overheads / imputed profit	130,184
7 Cost price	2,040,000

## Uganda (revised up-scaling proposal 2014<sup>11</sup>)

<b>Promoted technology</b>		SHS, PicoPV, grid, stoves, (hydro)			
<b>Project period</b>	old	04.2009 – 12.2014	<b>Budget (EUR)</b>	old	6,000,000
	new	04.2009 – 03.2016		new	8,000,000 <sup>12</sup>
<b>Target groups</b>		main target group: households additional target groups: social institutions, SMEs			
<b>Lead political partner</b>		Ministry of Energy and Mineral Development (MEMD)			
<b>Implementing organisation</b>		GIZ			
<b>Implementing partners</b>		Rural Electrification Agency (REA), private sector, NGOs			
<b>Coordination with other programmes</b>		PREEEP closely coordinates with its sister GIZ programmes at the Office of the Prime Minister (OPM) and Financial Sector Development (FSD) as well as the Energy for Rural Transformation (ERT) II Programme financed by World Bank – especially with regards to the Photovoltaic Targeted Market Approach (PVTMA)			
<b>Summary of key interventions and outputs</b>		- Support access to energy for lighting and electric household appliances (grid connection and solar PV) - Support access to cooking energy for households			
<b>Targets</b>		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		12,500	34,000		people
<b>Cooking / thermal energy for households</b>		600,000	500,000 <sup>13</sup>		people
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		200	275		institutions
<b>Energy for productive use / income generation</b>		100	445		SMEs
<b>Project manager</b>		Markus Exenberger (Markus.Exenberger@giz.de)			

### 1. Situation analysis

#### 1.1. Energy situation

Development of the energy sector is key to economic growth in Uganda. The country has a total energy consumption of approximately 11 million TOE (tonnes of oil equivalent) (2010). This demand is met by various resources including solar and biomass energy, hydro power and fossil fuels. Biomass energy is used by 97% of the population in form of firewood, charcoal or crop residues to satisfy the need for cooking and water heating in rural and urban areas and accounts for 91.5 % of the total primary energy consumption. Due to this heavy dependence on biomass energy, 30% of rural regions in Uganda register a rapid depletion

<sup>11</sup> The up-scaling proposal in the Annual Planning 2014 with a budget of EUR 8.5 million (with EUR 6.5 million EUEF funding) was subject to approval by the EU Energy Facility. According to EU decision of Mid-March 2014 this proposal was not approved. Therefore, project budget, duration and target needed to be revised. As baseline for this revised proposal we apply the figures of the previous proposal (for project period, budget and targets).

<sup>12</sup> As confirmed with the Annual Planning 2014, if the co-financing would not be approved, the budget will be reduced to EUR 2 million, with activities and targets reduced accordingly - which is subject of this revised up-scaling proposal.

<sup>13</sup> The new target is reduced by 100,000 people, because the approach and the partner structure have changed towards a more sustainable model, which proved to result in a slower increase in numbers. For further information see Chapter 2.3 of this proposal.

and overuse of forests. Currently only 7% of Uganda's land area is covered with forest. Most severely affected is the tropical high forest which has been reduced from about 19% coverage of Uganda to a mere 3%. Deforestation continues at a rate of 2.2% per year of the remaining forest coverage, leading to fuel wood scarcity in rural areas and an increase in price levels of charcoal and fuel wood in urban areas (about 6% per year). The speed of deforestation partly is due to the use of inefficient three-stone fires.

According to available data, Uganda's electrification rate is 12% at national level and 5-6% in rural areas. Especially rural households strongly rely on traditional lighting technologies (e.g. candles or kerosene lamps) that give poor quality lighting, emit noxious fumes and present a hazard in terms of fires or burns (especially for children). The majority of social institutions in rural areas do not have access to electricity, significantly lowering the ability to deliver good quality services. Lack of access to electricity also is a key factor obstructing local economic development; lack of electricity hampers establishment of businesses and job creation that require electricity and forces companies to buy diesel or petrol generators that are costly to operate. In addition, lack of electricity limits access to information and communication technologies, which contributes to continued isolation of rural areas. Although the Government of Uganda acknowledges this challenge, funds and human resources are limited and focus mainly on the national centralised grid. With the commissioning of the Bujagali power plant in 2012 the power crisis causing massive load shedding has been overcome – for now. Load shedding is expected to dominate the power supply system starting from 2015 again, as increasing generation capacity cannot keep pace with increasing demand. On the distribution side, governmental grid extension plans focus on connecting bigger towns and industrial clusters to the grid – leaving out most of the rural communities. Even rural communities located along main road and power lines usually do not have access to electricity, because low voltage power lines are only constructed in densely populated and economically vibrant urban areas. In conclusion, an approach for access to electricity is needed, that enables rural communities far of the national grid to benefit from reliable and affordable electricity supply.

## **1.2. Policy framework, laws and regulations**

The government of Uganda has over the past eight years embarked on a Power sub-Sector Reform Programme which has seen the implementation of significant structural changes within the sector. The reform programme is aimed at providing adequate, reliable and least-cost power supply to meet the country's demand, promoting the efficient operation of the power sector and scaling up rural and peri-urban access to energy. These reforms have established a solid framework, while the country continues to experience significant challenges in increasing access to modern energy services. A low level of access to modern forms of energy, particularly electricity, has continued to be one of the major infrastructure bottlenecks to socio-economic growth in Uganda. Of special importance for the sector is the Electricity Act (1999) and the Renewable Energy Policy (REP) for Uganda (2007).

Energy is also an integral part of the Ugandan government's Poverty Eradication Action Plan (PEAP) which includes frequent references to the link between energy and poverty alleviation. The Ugandan government has set the target of providing 10% of rural population with access to electricity until 2012. It was planned to be achieved by grid extension (including through private sector involvement), mini-grids and stand-alone electrification systems. The national electrification rate has been increased to about 12% – but in rural areas only 5 to 6% are electrified. Hence, further interventions are needed to achieve the

targets and increase access to electricity. Therefore, the Government of Uganda through the Rural Electrification Agency (REA) is in final stages to publish a revised Rural Electrification Strategy.

Though the Renewable Energy Policy shows some emphasis on the biomass sector in Uganda, it is less understood and heavily underfinanced. Currently the Ministry of Energy and Minerals Development (MEMD) has embarked on the development of a Biomass Energy Strategy in cooperation with UNDP, GIZ and other partners.

### **1.3. Institutional set-up in the energy sector**

There are three main government institutions dealing with renewable energies for power generation:

a) The Ministry of Energy and Mineral Development (MEMD) is the lead agency in the energy sector. The Ministry is responsible for policy formulation, promotion, coordination, monitoring and evaluation. MEMD is also responsible for initiating legislation in the energy sector. Uganda's National Energy Policy is so far centralised, i.e. there are no energy officers at sub-national/district level. Part of MEMD is the Energy Department (ED), which is structured according to sectors. ED comprises four divisions "Energy Efficiency", "New and Renewable Energies", "Electric Power" and "Provision with Oil Products".

b) The Rural Electrification Agency (REA) functions as the secretariat to the Rural Electrification Board, which realises MEMD's rural electrification plans as stipulated in the Indicative Rural Electrification Master Plan. REA controls public funds as regards the subsidisation of rural electrification projects.

c) The Electricity Regulatory Authority (ERA), which was established by the Electricity Act of 1999, is in charge of issuing licenses for generation, transmission, distribution or sales of electricity. ERA also has the mandate to establish a tariff structure and investigate tariff charges and approve the rates of charges.

Regarding biomass, the New and Renewable Energies Division of the MEMD has been coordinating the dissemination of improved cook stoves and other biomass technologies. The private sector association "Biomass Energy Efficient Technologies Association" (BEETA), consisting of mainly improved biomass stoves businesses is one more institution advocating biomass issues and gaining strength by the day.

### **1.4. Major donor activities**

Uganda has a large community of international development partners in the energy sector, who coordinate activities through the Energy and Mineral Development Partners Group (EMDPG), which meets on a monthly basis. Germany is leading the group since November 2010. Most development partners focus on the supply side of the power sector as well as electricity transmission and distribution. A new field of support is the oil and gas sector after discovery of fossil resources in the country. German Development Cooperation and EnDev are the key partners of the Ugandan Government in the field of access to modern energy services (electricity and biomass energy).

The following table shows an overview of the on-going and foreseen projects by main focus and donor in the energy sector in Uganda:

<b>Donor</b>	<b>Activity focus</b>
EIB	Reduction of distribution losses
EU	Development of renewable energy markets with focus on micro finance energy enterprises; dissemination of efficient cook stoves in some districts
France	Power transmission, grid extension and densification, connection loans and subsidies for end users,
Germany (KfW)	Distribution and access; power transmission, reduction of distribution losses, generation with focus on large hydro power, policy and technical assistance
Japan	Power generation with focus on large hydro power; distribution and access; power transmission
Norway	Power transmission; power distribution; power generation; oil & gas
UNDP	Policy and technical assistance, preparation of activities in the field climate change / clean technologies /technology transfer
US	Oil & gas sector

Table 1: On-going and foreseen projects by main focus and donor in the energy sector in Uganda (Source: Donor Working Group, 2014)

## 2. Project approach

### 2.1. Energy technologies and services promoted by the EnDev project

The main technologies promoted by EnDev Uganda are:

- On-grid: Connections to the centralised electricity grid
- Off-grid: Support of solar PV markets
- Biomass energy: Support of improved cookstoves markets

This revised up-scaling proposal focusses on one of the two key interventions: Support access to energy for lighting and electric household appliances (grid connection and solar PV), by

- up-scaling of existing interventions to support the solar market development (PicoPV and SHS) and
- up-scaling of existing interventions for grid densification.

The other key intervention, supporting access to cooking energy for households, will continue without new financial requirements.

The MHP measures are generally completed and the two plants (Bwindi and Suam) are established, but EnDev Uganda continues to provide technical and management assistance to contribute to their long-term operations. This will require further financial investments for both MHPs.

## 2.2. Energy for lighting / electrical appliances in households

Component 1: Solar market development: The Energy Programme Uganda has been supporting the development of the rural solar market<sup>14</sup> since 2007. The current approach is fully based on market structures: solar equipment importers, distributors and installation companies dedicated to high quality products are supported to reach out to more customers and improve technical and business skills. The approach targets the needs of each market segment individually:

Kampala-based companies (importers): In the past years, support was focused on Kampala-based companies. By now, most of them have succeeded in being contracted by the Government of Uganda and donor organisations for large installations contracts. Accordingly, support to building up their businesses and establish them in the market is no longer required. Instead, support continues on ensuring knowledge exchange and management within the sector with regards to policy frameworks, quality standards, available products and technology developments.

Rural-based solar dealers: The core of activities has now been shifted towards setting up a rural network of high quality solar dealers. Rural dealers are closer to the potential customers and can more easily reach out into rural communities. Shops are typically located in the main town of the respective district. This group of companies is supported with marketing and promotion activities under the quality brand *access to solar*. The introduction of the brand enables customers to identify those companies that trade high quality products and provide decent after-sales services. Apart from promotion, dealers are supported with tailor-made technical and business trainings, financial audits as well as enabling distribution channels from importers through dealers to customers, including linkages to MFIs and SACCOs for financing purposes.

PicoPV importers and distributors: Since January 2013, EnDev Uganda has ventured into supporting the market penetration of so-called PicoPV products. All products supported are certified by the Lighting Africa initiative of the World Bank. While these companies have been part of former activities in networking events and training, in the first half year of 2013, some specific PicoPV pilot activities were developed and implemented:

- Small Solution (Sunking, Little Sun): The young company was supported with marketing and awareness (events in West Nile and Western region), as well as with the process of hiring new agents in the districts. In addition, the main office was equipped with some basic office furniture, a sign post installed, etc. (start-up support)
- Light Up A Village (LUAV) (Barefoot Power): The company approached EnDev Uganda with the idea to electrify whole villages on the basis of PicoPV products. After identifying 5 remote villages with more than 260 households, 5W PicoPV systems were installed within two weeks providing for 4 lights and phone charging for each beneficiary household. EnDev mobilised the financial contribution of the respective community. Apart from direct installation, the company also trains selected community members to become technicians for after-sales services as well as agents for Barefoot Power products in the area. (electrifying villages)

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<sup>14</sup> The Rural Electrification Agency (REA) is implementing a solar PV subsidy scheme to lower end-user prices called PVTMA. As most solar companies and rural solar dealers in Uganda are qualified to channel the subsidy, in order to avoid double counting only a share (one third) of the solar PV systems sold with EnDev support is counted as achievements for EnDev; next to other problems this is one of the reasons why achieving per capita investment benchmarks in Uganda has been difficult.

Under the revised up-scaling proposal, EnDev Uganda will scale up the SHS and PicoPV activities under the existing approaches described above. In conclusion, the activities in the area of solar market development will:

- Further strengthen the network of currently supported rural dealers;
- Increase the number of rural dealers supported;
- Consolidate the lessons learned from past pilot projects concerning the promotion of Pico-PV and reassess the current approach. It is anticipated, that EnDev Uganda will continue to identify new partnerships with PicoPV distributors (e.g. establishment of rural warehouses to improve access to stock).

Component 2: Grid densification: Since 2008, EnDev Uganda has implemented various grid densification projects. Especially the two community-based projects of Konapak and Ameni village have had a positive impact on the community and act as a “door-opener project” in the area. With the associated productive use training, some shop owners have diversified business while some schools have ventured into vocational skills training, computer lessons and night classes (impact assessment is available). Their successful completion acts as a basis of trust with local authorities and surrounding communities.

In 2012, a number of projects were identified and surveyed by EnDev Uganda in Lwamata, Kirinda, Amen-II, Corner Park-II, Bar Apwo and Apii villages. They had not been implemented, due to the high estimated costs per customer connection solely to be borne by EnDev Uganda (including costs of survey, procurement of contractor, infrastructure and EnDev staff facilitation). In the meantime a new approach was developed, which is based on a strong cooperation between REA and EnDev Uganda. Under this approach the EnDev cost per customer reduces considerably, because cost of survey, procurement of contractor, and the infrastructure are covered by the Ugandan Government with a contribution of the households. The above-mentioned six projects are the first to be addressed in the implementation process. Other areas of intervention include villages that neighbour completed project areas and communities which directly approach EnDev Uganda for support or are directed to EnDev Uganda by REA. In whichever case, the community is assisted to mobilise, apply and come up with the 30% contribution towards the cost of the low voltage power line (high voltage lines are the responsibility of the government), as well as the cost of connection fees required by the service provider, UMEME. EnDev Uganda supports this effort by contributing to the connection fees and by providing technical assistance through consultants and own staff to mobilise the community's fundraising.

To ensure that all the households have access to electricity within the grid connected area, a follow up will be made to give assistance on an individual level. A consultant mobilises the communities, guides community representatives in making applications to UMEME (service provider) and REA seeking support, sensitises them on safe wiring, inspects premises that are ready for electrification, and inspects the connections made. This hands-on approach has in the past served the purpose of boosting numbers of connections in previously connected areas.

In summary, the programme now follows a two pillar strategy:

- EnDev Uganda has shifted from direct implementation of grid densification projects to cooperating with the Rural Electrification Agency (REA). The role of the programme is to prepare project areas (site identification, survey studies and mobilisation of communities and local authorities) to be implemented by the Rural Electrification

Agency (REA) according to their community-based approach. These joint projects will have the function as a “door-opener” to foster trust and long term cooperation on district level.

- Based on these new and the two already completed grid densification projects, EnDev Uganda introduces so-called “follow-up consultants” in the respective districts. These local consultants will built up a close cooperation with the district and local leaders to identify communities that are located at existing low-voltage lines, but have failed to connect to the grid. The consultant will assist potential electricity customers to go through the procedure to apply for a connection with the local service provider, bundle several applications and ensure quality of house wiring.

In conclusion, the activities in the area of grid densification are:

- Cooperate with REA by preparing grid densification projects and handing them over to REA for implementation (door-opener projects)
- Assist potential customers in areas where low-voltage lines are in place, to get connected to the centralised grid.

Component 3: MHP for households: Both MHP projects, Bwindi and Suam, were implemented following a community-based approach: A local community-based organisation (CBO) serves as board, which has a control function over the staff of a registered company limited by guarantee, which operates the schemes. The CBO is mandated to take action, in case the operator does not act in accordance with the needs of the community. A business plan has been calculated to ensure that the set tariff structure can maintain basic maintenance of the scheme financially. MEMD, REA and GIZ have agreed upon handing over the project after commissioning to REA. REA will sign a lease agreement with the community operator. This ensures continuous monitoring of the scheme by REA, in case of any constraints REA has the mandate and capacity to initiate re-trainings, offer support to the operator or even establish a new operator.

At the Bwindi MHP (64KW), which has started test operation on 3rd April 2012, 60 customer connections have been realised, besides providing energy for a state-of-the-art regional hospital and a local tourist lodge. The hospital serves 40,000 patients per year. Due to power supply by the MHP, the hospital saves diesel generator costs exceeding 2,000 € on a monthly basis. These savings allow the hospital to employ additional medical doctors and to purchase required equipment. Also, due to these freed funds, the hospital was able to open a nurse / medical officer’s training school. Bwindi is currently in need of a new generator, the emergency switch off needs to be replaced and the grid needs to be maintained. Currently, negotiations between the community and the hospital to shift the lead in the management of the scheme to the hospital (which as an institution has better technical capacities and access to funds) are ongoing.

Similar to Bwindi, for the Suam MHP (40KW) a support package to the community operator, supervision of test-operation and training programme was prepared. More than 150 SMEs and households are at present accessing energy through the MHP. The scheme is currently progressing well, with the community exhibiting a strong ownership for the scheme. In Suam, among other factors, the provision of energy has led to a swift development of the communities PUE and standard of living. Although this development surely is welcomed this has also led to energy demands now surpassing the MHP’s capacity. Accordingly, energy efficiency trainings will be performed in Suam.

Furthermore maintenance of the MHP will continue to be required before handover to REA. While in Bwindi a state-of-the-art Ossberger Turbine is installed, for Suam a turbine had been purchased and installed in the past which has proven to be of out-dated quality.

### **2.3. Cooking / thermal energy for households**

EnDev Uganda supports access to cooking energy for households. This intervention will continue according to the current approach without new financial requirements. The only change is an adjusted target for this intervention: reduced from 600,000 to 500,000 people. Due to limited sustainability, EnDev Uganda started a complete shift in the approach, from a "self-help" approach with HH building their own stoves to a commercial approach with stove businesses ("rural commercial energy service providers"). The consequence was considerably lower but more sustainable stove sales and usage figures. Observing this tendency for one year we recommend correcting the target for cooking energy for HH.

In 2013 EnDev Uganda has developed a market-based strategy that focuses on establishing rural commercial energy service providers who build stoves, provide maintenance and repair services as well as eventually provide other adjacent energy-related services as fits the community. Based on social marketing principles, rural artisans operate according to commercial principles and are supported by enhanced and coordinated marketing support through partnerships, and with the local community, the local administration and locally operating partner NGOs.

Currently there are approximately 350 active stove businesses/Energy Service providers (ESPs) in a total of 14 districts of Uganda. A group of Trainers of Trainers (ToT) has conducted (and will continue to conduct) technical and basic business trainings. As a next step individual performance assessments will be performed to identify high potential stove builders who eventually can be upgraded to cover additional technologies and services. In parallel, marketing and promotion campaigns as well as quality checks are being prepared to increase demand and trust in the technologies.

In cooperation with MEMD an ICS logo to brand ESPs and their products in preparation for the upcoming marketing and promotion campaign has been developed. This logo has recently been approved by MEMD and will now be launched officially. The development of the stove database "STOVEN" made an important step forward and is planned to be tested in the next reporting period. In addition, testing new stoves for safety and technical performance is ongoing.

The commercial approach will be further enhanced, providing technical and marketing support without direct price subsidy. The Biomass Energy Efficient Technologies Association (BEETA), of whom most of the stove businesses in the major urban centres are members shall be further supported to play a lobbying and normative role. The on-going cooperation with the Centre for Research in Renewable Energy and Energy Conservation (CREEC) at Makerere University shall be further enhanced to develop, verify and promote stove standards.

### **2.4. Electricity and/or cooking / thermal energy for social infrastructure**

EnDev Uganda has established a new cooperation structure with the Office of the Prime Minister (OPM). After the war that affected Northern Uganda, the Ugandan Government is making an effort to reconstruct the region, for example by improving infrastructure. In this context OPM is implementing the Peace Recovery and Development Programme (PRDP)

facilitating districts with funds. The GIZ Energy programme has partnered with OPM informing the districts that they can use these funds for their financial contribution to solar PV systems for social institutions. Five districts in Northern Uganda have welcomed this opportunity and have already budgeted for these funds in their binding work plans. EnDev commitments to those partners will continue to translate into SI activities throughout 2014. At present, it is planned to phase out the SI support in 2015.

### 2.5. Energy for productive use / income generation

Though the focus of EnDev Uganda is supporting access to energy for households as the main target group, SMEs benefit as well from the interventions. Especially in the field of access to electricity, SMEs purchase and use solar systems.

### 3. Expected impacts of the project intervention

Impact	Possible indicators
<b>Environment</b>	Renewable energy applications for electricity generation in targeted areas. The use of improved cookstoves will reduce the demand for firewood and thus decrease pressure on forest stocks. Due to stoves promoted, more than 140,000 tonnes of fuel wood and corresponding 10,000 hectares of forest will be saved.
<b>Health</b>	Risk of burns using kerosene lamps reduced. Reduced indoor air pollution through improved cookstoves reduces respiratory diseases and eye irritations. Access to electricity facilitates night emergency services and improves standard of living of staff.
<b>Poverty / livelihood</b>	Business creation and income generation along the solar value-chain. Income generation for stove businesses; firewood saving and thus reduced expenditure for households. SMEs generate income from productive use of energy
<b>Education</b>	The awareness and understanding regarding renewable energy issues of students in target schools is enhanced. Schools with access to electricity provide classes and study time in the evenings, offer additional classes and the standard of living of staff is improved by usage of improved cooking and lighting technologies.
<b>Governance</b>	District officials and community leaders develop by laws and ordinances in support of the dissemination of improved stoves and solar PV technologies in their districts.
<b>Climate change</b>	Reduced CO2 emissions as well as substantially reduced emissions of 'black carbon' by improved combustion of biomass.

### 4. Possible risks and potential ways to mitigate them

Technology	Risk	Impact	Risk level	Action for risk mitigation
Grid-Densification	1) Communities fail to mobilise own contribution 2) Communities have	Slow implementation	Moderate	Continuous engagement with communities to

	low confidence in Governmental implementation capacity			sustain trust Development of alternative grid-densification approach(es)
SHS	SHS: Solar companies are slow in extending their businesses into rural areas  Limited purchasing power in rural areas for SHS systems	SHS: Slow implementation  Solar companies focus their business attention to more urbanised areas	SHS: Low to moderate	SHS: Continuous interaction with companies and awareness and marketing campaigns in rural areas.  Development of appropriate financing models (i.e. leasing models)
MHP	The financial viability and sustainability of the current operation models is not guaranteed/realistic (the scheme doesn't cover costs and requires external support)	Bwindi: Scheme currently not running due to mismanagement  Suam: Current overuse of scheme  Equipment might fail	Bwindi: Currently high  Suam: Community operator currently moderate  Equipment moderate to high risk	Bwindi: Currently efforts to change operational lead to community hospital  Suam: Currently EE-trainings  Assessment of equipment to be performed before possible handover to REA
Improved cook-stoves	ESPs fail to increase their stove production	Slow implementation	Moderate /High	Train additional cookstove builders  Identify new partnerships to tap into existing structures and create synergies
SI	High costs due to past obligation	Limited available Budget	Moderate	Unavoidable
PU	No current risks			

## 5. Budget

	<b>EUR</b>
<b>1 Human resources and travelling</b>	550,000
<b>2 Equipment and supplies</b>	300,500
<b>3 Funding financing agreements / local subsidies</b>	200,000
<b>4 Other direct costs</b>	709,500
<b>5 Total direct costs (sub-total)</b>	<b>1,760,000</b>
<b>6 Mark up costs / administrative overheads / imputed profit</b>	240,000
<b>7 Cost price</b>	<b>2,000,000</b>