ANNUAL PLANNING 2013 – UPDATE

on

Energising Development – Phase 2

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Contents

A. Introduction

The main purpose of this interim Annual Planning Document (update to the already submitted Annual Planning 2013) is to ask the Governing Board for approval of the first tranche of Result Based Financing (RBF) measures. In addition to the RBF measures, this Annual Planning also presents two urgent up-scaling proposals (Benin and Peru) under the traditional EnDev modality. The objective of the up-scaling of EnDev Benin (rural electrification) is to continue the electrification activities. The purpose of the EnDev Peru proposal is to use a promising opportunity to fund biomass activities and to fully utilize the funding opportunities provided by AusAid.

The RBF approaches are to be considered as an integral part of the EnDev portfolio. Therefore, wherever EnDev is already active in a country, the RBF proposals have not been 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

In 2012 considerable efforts were put in the development of an RBF window within EnDev, at the request of the UK Department for International Development (DFID). RBF for private entrepreneurs in the energy (access) sector is so far unique, meaning that the development of this pilot within EnDev, translating the DFID Business Case into real practical projects, posed a significant challenge to the programme on both the central level and in the participating countries.

A call for concept papers to GIZ offices within EnDev countries as well as to a limited number of potential partner organisations (Stichting Nederlandse Vrijwilligers [SNV], Practical Action [PA] and Global Village Energy Partnership [GVEP]) led to 32 high quality concepts. An evaluation committee of EnDev (GIZ and NL Agency), DFID, Energy Sector Management Assistance Program (ESMAP), and an external consultant selected twelve proposals (including one from PA and two from SNV) for further elaboration into full proposals.

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 for each country – a pair of consultants.

Of the twelve concept notes selected, four dropped out in the preparation of full proposals, for different reasons. In Mozambique, the project had to shift priorities to the implementation of the time critical biomass component financed by the Directorate-General for International Cooperation of The Netherlands (DGIS). The technology for chicken brooders in Malawi is still new and field tests are being carried out to assess its performance. Therefore the project was postponed to the second round of RBF, when hopefully more solid data would be available to underpin the economic viability of the RBF case. The same goes for the cookstove project presented by PA for Rwanda. Additionally with this project, information available was insufficient to justify submitting a full proposal. The Indonesia hydro concept was thoroughly checked by a team of consultants who came to the conclusion that some key assumptions regarding willingness to invest of the private sector would not hold.

Eventually, at the end of 2012, eight full proposals were submitted to the evaluation committee, which recommended taking seven of these into EnDev's RBF portfolio, conditionally to DFID management and EnDev Governing Board approval. These are biogas in Vietnam, PicoPV in Benin, Rwanda, Tanzania, and Bangladesh, improved cookstoves (ICS) in Ethiopia, mini-grids in Rwanda. The Benin proposal combines PicoPV with PV-water pumping and PV streetlights.

The Peru solar water heater (SWH) project was seen by the evaluation committee as an interesting case with potential. It intends to incentivise an urban to rural and rich to poor market shift. However, the evaluation team concluded that the approach was not yet ready for a full-fledged RBF measure. Therefore a pilot with limited financing has been included in this Annual Planning Update under the traditional EnDev modality.

EnDev also participated considerably to the consultation process of ESMAP / Vivid Economics work on RBF in the energy sector, contributing valuable experiences from the actual preparation work in the field.

In the process valuable lessons on the (im)possibilities of RBF were learned. When projects enter into implementation the learning effect will continue to rise. EnDev will, depending on available funding, actively analyse and share these lessons internationally. One of the lessons learned so far is that a very strict implementation of RBF, as laid down in the DFID Business Case, limits the opportunities of the instrument to situations where there is adequate and sufficient institutional capacity (private and public, incl. policy and regulatory frameworks), and where there is sufficient access to pre-financing. Such an ideal situation does not often occur, so that in many situations there is a need for combination with other activities, such as capacity building and training, inclusion of financing institutions (FIs), policy advice, etc. In the proposed RBF portfolio a number of projects synergise with efforts

from other donors or earlier planned EnDev interventions, whereas in some a limited amount of capacity building was deemed essential for the success of the project.

A second round for RBF concepts and full proposals will be initiated in the second half of 2013. EnDev hopes to include the learning effect from the first round to reduce the required efforts and increase efficiency.

C. General decisions on the RBF facility

The table below contains an overview of all RBF measures presented in this Annual Planning.

Country	Title	RBF Budget
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
	Sum	**EUR 18,388,000**

The total amount of EUR 18,388,000 exceeds the EUR 17,140,000 (14,650,000 GBP) reserved in the DFID contribution to EnDev for the first tranche of RBF measures. It is unlikely that all projects will fully disburse their budget allocations as, by the nature of RBF, disbursements happen only after actual sale of a product by private sector actors. Therefore this excess planning is necessary to ensure the DFID funds will be spent. **The GB postponed the decision on using non-DFID funds for a theoretical gap of 1.2 million EUR in funding. It is likely that projects will not disburse fully. Therefore a decision will be taken in two years whether funds will be taken from non-disbursing projects or non-DFID funds shall be used.**

In addition to this, it appears that the RBF facility will encounter a considerable delay beyond the Governing Board meeting because of the pending sign-off by DFID management and deposit of the promissory note via the Bank of England. At the same time projects have been and are approaching EnDev management, some with urge, about stakeholders inquiring when the project is ready to start. In most of the countries considerable expectations were raised, notably in Rwanda where the RBF was discussed for already a number of years. In other countries the RBF is supposed to follow-up on existing activities that are running rapidly out of funds now (the Vietnam project). EnDev tries to manage these expectations as much as possible but in some cases further delay is not an option. Rwanda and Vietnam will not be able to maintain a credible relationship on the RBF with their local counterparts if the start is delayed further. **The GB approved pre-financing the Vietnam and Rwanda project from non-DFID funds under the condition that the funds are transferred back afterwards. This decision has not been relevant, as DFID funds have been approved in mid-May.**

D. Overview about planned country activities in 2013 under EnDev 2

The total budget of the second phase is currently EUR 185.8 million. Below, an overview of country activities is provided. Table 1 gives an overview of on-going and unchanged projects (compared to the previous Annual Planning 2013 document). Country activities that are foreseen to be extended without up-scaling are presented in table 2. Table 3 presents the country activities that are proposed to be up-scaled with an RBF component and (in the case of Benin and Peru) with additional funding under the regular EnDev modalities. Table 4 presents the Vietnam RBF component, which is a new country activity.

Table 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 stoves	stoves	10 / 09	12 / 14	4,000	800,000
Bolivia	r.e., stoves	10 / 09	12 / 14	9,400	512,000
Burkina Faso	stoves	05 / 09	12 / 14	3,500	500,000
Burundi	r.e., stoves	09 / 10	12 / 14	1,500	411,000
Cambodia	biogas	12 / 12	12 / 14	2,000	58,515
Ghana	grid	01 / 10	06 / 14	1,650	*(600 SMEs)*
Honduras	r.e., stoves	10 / 09	12 / 14	5,630	174,300[1]
Indonesia r.e.	solar, hydropower	05 / 09	06 / 14	9,000	112,000
Indonesia biogas	biogas	12 / 12	12 / 14	1,150	20,000
Kenya	PicoPV, stoves	07 / 09	12 / 14	5,800*	3,770,000
Madagascar	stoves	12 / 12	03 / 14	300	47,500
Malawi	stoves	12 / 12	03 / 14	250	62,500
Mali	BCS, minigrid	01 / 13	12 / 14	850	0[2]
Mozambique	r.e., stoves	01 / 10	12 / 15	10,800	321,000
Nepal	grid, hydropower	05 / 09	06 / 15	4,740	240,637
Nicaragua	r.e., stoves	10 / 09	12 / 14	5,640	174,000[3]
Senegal	r.e., stoves	04 / 09	12 / 14	8,500	559,700
Uganda	r.e., stoves	04 / 09	12 / 14	6,000	612,500

* plus variable up-scaling upon achievement of milestones (see country sheets)

[1] Includes planned outcome of 125,000 of regional cookstove activities Honduras/Nicaragua
[2] ELCOM3 to secure sustainability of ELCOM1 and ELCOM2 outcomes in the view of the political situation.
[3] Includes planned outcome of 125,000 of regional cookstove activities Honduras/Nicaragua

Table 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
Liberia	PicoPV, solar dryer, stoves	05/12	12 / 13	06/14	750*	10,500

* plus variable up-scaling upon achievement of milestones (see country sheets)

Table 3: 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
Bangladesh	stoves, solar, solar-RBF	06 / 09	12/14	06/17	8,850	12,064	1,420,000	2,158,225
Benin r.e.	r.e., solar-RBF	10 / 09	12/13	06/17	1,600	7,160	15,399	406,415
Ethiopia	r.e., stoves, stoves-RBF	01 / 10	12/13	06/17	11,145*	12,687	655,000	930,000
Peru	grid, SHS, stoves, SWH	06 / 09	12/14	12/15	7,900	11,350	335,000	396,000
Rwanda	hydropower, biogas, solar-RBF, minigrid-RBF	10 / 09	12/13	06/17	7,200	12,491	40,244	938,994
Tanzania	stoves, solar-RBF	12 / 12	12/14	06/17	500	2,041	45,000	226,970

* including variable up-scaling upon achievement of milestones

Tab. 4: **New country activities**

Country	Activities	Project Duration		Funding	Planned outcomes on HH level
		Start	End	In EUR 1,000	In persons
Vietnam	biogas-RBF	07 / 13	06 / 17	3,740	275,000

E. Forecast for Annual Planning 2014

This Annual Planning 2013 Update focuses on the first round of the RBF facility. The next general round of up-scaling proposals will be prepared for the Annual Planning 2014, due in September 2013. 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 2014:

- Bangladesh
- Burundi
- Ethiopia
- Ghana
- Indonesia
- Kenya
- Uganda
- Malawi
- Nepal

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

Project phase	old: 06.2009 – 12.2014			new: 06.2009 – 06.2017		
Project budget	old: EUR 8,850,000			new: EUR 12,064,000		
Target groups	Rural population of Bangladesh					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HH appliances				740,000	1,478,225
	Cooking energy for HHs				680,000	680,000
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure				0	0
	Energy for productive use / income generation				0	0
Promoted technology	[×] Solar	[ ] Biogas	[ ] Stoves	[ ] MHP	[ ] Grid	[ ] Other
Summary of key interventions and outputs	Through the RBF intervention in the solar sector, the following key activity will be added: • Promote access to electricity by PicoPV systems disseminated through an RBF mechanism with IDCOL All other key interventions remain unchanged.					
Coordination with other programmes	SSHS Project: IDCOL donor organisations (IDA, ADB, SIDA, DFID, KfW) ICS Project: Ministry of Environment and Forests (Mission 21)					
Lead political partner	Power Division, Ministry of Power, Energy and Mineral Resources Ministry of Environment and Forests					
Implementing organisation	GIZ					
Implementing partners	SSHS project: IDCOL PicoPV project: NGOs and private organisations, IDCOL ICS project: NGOs, private entrepreneurs, local government boards					
Project manager	Name: Erich Otto Gomm			Mail: otto.gomm@giz.de		

- **RBF for PicoPV**

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	738,225 people
EUR per person gaining access	4.38
T CO_2 emissions avoided (over the lifetime of products sold during project)	56,952
EUR per t CO_2 emissions avoided	56.43
Private sector leverage ratio	2.5
Jobs created	not quantified
Enterprises created	20
Technologies deployed	255,000 PicoPV systems (mix)

1 Country and project area context

Bangladesh is one of the world's poorest and most densely populated nations. 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 %), having incomes below the lower poverty line. 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. About 58 % of the rural dwellers do not have access to electricity. The RBF project targets these households (HHs), with a focus on the poorest strata via introduction of small systems.

2 Sub-sector and technology focus and rationale

About 55 % of the Bangladeshi population has electricity access. Roughly five percentage points of these 55 % are Solar Home Systems (SHS), making Bangladesh the most massive and most widely recognized SHS programme in the world, with continued growth in the segment of large SHS. The electricity supply by grid is not reliable and peak demand cannot be met in any area. Most HHs without access to electricity will not be connected within the next ten years and remain with inefficient and polluting kerosene as fuel for lighting, and cheap as well as short-lived (and environmentally harmful) dry cells for radios. Furthermore many have to rely on expensive weekly cell phone charging services.

While large, "traditional" SHS (for relatively better-off families) have been such a success in Bangladesh, recent technology breakthroughs have not yet reached the market. On the contrary, the attractive and well-known national support for large SHS (30-100 Wp) to some extend blocks market entry for a new generation of PicoPV solutions. The latter are easy to use over-the-counter (OTC) products which allow for impressive service quality (1-5 bright lights, radio and cell charging) and lifetime (5-8 years with Li-Ion batteries) at much smaller PV module sizes (1-10 Wp) and better poverty targeting than large SHS – but they are not eligible under the current main national scheme. This is where the proposed RBF (and its companion proposal for small SHS (SSHS) via the *Infrastructure Development Company Limited*[4] [*IDCOL*]) would intervene, to address the present market inefficiency by providing customers with more choice. The RBF-project targets to introduce this new technology which requires less investment and is therefore more affordable for the poorest strata of rural HHs. These new products will improve the overall poverty targeting of Bangladesh's off-grid PV efforts and their environmental sustainability. With RBF support, high quality and energy

[4] IDCOL is a state owned company responsible for the management of refinancing and subsidy funds for its renewable energy programme

efficient solar lamps (torches, lanterns and very small kits) with solid performance (in terms of light output, reliability and over total product life) will be promoted. For the systems sold, customers will benefit from after sales service by local technicians or sales hubs close by. LED lighting and lithium-based batteries will ensure environmental soundness and long lifespan of the systems. These technologies focus on the need for lighting and energy for communication and reduce the required total investment required for access to these basic services.

The PicoPV systems will comprise a small solar panel of up to 10 Wp and one to five light sources with six to twelve hours backup from a full battery. Furthermore, most of the systems will provide a facility for cell phone charging as well, since 57 % of the rural dwellers use mobile phones for communication.

3 Outline RBF incentive design

An innovative lumen-hour-based and autonomous runtime subsidy, that increases with better performing systems being employed, will ensure that systems with an optimal benefit per month and over system life become affordable for the rural poor population. It will also decrease rent-seeking through the employment of poorly performing systems which fulfil only the minimum technical requirements (i.e., just meet the minimum lumen-hours or lux required as per whatever specifications to enter a given subsidy programme). The proposed scheme will also set an incentive for producers and retailers to sell more efficient products, and to improve the output / system cost relation of PicoPV in order to benefit more from the subsidy. The target is to provide a subsidy level that allows amortization within the first 36 month (ideally close to two years) while not exceeding a maximum subsidy level of 33 % of the expected system costs.

The novel RBF incentive would comprise (i) an ex post grant for each PicoPV system sold, and (ii) a contribution to the monitoring activities of the Financial Institution (FI) which carries out the RBF. The FI verifies the sales of the system and possibly the application of a very simple half page questionnaire (cell phone and name of client) before the incentive is paid out to the PicoPV retailer.

The proposed RBF scheme will provide access to basic energy for lighting and communication to approximately 738,225 people, at extremely low unit subsidies, by bringing a completely new generation of “strong performance” PicoPV products to Bangladesh for the first time, to challenge the current focus on “traditional SHS” which was a natural result of the successful IDCOL programme. Modern solar lanterns with basic information and communication technologies (ICT, but no TV) are now available in other countries for end user prices well below USD 70 and can reach lifetimes of five to eight years!

	lumen	**runtime**	**total performance**
Minimum configuration	160	6	20 %
Medium low configuration	160	12	40 %
Medium high configuration	200	12	50 %
High configuration	400	12	100 %

After two years, the programme will be evaluated in order to decide on possible adjustments regarding systems specifications and up- or downscaling. The subsidy will be reviewed and adjusted annually and will be phased out gradually until 2016.

4 Impacts on people and the environment

On the one hand, PicoPV systems have direct monetary benefits for HHs since kerosene is replaced - and on the other hand, they have macro-level benefits as the fuel in Bangladesh is heavily subsidised so that savings will relieve pressure on a very tight public budget. The

kerosene price has been highly volatile and increased from BDT 42[5] (end 2010) to BDT 61 (end 2011) per litre as the government is reducing subsidies on oil products. Thus, a substitution of that fuel also contributes to better resilience of HHs to future price hikes.

According to the World Health Organization (WHO), indoor air pollution (IAP) causes 46,000 deaths every year only in Bangladesh. While cooking facilities clearly are the main source of IAP, not enough attention has been given to date to the fact that kerosene lamps are also a contributor to indoor particle and CO emissions and their replacement will improve the health and living situation in HHs significantly. Women and children are those who benefit most from this effect, since they spend more time at home than men usually do. In addition to health effects related to particulate matter emissions, severe burns induced by kerosene usage in both stoves and lamps have frequently been evidenced in the literature.

Li-Ion batteries are a suitable alternative to lead-acid batteries especially in small systems. Many lead-acid batteries were distributed with SHS and pose a potential risk on the environment today. Nickel metal hybrid (NiMH) batteries are even worse, for obvious reasons. Although battery collection schemes are in place, batteries are often not treated appropriately and harmful toxins may be released into the environment. The same is true for the small dry cells used in portable radios: cheap low-end versions often only last for one day, and are ditched in situ afterwards. In contrast the disposal of Li-Ion batteries is not harmful and the batteries do not contain toxic materials and, thus contribute to reducing environmental risks.

Jobs will be created in companies along the supply chain of PicoPV products. First movers have already started preparation for local assembly stations for some systems and more people will be employed for the management of sales, service and maintenance.

Productive Use

Improved lighting can lead to better income opportunities for home-based businesses or small shops. SHS are commonly found in small enterprises such as tea stalls, pharmacies and shops, since improved lighting allows extending business hours in the evenings. In HH, the light may be used productively in the case of home-based income generating activities. This plays a role specifically in low contrast tasks like sewing and stitching. Jobs are also created in companies along the supply chain of SSHS: in the manufacturing of the systems as well in the management of sales, service and maintenance.

5 Strategic fit and alignment with national policies

The RBF scheme is in line with the country's Renewable Energy Policy (REP)[6]. The project contributes to *"harness[ing] the potential of renewable energy resources and dissemination of renewable energy technologies in rural, peri-urban […] areas"* while *"enabl[ing], encourag[ing] and facilitat[ing] both public and private sector investment in renewable energy projects"* at the same time [REP Section 2 (i) and (ii)]. It emphasizes the importance of micro-credit systems *"especially in rural and remote areas to provide financial support for purchases of renewable energy equipment"* and enhances the private sector participation in renewable energy projects.

The Ministry of Power, Energy and Mineral Resources (MPEMR) outlined the national goal of providing access to energy for all until 2021 and emphasized the need for solar lanterns and PicoPV systems for lower income strata.

6 Market analysis of technology and sector closeness to commercial viability

SHS, solar systems with more than 30 Wp, are supported by IDCOL since 2003. The grant incentive was reduced regularly and has been phased out by the end of 2012; the

[5] EUR 1 = BDT 104 (28.02.2013)
[6] http://www.powercell.gov.bd/images/additional_images/REP_English.pdf

concessional financing component through IDCOL will still remain. SSHS with less than 30 Wp will be supported until 2014 though.

Experience with (S)SHS during previous phases is very satisfactory in Bangladesh (less so in some other countries with poorly designed incentive schemes, where private sector-driven nascent local markets have all too often been destroyed by ill-advised subsidies) and a strong market for bigger SHS has already been established through the long duration of the programme. About 1.5 million (S)SHS have been sold since beginning of the programme in 2003. At the moment around 60,000 (S)SHS are being sold commercially through about 30 private sector organizations and NGOs every month. Although market conditions for solar products are very favourable and people in rural areas are eager to purchase SSHS, not many users and not many retailers are aware of the fact that there is an additional new off-grid PV segment, below the currently distributed SSHS, which promises to have even greater attraction for the poorest income strata. The RBF intervenes at this point.

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

There are no structural barriers to address for a widespread dissemination of PicoPV systems. However, some challenges still hinder the prosperity of the sub-sector. These are (i) the high price of quality PicoPV systems, (ii) the lack of knowledge and trust in the technology in combination with low-quality products in the market, and (iii) a lack of capacity within the partner organisations. Long lifespan and bright light after several years are promised by several producers (and proven in lab tests) but must be demonstrated to users and retailers in order to convince people of the opportunity to save money by purchasing a smallish high-quality system for a seemingly high price. The proposed RBF targets this barrier through a performance-based subsidy scheme to create inducement prices for all components of the PicoPV system. System requirements or the amount of subsidy are adjustable to react on changing market conditions.

8 Expected private investment and participation in the RBF

The companies and shops involved in the IDCOL project have the technical know-how and capacities to manufacture and install SHS and provide maintenance and repair services. Some of these companies have already expressed their interest to roll out PicoPV systems as well and are looking into options for local production and assembly of the systems.

9 Implementation strategy and partnerships

With EnDev support high quality solar lamps will be promoted. These technologies still have their price but, as they focus on the basic need for lighting, will maximise the potential benefit for poor customers in terms of monetary savings. PicoPV systems in the range of 2.5-10 Wp have an estimated market price range of EUR 40-130 depending on their size and configuration and can provide a similar benefit through light from LEDs and more focused and task-oriented lighting devices. Also these systems have a much longer expected lifespan and hardly any environmental impact. Yet it will be difficult to sell both systems side by side if the users compare only price per watt. Therefore a buy-down grant will be provided to speed up the market penetration and to reduce the perceived risk of the investment for the customers. As people will realize the systems' benefits over time and word of mouth is strong in Bangladesh, fewer subsidies will be needed to support the systems' market advance and the sectors scale as well as technology advances will help to keep the price of systems low.

Results from a baseline survey show that a typical Bangladeshi HH on average uses three kerosene based lamps and around four litre of kerosene per month. At current kerosene price of BDT 65-70 it amounts to expenditures of approximately BDT 260-280 per month for kerosene[7]. This consumption will be reduced by at least 50 % through the solar lamp

[7] EUR 1 = BDT 104 (28.02.2013)

systems, which will comprise of one to five light sources, a small panel ten Wp or below and will provide between 160 lumen (lm) and 400 lm total light output for about six to twelve hours from a full battery. Most of the systems will provide a facility for cell phone charging as well.

The intended quality and performance based subsidy scheme will make these lamps affordable for a price close to the savings that can be generated within the system's warranty period. This is meant to reduce the customers' perceived financial risks that would arise from an investment in low quality products that are already available on the market.

The PicoPV systems will be installed by partner organizations of IDCOL and acquired by individual HHs or SMEs through hire-purchase offered by the Partner Organisations (PO). Awareness raising and promotion for solar systems is carried out by the POs as part of their regular business activities. The project will support these efforts through complementary and supportive activities. Business development services are provided by IDCOL. IDCOL monitors the activities of partner non-governmental organisations (NGOs) and ensures the quality of systems. IDCOL provides POs with the market development grants for customers and organizes and manages the funds for the credit component of the scheme.

The existing financing structures provided by IDCOL will be used for provision and management of refinancing loans. Funds for refinancing will be provided by IDCOL, whereas the proposed partnership project will only provide the buy-down grant component in form of a lumen-hour based subsidy. It is expected that at least 20 of IDCOL's POs will have joined the project and taken up sales of PicoPV systems after the four year project phase.

IDCOL's further responsibility will be to monitor the system sales, quality and compliance of dealers and manufacturers with warranty. This would be the first time such a clear focus on outputs and warranty is implemented for PicoPV. Servicing of the systems through the POs as well as their bookkeeping will be checked and verified before funds will be released to the vendor.

As the users will be owners of their systems, motivation to keep the system functional will be high. Especially user trainings will turn out beneficial under this project, as it has been observed that the customers often do not position their systems adequately. Maintenance and after-sale service will still be ensured and provided free of charge within the payback and warranty period. Technical failures are expected to be rather rare though and will be taken care of by the suppliers of the ready-made packages as part of the warranty. During this time the systems can be regularly checked by PO staff as they visit HHs to collect the monthly instalments.

Based on the dissemination progress during the first four years of SSHS promotion, it is expected that 255,000-440,000 PicoPV systems will be sold within a similar period.

EnDev-Bangladesh will follow up on PO as well as FI compliance with contractual obligations as well as the field performance and impacts of disseminated systems. Additional surveys for the evaluation of the employed systems, their impacts and sustainability will be carried out on a regular basis. Cell phones may be used as described above. Lumen-hour outputs will be calculated from lab tests of lamp types, field data on sales and small samples of field performance.

10 Sustainability and risk mitigation

The RBF subsidy will be revised and adapted annually to be gradually phased out. IDCOL's experience with supporting solar systems shows that a self-sustaining market can be developed and that the market price of SHS has not increased significantly when the subsidy was lowered. It is expected that the local retail price of PicoPV systems will decrease due to increased sales volumes over which retailers can leverage their transaction costs as well as improved information in the market and technology advances. A hire-purchase scheme will

be established in order to ensure that poor people can access the technology beyond the project period.

11 Summary of expected outcomes and impacts

- The abandoned use of kerosene lamps leads to less kerosene consumption and CO_2 savings of more than 56,000 tonnes over the lifetime of the products sold during the project.
- It is expected that the market price will go down until the end of the four-year period due to the market scale and technology advances
- Every EUR of RBF leverages EUR 2.5 of private investment. If the import duties can be brought down to zero the leverage could be around 1:6.2.
- With an average HH size in rural areas of 4.5 and 225,000 systems in place 738,225 people would benefit from improved access to electricity for lighting and ICT.
- Savings for the HHs after system amortization
- Mitigation of toxic waste, as systems use environmentally harmless Li-Ion and LiFePo4 batteries

12 RBF-Budget

	EUR
1 Human resources and travelling	274,770
2 Equipment and supplies	710
3 Funding financing agreements / local subsidies	2,711,162
4 Other direct costs	14,027
5 Total direct costs	3,000,669
6 Mark up costs / administrative overheads / imputed profit	213,331
7 Cost price	3,214,000

Benin r.e.

Project phase	old: 10.2009 – 12.2013			new: 10.2009 – 06.2017		
Project budget	old: EUR 1,600,000			new: EUR 7,160,000		
Target groups	Rural population of Benin, predominantly in EnDev 1 and EnDev 2 connected villages					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HH appliances				15,399	406,415
	Cooking energy for HH				0	0
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure				79	100
	Energy for productive use / income generation				39	100
Promoted technology	[×] Solar	[ ] Biogas	[ ] Stoves	[ ] MHP	[×] Grid	[×] Other
Summary of key interventions and outputs	• Follow-up of EnDev 1 and 2, further densification of grid connections, quality and safety • Extension of low voltage grid in EnDev 2 villages • Promotion of rechargeable systems outside the grid corridor in EnDev 1 and 2 villages • Project Development Activities for future role-out • Develop a market for three off-grid PicoPV technologies (lighting, pumping, street lighting) through an RBF approach					
Coordination with other programmes	ACP - EU-Energy Facility, Agence Française de Développement (AFD), BMZ - GIZ Agriculture Programme, BMZ - GIZ Decentralisation Programme and BMZ - GIZ Water Programme					
Lead political partner	Ministre de l'Energie, des Recherches Pétrolières et Minières, de l'Eau et du Développement des Energies Renouvelables (MERPMEDER)					
Implementing organisation	GIZ					
Implementing partners	Société Béninoise de l'énergie électrique (SBEE), Agence Béninoise pour l'Electrification Rurale et la Maitrise de l'Energie (ABERME), village communities, private sector					
Project manager	Name: John Ulrich Fimpel			Mail: john.fimpel@giz.de		

- **Regular up-scaling**

1 Situation analysis

1.1 Energy situation

The national consumption of Benin in 2011 was at 975 TWh or 107 kWh per capita and year. More than 90 % of electricity consumed is imported from the Ivory Coast (hydropower), Ghana (hydropower), Togo (hydropower) and Nigeria (thermal - gas - power plants). Renewable energy generation within the country is marginal at present. On the national level 27.9 % of all HHs (9.6 million capita in 07 / 2012; population growth 2.9 % per year) have access to grid electricity. It is also interesting to know that electrical power outages in towns and connected villages outside of Cotonou sum up to around 30 days per year, in particular during dry season due to low water level of the Volta-Lake (Ghana). This situation will worsen over the next years, since Ghana, which is the main exporter of electrical energy, has itself an increasing demand in electricity. In addition, the amount of freshwater supplying the Volta-Lake is decreasing due to climate changes which leads to a reduction of the amount of energy produced. However, the West African Power Pool (WAPP) has no short term plans to compensate such losses by sourcing additional energy from other countries.

Around 80 % of Benin's population (7.7 million persons) lives in rural areas. 2,326 villages still have no access to the grid (2011) and only 3.8 % of rural HHs are provided with electricity. This poor access-rate is mainly due to lack of funding and small support by decision makers on the national level as well as a general lack of information / competences about off-grid alternatives which could render electricity economically viable in the numerous remote villages. Another limiting factor is that energy consumption rates, especially among the rural poor, remain relatively low. This makes it difficult for SBEE to cover its opportunity and operation costs.

Poor access to electricity increases the level of economic inequality: The energy expenditures in non-electrified HHs are e.g. nearly twice as high, even when the consumption is lower in comparison to primary consumers. A socio-economic study carried out in 2007 by the Rheinisch-Westfälisches Institut für Wirtschaftsforschung (RWI) on a rural electrification project of GIZ in Benin explained that an electrified HH spends approximately 4,500 F CFA less on HH energy (lighting, radio and television set, without wood and charcoal) while enjoying a better light quality. Non-electrified HH typically spend more than 20 % of their income on energy supply (without wood and charcoal).

1.2 Policy framework, laws and regulations

The regulatory framework governing the production and distribution activities in Benin is based on two legal instruments: the Benino–Togo Electricity Code and the Benin Electricity Code. The Benino-Togo Electricity Code (2005) gives the monopoly of electricity supply to the Communauté Electrique du Bénin (CEB). The Mission of the CEB is to produce and exploit electric power, in accordance with the regulations governing industrial and commercial corporations as exclusive transmitters, all over the territories of the two States. This monopoly ensures the privilege of being the sole buyer for the needs of the two States.

The CEB also enters into agreements with neighbouring countries, on the import of electric power (e.g. Ghana and Nigeria). The Code has also opened up the activities of electric power production, hitherto restricted, to private operators. However, regarding power meant for sale, the CEB remains until now the sole buyer of such production.

The Benin Electricity Code organizes the power sector on the Beninese territory. It spells out the functions of the SBEE, determines the conditions for carrying out activities relating to the production and transmission of electric power and provides for control mechanisms of all electric utilities in the Republic of Benin. The Benin Code also regulates issues of power supply to rural areas, including setting up the fund for rural electrification (3 F CFA per kWh consumed) and the ABERME.

In order to tackle the challenges in the energy sector the government of Benin has formulated the Policy and Strategy Document for the Development of the Electricity Sector that provides the long term vision and the strategy of the country by 2025. The overall energy strategy can be summarised as follows:

- Strengthening the legal and institutional framework;
- Ensuring reliable electricity supply to support economic activities and achieve the national energy security and an efficient energy delivery system with an optimal energy resource mix;
- Increasing energy access to population through new power generation plants, regional interconnection and rural electrification;
- Promoting private investments in the power sector by creating the enabling market environment for private sector participation
- Promoting energy efficiency in all sectors.

The success of the implementation of the Policy and Strategy remains to be seen.

1.3 Institutional set-up in the energy sector

- MERPMEDER
- CEB
- SBEE
- ABERME

1.4 Major donor activities

- IDA, FND, BOAD and the World Bank (WB): Construction of a 161 kV connection between North Togo and North Benin and rehabilitation of medium voltage lines in Cotonou, Porto Novo and Sèmè
- IDA, GEF, ESMAP, FND, KfW, BEI, FFEM: Construction of various 161 kV power lines and grid extension in several towns of the country
- BIDC (ECOWAS): electrification of 58 rural villages
- FAD: electrification of 27 villages
- EU, AFD, EnDev, GIZ: electrification of 105 villages

2 Planned Outcome

Energy service segment	Old target	New target[8]
Energy for lighting and electric HH appliances	15,399 people	63,000 people
Cooking energy for HH	0 people	0 people
Electricity and / or cooking energy for social infrastructure	79 institutions	100 institutions
Energy for productive use / income generation	39 enterprises	100 enterprises

3 Project approach

3.1 Energy technologies and services promoted by the EnDev project

After a first phase under EnDev 1 where twelve villages were connected through grid electricity, EnDev-Benin r.e. currently expands the grid into 105 villages in Benin. HHs are connected through pre-paid meters, while connection fees are being reduced by the project to 57,500 CFA (EUR 87). It is observed in EnDev 1 villages that each primary connection is extended with up to three and more secondary connections (illegal and lossy and therefore

[8] Excluding RBF targets given in next section

not endorsed by the utility SBEE). The quality and safety of these secondary connections is in most cases significantly insufficient. In addition to providing access to the grid, EnDev will henceforth engage in awareness raising among the population and training activities of local electricians for “in house” wiring.

The proposed up-scaling is meant to increase the number of HHs and where possible social institutions and productive users benefitting from primary grid connections. Another objective is to increase the safety of secondary connections and, where desired, to enable secondary consumers to obtain primary status. It appears that demand is bigger than can be fulfilled with the current project which works on a first come, first served basis. Furthermore, there is a suppressed demand situation as more people are willing to connect once they experience that the grid is operative and serving their neighbours. The project intends to connect those HHs, SMEs and SI that have previously not been considered including the provision of pre-paid meters and, where cost efficient, the extension of low voltage lines within villages.

For technical reasons, the distance between power poles and individual connections cannot exceed 40 meters. For people living outside the 40 meters grid corridor, the project aims to promote rechargeable devices for lighting and phone charging / radio.

The up-scaling project shall further assess the feasibility of privately operated minigrids in rural Benin, envisaged to be powered by PV-hybrid-installations.

3.2 Approach to provide electricity to households

This up-scaling proposal is focusing on increasing and thus capitalising on the benefits of EnDev investments made in rural electrification in Benin so far. Overall, it is anticipated to reach approximately an additional 5,000 HHs beyond the 16,000 HHs that will be partly accountable for EnDev 2 under the current multi-donor intervention. As the proposed extension of the current phase will be entirely financed through EnDev donors, the people reached in additional HHs are fully attributable to EnDev. In this line, outcome target will increase more than proportional to the number of HH connections (from 15,399 to 63,000 people, compared to 16,000 vs. 5,000 HH.

To achieve this outcome, three main approaches are suggested: (1) Connecting more people within the range of the existing lines in already connected villages, (2) extending low voltage lines in the connected villages, to sub-villages and quarters which have not yet been covered and (3) offering off-grid electricity solutions to those who cannot be reached by the grid in the connected villages. In addition, EnDev will invest into (4) the preparation of rural electrification activities in villages beyond the current scope.

(1) Follow-up of EnDev 1 and 2, (further) densification of grid connections, quality and safety:

The planned connection of 17,000 HH in 117 villages (EnDev 1 and 2) in the two prior phases will not encompass all potential clients living close enough to the low voltage grid. Only the fast deciding HHs are considered. Leading by example, it is assumed that their role model will motivate late movers to mobilise funds for their own connections. It is proposed that EnDev will implement a second round of sensitization to accommodate these latecomers. Individual connections shall be offered to the same conditions as in the first round of electrification (EUR 87). This form of densification is the most cost efficient approach for scaling up and will improve the viability of electricity infrastructure.

Assessments in the EnDev 1 villages have shown that a high number of secondary connections have been linked to primary counters. On the one hand this is a proof for the existing additional demand for new connections, which is justifying the inclusion of these twelve villages in the densification activities described above.

At the same time, the poor quality of installation works done by local electricians in the houses of clients in EnDev 1 villages suggests a need to train local electricians to improve sustainability and safety. Training measures and awareness campaigns shall consequently

also be carried out in EnDev 2 villages to ensure that the quality and safety of energy services extended within the HHs reached by EnDev (and eventually to neighbouring houses) fulfils minimum standards.

(2) Extension of low voltage grid in EnDev 2 villages:

In the planning of the grid in the 105 EnDev 2 villages, the original assessments encompassed a much wider range of village areas than the ones that can be covered with the actual grids now installed. HHs which were at an early planning stage mobilized and paid a contribution had to be left out as their houses were standing too far away from the grid. This unsatisfied demand is both (a) a good potential for scaling-up as people have proven already their preparedness for being connected and (b) a source of dissatisfaction and conflict within village society. Additional to densifying the planned low voltage grid, this up-scaling includes construction material for low voltage lines in order to connect additional high potential areas and to reach many of those interested HHs which had been left out until now.

(3) Promotion of rechargeable systems outside the grid corridor in EnDev 1 and 2 villages:

Even with the interventions described above, there will still be HHs which cannot (distance > 40 meters) or do not want to (e.g. affordability) be connected to the grid both within these 117 EnDev 1 and 2 villages and in neighbouring villages. To address their needs, a concept shall be developed and piloted to promote rechargeable systems (e.g. lanterns and simple SHS) through private sector delivery. Effort will be undertaken to integrate this within the Benin RBF project where useful.

(4) Project Development Activities for future roll out

The EnDev approach for grid extension in rural areas has been implemented in cooperation with a number of partners in the electricity sector of Benin. The Government, but also donors like the EU and AFD are satisfied with the approach and are considering to capitalise on the procedures, innovative planning instruments, and experience generated by EnDev for future rural electrification projects. In the proposed up-scaling, the EnDev team will consolidate the developed approach by assisting partners with the application of these instruments. EnDev will also assist with the planning of their programmes and explore opportunities for cooperation through pooled funding and project management. Besides, the EnDev team shall document their current instruments and process knowledge for the exchange within the region and within EnDev.

Beyond the existing model of grid extension, the government has expressed interest to learn more about minigrid solutions for villages that are remote from the national grid (> 10 km). EnDev has gained substantial experiences on this subject in Senegal and other countries. An assessment of the economic viability, technical requirements and the legal and regulatory framework shall be made in preparation of a potential new phase. A private sector approach will be pursued as far as possible.

3.3 Approach to provide clean cooking technologies to HH

Not relevant for this proposal

3.4 Approach to provide access to modern energy services for social institutions

In the implementation of the components (1)- (3) specific attention will be given to connecting social institutions (school, health stations, markets) and small enterprises that could not be connected during the original roll-out phase of the grid. Where feasible, the low voltage grid will be extended to institutions and enterprises where substantial impact can be expected.

Additionally, focus for productive use will be on vendors / distribution chains for rechargeable lanterns / equipment, as well as charging services at the village level for this equipment. Currently in urban and peri-urban areas of Benin small vendors sell rechargeable lanterns of

low and medium quality, emergency lighting systems for more developed markets, as well as battery powered devices, mainly produced by Chinese manufacturers. The project aims to define standards and introduce quality products. In order to make these products widely available, the project also envisages to support private entrepreneurs (local or regional) and to expand into rural markets and villages under this project. Where possible a link with the PicoPV RBF Benin will be established, possibly by promoting the additional introduction of a product line for rechargeable devices.

3.5 Approach to provide access to modern energy services to SME's

See above under 3.4

4 Expected impacts of the project intervention

Impact	Possible indicators
Environment	Less uncontrolled battery disposal (radio's, torches), reduced kerosene and diesel consumption
Health	Less kerosene smoke related diseases (lung- and eye problems), improved health service by local clinics, improved technical safety of in-house installations
Poverty / livelihood	strengthening of existing and stimulation of new SME's, reduction of HH energy expenditures, improved safety due to better lighting of compounds and streets
Education	Better education results due to improved study conditions in schools and at home
Governance	Access to information on political processes through television and radio

Impact on poverty / living standards / economy

The impacts of electrification on HHs are fourfold. First of all, electricity provides better value for money when it comes to HHs energy use. Consequently, reduced energy costs are freeing up resources for improved living standards and investments. Secondly, the quality and availability of light from electricity improves working conditions in the HHs both in terms of the temporal flexibility to work, as well as in terms of the improved visibility during work. Thirdly, electric light is appreciated by the population in so far as it improves security conditions in villages and compounds. Finally, electricity allows improved access to information through telecommunication and media (radio, TV). These possibilities have both social as well as political benefits (see governance). Television and radio are referred to as leisure opportunities which contribute to overall well-being, as well as information opportunities regarding political and economic occurrences.

Furthermore, local economies profit from grid connection as well. Existing SME have more opportunities to improve and extend their services, work more efficiently and temporally flexible. Above all, access to electricity creates entirely new opportunities for economic activities such as for example retail of refrigerated and frozen food items or welding.

Education

In terms of education, the availability of electric light enables children to study after dusk. This often leads to an increase in overall study time and therefore an improvement of education levels. What is more, secondary schools can offer evening courses for repetition of learning matter and elective subjects to support specific interests of pupils as well as adults.

Health

While rural electrification usually does not lead to abandoning the use of biomass in kitchens, it can nevertheless lead to a reduction of smoke related diseases. This is due to the replacement of kerosene lamps for lighting, which are known to cause both lung- and eye problems. Again, connected health centres and clinics are enabled to improve their services (e.g. refrigeration of vaccines, better lighting for operations and deliveries) to better respond to the healthcare needs of the population.

Environment

Environmental impacts of electrification are ambivalent. On a local level, electricity replaces the use of other sources of energy. In this line, the use of batteries and their uncontrolled disposal can be reduced. Again, use of kerosene for lamps and diesel for generators can be abated. However, as overall energy consumption might increase, it strongly depends on the manner of electricity generation, if the overall environmental impact of electrification is positive or negative. However, as the energy mix of the national energy provider is beyond the sphere of influence of the project, this indicator cannot be considered in the evaluation of the project.

Governance

As mentioned above, electricity allows improved access to information through telecommunication and media (radio, TV). These technologies enable the rural population to be informed about political and economic occurrences and processes and therefore better reflect and react on political changes.

5 Budget

	EUR[9]
1 Human resources and travelling	702,300
2 Equipment and supplies	1,170,000
3 Funding financing agreements / local subsidies	0
4 Other direct costs	240,600
5 Total direct costs	2,112,900
6 Mark up costs / administrative overheads / imputed profit	387,100
7 Cost price	2,500,000

[9] Excluding RBF budget given in next section

- **RBF for three off-grid PV technologies**

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	343,415 people
EUR per person gaining access	8.91
T CO_2 emissions avoided (over the lifetime of products sold during project)	215,000
EUR per t CO_2 emissions avoided	14.23
Private sector leverage ratio	3.2
Jobs created	not quantified
Enterprises created	10
Technologies deployed	441,282 PicoPV 2,550 streetlights 262 solar pumps

1 Country and project area context

With a per capita income of EUR 750 in 2011 (in 2008: EUR 771) and a ranking of 167 out of 187 countries (HDI ranking 2011), Benin is one of the poorest countries in the world. While the coastal region enjoys some commercial advantages afforded by the combined influence of industrial activity and trade linkages, the rural regions of Benin are dominated by a subsistence-oriented agrarian economy that is largely detached from external markets. Benin's economic growth only reached 2.1 % in 2010 (2008: 5.1 %).

Around 80 % of Benin's population (7.7 million persons) lives in rural areas. 2,326 villages still have no access to the grid (2010) and only 3.8 % of rural HHs are provided with electricity. This poor access-rate is mainly due to lack of funding, remoteness (making grid electrification de facto unviable), affordability limits especially in poor strata, and small support by decision makers on national level as well as a general lack of information and competences about off-grid alternatives.

The opportunities of photovoltaic technologies are generally known to politicians and decision makers, but have led in only very few cases to some small (political) projects, which have not been sustainable. All projects reviewed in this context have not been market based but have been set up mainly for political (e.g. total financing of initial costs by Chinese or Indian government, no follow-up planned) or charity reasons.

2 Sub-sector and technology focus and rationale

Most of the roughly 7.5 Million rural Beninois, at present without access to electricity, will presumably not be reached by grid extension over the next decades. Off grid-technologies - such as solar PV, hydro (little potential), biomass and clean cooking - are therefore the only realistic options for the provision of sustainable access to modern energy over the next decades.

The number of active players in the PV-sector is currently very small, and general knowledge about solar PV, including competences on operation and maintenance, is at a very low level. Consequently, because of the absence of poor quality solar equipment in the market so far, no market spoilage occurred and Benin is considered as a Greenfield market for solar products. The market potential however is deemed large enough to assure commercial viability for several solid players in spite of the relatively small country.

The RBF project will pursue three components: PicoPV (lanterns), Solar Water Pumps, and PV Streetlights. These are present in the market, but demand in rural areas is still tied to foreign aid driven projects. The total number of players seeking to grow and develop the market is low with only five of the private companies, social businesses and NGOs interviewed (Fonroche, Bonergie, ASVB, Fisconsult and WEZIZA) actively promoting solar, and with a combined installed base of active projects < 50. It is obvious that the Benin solar market is at present on a very low-volume level and needs to be "unlocked" and stimulated to reach the next sustainable level, addressing the following constraints:

- Users and suppliers lack information about optimal products, business practices (and models) and pricing strategies.
- The low number of current players in the Beninoise market, and the need to attract more experienced companies active in other countries in Africa (e.g. Barefoot Power, Dlight, ToughStuff, MKopa, SolarNow, SunnyMoney, and others).
- Lacking access to debt financing in the face of the high upfront cost of RE. National FIs offer no adequate financial products to support the solar supply chain or end user financing because the very low levels of activity do not justify a specialized approach.

3 Outline RBF incentive design

This RBF programme will lift the national off grid PV market subsector to a promising and mature business by project exit (2017), with (i) higher sales volumes at lower unit cost, (ii) increased number of commercial players in this market, offering a large variety of quality PV equipment for a diversified application range, (iii) specialized supply chains, (iv) better informed customers demanding appropriate PV products and (v) well informed FIs, aware of opportunities of the PV market.

RBF payments will be disbursed ex post by the selected FI against verified sales (customer list with cell phone numbers for ex post sample verification) of PicoPV products of sufficient quality according to existing EnDev criteria to pre-qualified private sector or for profit social enterprises players. We propose a simple subsidy against sales price will reduce over the programme from a level of 50 % in year one, 35 % in year two, 20 % in year three and 10 % in year four. The high subsidy level planned for year one is required to overcome the considerable costs of initial investment for setting up new diversified supply chains throughout the country, for developing effective marketing strategies, and for training technical and managerial staff in order to improve their understanding in regards of quality assurance and guarantee issues. To specifically address the working capital pressure caused by launch costs we intend paying partners in year one and year two 50 % of the subsidy at the moment goods are available for sale in country and the other 50% against proof of the sales to the actual final client. Sales prices will be reported and shall not be lower than prices that can be sustained after project exit (year 5+).

The incentives in the street lighting and the PV water pumping components are similar to those in the PicoPV component, with some small differences:

- For the street lighting 1/3 of the RBF subsidy will be withheld until one year after installation to make sure that municipalities (main clients in this component) take responsibility for maintenance and operation. In this component the RBF project will cooperate closely with the on-going GIZ decentralization programme to add solar street lighting to the menu of annual public spending on infrastructure in the villages.
- For the PV-irrigation component the same measure of paying 1/3 of the incentive only after one year of successful operation will be taken. This component will work together with the GIZ ProAgri Agricultural programme and the GIZ water programme in Benin to identify users, user groups and raise awareness.

4 Impacts on people and the environment

PicoPV: People who currently rely on kerosene lamps and candles for off-grid lighting will benefit from non-polluting, brighter, more convenient and better lighting services (better health, less accidents) at lower cost than their baseline situation (economic gain through reduced running costs). People and micro businesses in rural areas will also benefit from access to cell-phone charging, thus cutting costs and time to go twice or more per week to charge their phones at high costs (around F CFA 100 – 150 per loading-cycle). They will also enjoy the benefits from other low-power electricity appliances like radios or small LED TVs without high expenses for disposable, low-quality batteries. This will have a positive impact on the environment as well, as much less spent batteries will be dumped. For the rechargeable batteries in the lanterns a refund system will be mandatory for RBF participation.

Street Lighting: Recent academic research on the benefits of electrification suggests that the social benefits of street lighting have too often been ignored in electrification cost-benefit discussions because they are difficult to quantify based on available data. Yet, the safety aspect and the social and psychological impacts are obvious to practitioners. In those few villages, e.g., that are already equipped with solar lighting of public spaces, students gather after nightfall under those lights to do their homework for school.

Water Pumping: Agricultural production in Benin depends mainly upon seasonal rainfalls and motor pumping of surface water to fields located next to rivers and streams. PV-Systems in combination with immersion-pumps offer farmers the opportunity to increase their production, to improve their income and to provide more food for the alimentation of the population with fresh, healthy products. Water pumping systems are also an interesting alternative for fresh water provision of the population. Usually drinking water is pumped by hand from shallow and contaminated (bacteria, viruses) layers of aquifers leading to severe sanitary diseases. By using immersion pumps, water from deeper aquifers could be tapped and the pumping system could also be used to pump water by pipe-systems to public water-taps within the villages thus decreasing the risk of waterborne diseases.

5 Strategic fit and alignment with national policies

It is the declared objective of the Benin Government to achieve in rural areas by 2015 an access rate of 60 % of all villages (thereof 36 % of HH connected) and 100 % (ergo all Benin villages) in 2025 (thereof 65 % of HH connected).

In 2012 the Benin Government developed a programme intending to promote PV technologies and energy-efficiency throughout the country (“Programme de Promotion de l’Efficacité Energetique et de l’Energie Solaire Photovoltaique pour l’Eclairage et le Pompage de l’Eau”). The focus of this programme is laid upon the following technologies:

- Solar streetlight systems for public spaces and streets
- Promotion of energy saving lamps for all Benin HH connected to the grid
- Installation of PV-lights in rural and peri-urban areas
- Installation of solar pumping systems for irrigation of vegetable farming

The Benin government has addressed foreign governments (e.g. China and India), international banks and donors for its financing and is considering credits to be paid back over a period of 20 to 40 years. Up to now this request has not shown any positive response among potential donors. However the intended programme and its formulation proves that the government has realized the need for larger investments and efforts into the sector of renewable energies as it is an explicit basic requirement for sustainable development, reduction of climate change, reduction of poverty and the implementation of its energy policy.

In this context it should also be mentioned that the import of equipment required for the production of electricity from renewable energies is encouraged by a law, promulgated in

2010, that excludes any type of this material from import- or tax-duties as long as the government's renewable energy agency ABERME approves its specifications.

6 Market analysis of technology and sector closeness to commercial viability

Interviews were conducted with 22 organizations active in the market. This confirmed that the market is at a very low level both in terms of the number of organizations engaged in selling or promoting the technology, and in the volume of projects or sales they had. Feedback from interviewees was consistent about the need for first stage awareness building about the technology. The complete absence of cheap solar lanterns from the market suggests that the technology awareness that this entry-level product creates is not present. On the positive side, Benin is therefore unaffected by the distrust caused by poor quality that is pervasive in East Africa for example, and could potentially respond more quickly to market development efforts.

The "temporary barriers" which lock the market into its current inefficient stage are: few players, high costs and prices, lack of finance, high taxes and CFA prices, lack of information on supply side and demand side (because PV has only recently reached price thresholds which allow payback times under three years, as required for most rural clients). Experience shows that there are three ways to lift markets to the next stage:

- Technical assistance with existing players, and / or
- Market sensitization using early sales volumes, lift to next stage, and / or
- Entry into the market of social entrepreneurs with experience in other SSA markets.

RBF is ideal for the latter two.

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

No structural barriers have been identified. The temporary barriers which keep Benin players from stepping up from nascent stage to early stage specialization stage are similar to the experience in other national LDC PV markets and will be addressed via the RBF. The import of equipment required for the production of electricity from renewable energies is as mentioned earlier encouraged by a law excluding this equipment from import- or tax- duties.

The renewable energy market is generally much undeveloped as described previously. To assess how distribution channels, retail outlets, financing and after sales might work, one must look at similar technologies and how they are faring in the Benin market: Small affordable but battery-powered lights are widely available throughout Benin, in markets, and roadside retail outlets, both in the city and up country. Their sales price lies between 2,500 and 7,000 F CFA (EUR 5 – 11), and is thus close to the cost of high-quality solar lanterns. The source of most of these lights is China, so there will appear to be no inherent barriers to importing and distributing small lights. Lebanese wholesalers mainly import the devices.

8 Expected private investment and participation in the RBF

Talks have so far been held with several national and international private sector firms (Fonroche, Bonergie, Inensus, Solaris, ASVB, Ghana Capital and Fisconsult), NGOs, GIZ's decentralization programme, and EnDev. At this point it is obvious that Fonroche, Bonergie, ASVB and Fisconcult at minimum will participate in the proposed project. They will create with local companies and NGOs a network for distribution and maintenance of their products.

The French company Fonroche is investing around EUR 100 million in Benin and establishing at present and at Cotonou an assembly site for PV-streetlights, and possible for PV solar- home-systems as well as PV-units for small and medium sized enterprises. Fonroche sees Benin as an important market for PV technology and as a country from which these products can be exported to all other West African countries including Nigeria.

Bonergie is strong in marketing PicoPV systems in Senegal and is at present entering the market in Benin. They gained profound experiences in establishing credit-lines allowing the poorer population to buy pico-SHS which give them light and the opportunity to charge mobile phones or to operate e.g. small refrigerators, radio, radio LED-TV.

ASVB has independently funded and installed six solar water pump projects in Benin over the last six years. Once installed, ASVB continues to monitor and maintain the equipment.

Fisconsult is active in water pumping and solar. In particular it has already established its own communal solar model to provide very limited power (single lights) to multiple HH in a single village, without any NGO or development aid cooperation. They have expressed a strong interest in expanding their activities with the added benefit of a subsidy programme.

9 Implementation strategy and partnerships

In the implementation of the RBF the role of the local GIZ project will be slightly larger than is envisaged for RBF. As FI in Benin are not yet able to act as key-actors in the RBF-approach, their specific role is restricted to transferring the RBF subsidy onto the accounts of the PV-device selling companies, to municipalities (streetlights) or pump-operators after verification. Regular monitoring is carried out by the project itself, but evaluation and validation will be done independently by a to be contracted international consultant. Furthermore GIZ's programmes on decentralization and agriculture will support awareness raising and identifying target clients for the street lighting and solar pumping components. The role of the Benin Ministry of Environment and its agency ABERME, at present in charge of initiating and monitoring projects on renewable energies (note: a task which they don't succeed to accomplish), will be to serve as a platform of information-exchange.

10 Sustainability and risk mitigation

The basic approach to sustainability of the three components is the shifting of the market to a new, commercially sustainable market level. As the market is at an early stage of development with no established players, there will be a level playing field for new entrants, small or large.

The main general risks of the project we see at this stage are as follows [Mitigation Measures in brackets]:

- Small country and short project may not allow for attractive markets at project exit. [Several components – enough volume to work without subsidies at project exit. Companies are allowed and encouraged to take a portfolio approach]
- Subsidy in small country should not carry the local market to overly deep penetration of total potential, as this will implicate inefficiencies (especially in light of fast falling off grid PV prices) and leave a less attractive total volume at project end. [near zero base makes this outcome unlikely; scale that is developing in SSA means a new market will attract larger established players]
- Don't destroy market (by supporting some players but not all). [In the case of Benin, the programme can easily reach all transparently – and keep end user prices low].
- That long-run economic cost may not be lower at project end, due to short project duration and / or lack of effect on cost structure. This risk is especially prominent for a four-year project!
- Disbursements and verification may take too long: DFID guidelines and own experience suggest 6-36 months lags between result and payment. [The detailed RBF design aims at putting payments as close to those results for which a given player can actually take responsibility.]

11 Summary of expected outcomes and impacts

- Poor people with access to (HH) lighting services 343,415
- Streetlights installed 2,550

- PV pumps installed 262
- Number of sustainable enterprises established or strengthened 19
- Tonnes of CO_2 avoided or reduced over the lifetime of product 215,000
- Programme costs per beneficiary EUR 2.39

12 RBF-Budget

	EUR
1 Human resources and travelling	331,920
2 Equipment and supplies	14,000
3 Funding financing agreements / local subsidies	2,448,000
4 Other direct costs	63,026
5 Total direct costs	2,856,946
6 Mark up costs / administrative overheads / imputed profit	203,054
7 Cost price	3,060,000

Ethiopia

Project phase	old: 01.2010 – 12.2013			new: 01.2010 – 06.2017		
Project budget	old: EUR 11,145,000			new: EUR 12,687,000		
Target groups	Rural population of Ethiopia					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HH appliances				35,000	35,000
	Cooking energy for HH				620,000	895,000
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure				450	450
	Energy for productive use / income generation				1,000	1,000
Promoted technology	[ ] Solar	[ ] Biogas	[×] Stoves	[ ] MHP	[ ] Grid	[ ] Other
Summary of key interventions and outputs	Through the RBF intervention in the cookstove sector, the following key activity will be added: • Promote access to clean cooking energy by ICS disseminated through an RBF mechanism All other key interventions remain unchanged.					
Coordination with other programmes	Germany: Sustainable Land Management Programme; Urban Governance and Decentralisation Programme; Netherlands: SNV Biogas Programme; Horn of Africa Regional Environmental Centre; Norway: Energy +; Irish Aid: Health care programme; World Bank: Energy Access and Electricity Access (Rural) Expansion; Lighting Africa; Global Partnership on Output Based Aid; Climate Investment Fund: Scaling Up Renewable Energy Programme-Ethiopia Investment Plan					
Lead political partner	Ministry of Water and Energy					
Implementing organisation	GIZ					
Implementing partners	Ministry of Water and Energy incl. Rural Electrification Fund; Ministries of Agriculture, Health, Education and Trade; Environmental Protection Authority; Regional Governments / Bureaus of Energy, Education, Health and Agriculture; Universities / Institutes of Technology / Technical Vocational Educational and Training Units; Chamber of Commerce and Sectoral Associations; Solar Energy Development Association of Ethiopia; Ethiopian Hydropower Society; Regional (Development) Associations; private solar energy installation and maintenance companies; other private companies in the energy sector value chain (from input supply to end use); NGOs, Women's Associations. Assistance to Health System Expansion; Community Development Service Association (CDSA)					
Project manager	Name: Henning Vogel			Mail: henning.vogel@giz.de		

- **RBF for improved cookstoves**

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	275,000 people
EUR per person gaining access	5.61
T CO_2 emissions avoided (over the lifetime of products sold during project)	500,000
EUR per t CO_2 emissions avoided	3.08
Private sector leverage ratio	1.3
Jobs created	64
Enterprises created	16
Technologies deployed	103,000 MIRT stoves 103,000 TIKIKIL stoves

1 Country and project area context

Ethiopia depends for about 90 % of its energy consumed at national level on biomass in form of wood, charcoal and agricultural residues, thereby contributing significantly to depletion of natural resources. Statistics from the Central Statistic Agency (2012) indicate that 99 % of rural and 80 % of urban HHs use biomass fuels for cooking. The cooking technologies used in most HHs are traditional and three stone open fire, which are extremely energy inefficient and harmful to health. In order to alleviate these problems, different endeavours have been attempted to promote and disseminate ICS in the country. EnDev has been promoting efficient and clean cookstoves since 2005. The stove technologies being disseminated in the country are adapted both for every day cooking purpose as well as for Injera baking. The stoves were disseminated largely in urban and peri-urban settings via micro enterprises following a market approach; however distribution to rural HHs was largely neglected.

2 Sub-sector and technology focus and rationale

This project will address a national challenge in the subsector of biomass energy use and contribute to demonstrate solutions for broadening new technologies into rural areas. Mainly two locally produced improved fuelwood stoves will be considered for dissemination in rural areas, where they also fit into the use pattern of the local population: TIKIKIL for cooking and MIRT for Injera baking. These stoves save cooking fuels by about 50 % along with considerable emission reductions. Utilizing local raw materials and skill for the stove production renders costs of stoves low and minimizes the need for large subsidies. Nevertheless, addressing rural markets is until today an obstacle for producers and retailers due to high investments in transport. With this RBF project, the particular market failure will be addressed by supporting the introduction of wholesaler networks enabling new investments. **The objective is to overcome the current gap between urban production and rural ICS demand in selected Woredas of Ethiopia.**

3 Outline RBF incentive design

Retailing ICS in rural areas under given circumstances would increase the stove price due to transportation and transaction costs rendering them unaffordable to the majority of rural HHs. Since most rural HHs only have very limited disposable income, the price of a stove is a major factor in the purchasing decision. In addition, the lack of nearby points of ICS sale forms a significant barrier. The proposal at hand aims at supporting for instance rural based energy and agricultural cooperatives to buy stoves from existing urban production centres

and sell these to rural HHs. The RBF incentives would be paid ex post to the cooperatives against proof of sold and verified stoves.

The average factory prices of TIKIKIL and MIRT stoves are 180 ETB (EUR 8.18) and 120 ETB (EUR 5.45) respectively. This amount as well as transport costs from urban production centres to rural customers and overheads shall to be advanced by initial capital of the participating cooperative. To facilitate the purchase of ICS by poor HHs, the selling price of ICS is assumed to be the factory price, which causes a loss for cooperatives. Since RBF incentives will be paid after results are achieved, i.e. stoves sold, the loss has to be covered by interest charged for loans. The incentive per stove disseminated shall be EUR 6 for TIKIKIL and EUR 5 for MIRT respectively, partly covering additional costs of the cooperatives for logistics, overheads and loan. Based on these assumptions cooperatives could earn a profit of up to EUR 3.15 for TIKIKIL cookstoves and EUR 2.64 for MIRT Injera baking stoves. Profits are intended to be reinvested for purchasing new ICS, as well as for promotion and building of a long-term independent supply chain. By creation of new market areas and thereby rising demand, producers will also augment their incomes being able to reinvest in production efficiency and new production units. Due to gained economies of scale in production and distribution, post RBF price level of ICS in the rural implementation areas is expected to decrease. After the end of the RBF, a sustainable market is expected to be created, with a viable market price level of ICS that can be sustained by producers, retailers and consumers.

RBF budget and costs per stove limit the amount of subsidized stoves to roughly 110,000. It is intended to cover several Woredas in the two regions of Tigray and Oromia. Both regions are within the implementation area of the current EnDev programme and production units for ICS exist in urban settings. In Tigray, newly installed energy cooperatives will be invited to collaborate, whereas in Oromia agricultural cooperatives will take the role of rural ICS retailers. The number of subsidized stoves per year can be adapted to real market developments but subsidies are planned to decrease slowly over time, aiming at arriving at a sustainable market price after the RBF will have ended. Together with relatively high expected profit, this will reward first movers and foster their engagement. Main partners for the implementation of the proposed RBF scheme are micro finance institutions (MFI). Apart from their main assignment to manage and provide the fund to the cooperatives, they will play an important role in the triggering mechanism of the RBF: incentives will only be paid after cooperatives deliver lists of registered customers of ICS and after having independent verification of these lists.

4 Impacts on people and the environment

Rural HHs will benefit directly from the implementation of this project by gaining new access to ICS as well as by saving fuelwood expenditures and time to collect firewood. ICS significantly lower health risks by reducing indoor smoke. Stove producers and retailing cooperatives can both generate extra income. Their economic growth will create new jobs and profits will be reinvested in market extension. In addition, the project will have positive impacts on the environment and climate by mitigation of CO_2 emissions and reducing pressure on natural resources. Reductions in use of firewood for cooking purposes will have a positive impact on the situation of deforestation in Ethiopia.

In the course of the implementation and with a projection of a six-year post-RBF period, around 515,000 people will benefit through dissemination of 206,000 ICS to 103,000 HHs. Considering the number of stoves, around 500 k tons of fuelwood will be saved, saving in turn 151 k tons of trees. Also the promotion of gender equality is addressed via reduced burden of work on women and children related to firewood collection and via gaining extra time for productive purposes or leisure activities.

5 Strategic fit and alignment with national policies

The Ethiopian Fuelwood-Efficient Stoves Investment Plan was launched in 2011, derived from the country's Climate Resilient Green Economy (CRGE) strategy. Its concrete objective is to support the dissemination of nine million ICS in Ethiopia up to 2016 by building a sustainable market and institutional capacity. The ICS Investment Plan is coordinated by the Ministry of Finance and Economic Development (MoFED) and Ministry of Water and Energy (MoWE) as implementing partner. Development partners are among others the Government of Norway / NORAD as well as private ICS producers and distributors. A total budget of approx. 40 million US dollars is estimated.

At first sight, the ICS Investment Plan might lead to doubt the real need for the proposed RBF project in Ethiopia. But detailed considerations show compliance and a high potential of mutual benefits. The national ICS Investment Plan commits itself to a commercial approach for dissemination of ICS and not to subsidization. In case of success of the RBF project, its approach and design will be applied to other rural areas by the national ICS Investment Plan. Hence, the RBF project fits closely with government activities for broadening the use of ICS.

6 Market analysis of technology and sector closeness to commercial viability

Depending on prices and scarcity of fuel, mid and long-term considerations clearly state economic benefits for ICS compared to traditionally used stoves. The former Ministry of Mines and Energy piloted commercial dissemination of ICS. This attempt was however largely limited to urban centres. Since its beginning in 1998, GIZ supported trainings for more than 600 ICS producers who today are engaged in business either full time or as a contribution to other economic activities. Assuming approx. 12.8 million rural HHs in Ethiopia and taking into consideration their dependence on biomass as cooking fuel results in a high theoretical need and demand for ICS. EnDev's experience shows that with some support in form of demand creation or transport, commercial dissemination of stoves in rural areas is possible in cooperation with different stakeholders at local level. The targeted approach of this proposal will contribute to stimulate a new rural market for ICS by linking cooperatives with their huge presence and capacity with urban based stove producers.

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

The recently issued national Improved Cookstove Investment Plan indicates efforts to disseminate nine million ICS by 2016. The MoWE with its line structures down to the Woreda level is well organized and oriented towards these plans. Within the ICS investment programme, it is also planned to establish energy cooperatives, which shall play a pivotal role in realizing the various plans in the long run with the objective of creating access to improved energy technologies including ICS. These cooperatives are already functional in the region of Tigray.

8 Expected private investment and participation in the RBF

The proposed RBF scheme will enable mainly three private actors in the supply chain of ICS to invest in closing the current gap between urban production and rural demand and thereby creating a long-run independent market: cooperatives, producers and customers of ICS. The RBF incentive would allow the cooperatives to cover their costs for transportation and other management costs, while at the same time allowing them to sell the stoves at acceptable prices to rural HH. Urban producers are already well established. Due to the creation of a new buyer-market in rural areas through the RBF intervention, they will raise their production and consequently their incomes. To close the supply chain, the success of a new product always depends on the acceptance of end consumers, who will benefit from the advantages of ICS by saving money and time.

9 Implementation strategy and partnerships

EnDev-Ethiopia will take the role of the overall coordinating and managing entity of the project including the competitive selection of FIs, cooperatives and external verifier as well as the allocation and provision of RBF funds to the FIs. Furthermore, EnDev-Ethiopia will be responsible for follow-up, monitoring and evaluation, and reporting.

FIs in the two regions will be selected and contracted for the financial management and disbursement of the RBF fund as well as dealings with the cooperatives including data registering, monitoring and checking. Main criteria for selection will be their implementing capacity as well as the amount of related service charges (approx. 7–9%).

Cooperatives will be selected based on predefined criteria, such as implementing capacity and access to rural HHs. They will be responsible for the organization of transportation and sale of ICS to rural communities and promotion. Furthermore they need to register data of stove buyers for subsequent disbursement at FIs.

Independent verifiers will verify financial documents from involved cooperatives and lists of stove buyers.

In addition line offices of the MoWE at all levels shall support the intervention through awareness raising and demand creation.

10 Sustainability and risk mitigation

Although currently no working market for ICS exists in rural areas that could be spoiled by the RBF, there might be other risks. With regard to corruption / fraud, a carefully designed Monitoring and Evaluation (M&E) system will help to prevent misuse of RBF incentives. In addition, an external verifier will conduct sample site verification to minimize room for fraud. In regards to the effectiveness of the RBF, Ethiopia's policies and strategies do not hinder the commercial dissemination of stoves via cooperatives. Regarding the acceptance from the end user side, the national ICS Investment Plan will help to create the demand by awareness raising about risks and issues associated with not using ICS. A crucial point for long-term acceptance of ICS will be the price after RBF market intervention. That is why RBF incentives shall decrease over the implementation years to ensure a smooth transition. However, this will only happen if producers and cooperatives invest their extra income from the RBF incentive in building up a more efficient and productive supply chain. Despite a careful design of the RBF, due to lack of experience the risk remains that incentives are either set too low or too high. This could lead either to a non-working mechanism or to rent taking. The flexible design of the RBF at hand will permit to react by extension to more Woredas or by decreasing the number of annual incentives, what will foster competition between cooperatives.

11 Summary of expected outcomes and impacts

It is planned to reach 515,000 people through market development within ten years, 275,000 of them during the project period. 16 cooperatives will start business with ICS and together with production units satisfy the new demand. 64 new jobs will be created. Over the whole lifespan of disseminated stoves, more than 500,000 tons of CO_2 emissions will be avoided during the project phase. Especially women and children in the implementation area of the RBF shall benefit through a reduction of time spent for collecting firewood from around six to ten hours per week and HH. Summarizing expected outcomes and costs in a value for money analysis leads to specific project costs of EUR 3 per beneficiary and EUR 1.61 per ton of avoided CO_2 within ten years.

12 RBF-Budget

	EUR
1 Human resources and travelling	120,032
2 Equipment and supplies	8,000
3 Funding financing agreements / local subsidies	1,308,000
4 Other direct costs	4,976
5 Total direct costs	1,441,008
6 Mark up costs / administrative overheads / imputed profit	100,992
7 Cost price	1,542,000

Peru

Project phase	old: 07.2009 – 12.2014			new: 07.2009 – 12.2015		
Project budget	old: EUR 7,900,000			new: EUR 11,350,000		
Target groups	Rural population of Peru					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HHs appliances				175,000	175,000
	Cooking energy for HHs				160,000	310,000
	SWHs for HHs				0	1,000
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure				4,700	4,800
	Energy for productive use / income generation				2,500	2,600
Promoted technology	[ ] Solar	[ ] Biogas	[×] Stoves	[ ] MHP	[ ] Grid	[×] Other
Summary of key interventions and outputs	In addition to all on-going activities, • EnDev-Peru will work with the Alliance in Energy and Environment in the Andean Region Programme (AEA), currently funded by the Ministry of Foreign Affairs of Finland and the Inter-American Institute for Cooperation for Agriculture (IICA), to co-finance its regional competitive fund. The fund will provide financing for different activities linked to biomass energy, such as cookstove promotion activities and forest management activities. • EnDev-Peru will also develop a pilot project for SWH. This pilot project will last one year and will be developed under an approach of RBF. The pilot project will target SWH for 1,000 HHs and 65 enterprises.					
Coordination with other programmes	German bilateral programmes in Democracy, Water and Rural Development; IDB and World Bank (energy advisory services to Ministry of Energy); Energy and Environment Alliance (AEA, financed by Finland and IICA [Inter-American Institute for Cooperation for Agriculture]); EC and JICA (renewable energy promotion with Ministry of Energy). UNDP for cookstove promotion and carbon financing.					
Lead political partner	Agencia Peruana de cooperación internacional APCI, Presidencia del consejo de Ministros PCM					
Implementing organisation	GIZ					
Implementing partners	Ministries for Social Inclusion, Energy and Mines, Housing, Agriculture, Environment, Health, and Education, Support programmes for the poorest (JUNTOS.), Regional Governments, and Governments of the Provinces. Private companies especially from the mining sector. Farmer's associations.					
Project manager	Name: Ana Isabel Moreno Morales Mail: ana.moreno@giz.de					

- **Regular up-scaling**

1 Situation analysis

In the last few years, notable advances of the economic situation of Peru have allowed the implementation of various social policies. These policies are the main reason why important milestones in the reduction of poverty levels have been reached. However, 35 % of the population still lives in poverty; 12 % even in extreme poverty. The prevalence is even higher in rural areas: more than 60 % of the population lives below the poverty line. Biomass is the main energy sources for 37 % of the population living in poverty. This figure is again much higher in rural areas. Here, firewood is used by 77.4 % of HHs and manure is used by 14.5 % of rural HHs. Similarly, 95 % of schools in rural areas use firewood to prepare the daily food for pupils which also means that these meals are not appropriately prepared.

In an attempt to counter this problem, a broad coalition of public and private organizations, among them EnDev, launched in 2009 the campaign “Half a Million Improved Cookstoves for a Peru without smoke”. This campaign has allowed covering 20 % of the overall demand for ICS and has helped to make progress in technical regulations of those technologies and to match supply and demand in this formerly inexistent market concession.

Even though the campaign formally ended with the change of the government several organisations continue or even increase their activities such as EnDev to reach the objective of 500,000 cookstoves.

The present up-scaling is designed to reduce the use of biomass for cooking and heating by enhancing the use of improved biomass stoves and by promoting SWH in rural areas.

In Peru’s rural areas, hot water for families is an important energy service, especially in regions of high altitudes. However, hot water is often produced in an inefficient way, mainly by using stoves that burn charcoal, wood or other biomass. The market for SWH is still nascent and has – until lately – been restricted to the province of Arequipa. EnDev has already started promoting SWH for social infrastructure, for example, health centres, creating new possibilities for them to provide quality service and to properly maintain instruments. More than 100 social infrastructure institutions have been equipped to date. EnDev-Peru intends to stimulate the market in rural areas by implementing an RBF approach. For that purpose a concept was developed that was selected for the full proposal phase. However, in the joint DFID-EnDev evaluation the Peru proposal was not selected for implementation under the 1st tranche of the RBF facility. Nevertheless, in the evaluation of the concept it was stated that the approach demonstrates potential justifying a one-year pilot using regular EnDev financing. Based on this, the RBF component is included as a pilot in this up-scaling proposal.

2 Planned Outcome

Energy service segment	Old target	New target
Energy for lighting and electric HHs appliances	175,000 people	175,000 people
Cooking energy for HHs	160,000 people	310,000 people
SWH for HHs	0 people	1,000 people
Electricity and / or cooking energy for social infrastructure	4,700 institutions	4,800 institutions
Energy for productive use / income generation	2,500 enterprises	2,600 enterprises

3 Project approach

3.1 Energy technologies and services promoted by the EnDev project

Within this up-scaling proposal, EnDev-Peru will co-finance a project fund currently operated by the programme AEA. The aims of this programme are to promote the use of renewable energy and energy efficiency in order to contribute to safe and sustainable energy access in rural areas. Thereby, the project will contribute to the reduction of greenhouse gases and will also contribute to the mitigation of and adaptation to climate change. EnDev's focus in the fund will be the promotion of energy efficient cooking and heating technologies and the improvement of biomass availability. AEA is currently funded by Finland with an assigned budget of EUR 4.9 million and managed by the IICA.

In addition, EnDev develops a one-year RBF pilot project to promote SWH for low-income population and SMEs in rural areas of the Arequipa region. 200 SWH will be promoted for HHs and an additional 65 SWH are targeted for SMEs.

3.2 Approach to provide electricity to HHs

Not relevant for this proposal.

3.3 Approach to provide clean cooking technologies to HHs

Although different projects can be financed under the AEA fund, only biomass and outcome related projects will be considered for the EnDev contribution. EnDev will especially finance innovative solutions for the progress and promotion of the use of biomass for cooking in a sustainable way.

Public institutions, SMEs, universities, NGOs, social organizations, cooperatives, associations as well as local and regional government entities can present proposals to the fund. In order to be eligible, the target population has to be living in rural and peri-urban areas. It is intended to finance 14 projects with EUR 50,000 to EUR 250,000 each with durations of between six and 15 months. The details of how the call for proposals will be initiated and how the evaluation process will be carried out will be jointly agreed upon by the assigned staff of the EnDev project and the AEA programme. EnDev will make sure that each project respects EnDev criteria in terms of cost efficiency and sustainability.

The volume of this component is EUR 3,150,000.

3.4 Approach to provide SWH for HHs / RBF pilot

The pilot project will be implemented according to an RBF approach. Monetary incentives will be used to motivate both technology providers and MFIs. All of the incentives will be paid after SWH installation and verification. The incentives will not distort the price of SWH in rural areas. Only quality-certified SWH will be eligible for funding. The average urban price at the start of the project plus a certain percentage premium for transport to and installation in rural areas will be used as a reference for incentive calculation. This reference price will remain fixed over the period of the pilot project. By setting the reference price (and therefore the reference incentive, independent of actual sales prices) for SWH at the outset, technology providers will have an incentive to reduce cost by innovation, because this would increase the incentive relative to the actual cost of SWH.

MFIs will play an important role in this pilot project, as they will be the ones doing business with the rural population. This has the advantage that one can build on their existing client network and field structure. MFIs will take direct responsibility for any mal-function or post-sale problem that the client could have with the product (This will also contribute to the sustainability of the intervention). Therefore, in order to qualify for participation, SWH technology providers must fulfil certain standards, to be certified upon application by the Department of Physics and Engineering at the San Agustin Public University in Arequipa.

Another important aspect of the Pilot Programme is the Energy Inclusion Initiative (EII), which is promoted by GIZ through its EnDev-Peru programme in partnership with Appui au

Développement Autonome (ADA) and Microenergy International (MEI). The goal of the EII is to provide technical assistance to MFIs (e.g., FONDESURCO in the Arequipa Region), so that they can improve their capacity to give loans for the acquisition of “green products”, which are sold at the MFI offices (together with the accompanying loan).

The clear benefit of cooperation with EII in this pilot project is that a structured platform with well-known selling points and established rules is already available. In this sense, many of the activities for the implementation of the pilot project would already have a background and expertise that will help reduce costs and will not affect the current SWH market.

The volume of the EnDev pilot for RBF promotion will be EUR 300,000.

RBF incentive structure

Incentives will be provided to both technology providers and MFIs. All incentives will decrease over the course of the pilot project. The initial incentive level will be determined at the beginning of the pilot project. The incentive level cannot exceed 30 % of the urban retail price.

Incentive for technology providers for promotional activities and product innovation: This incentive will be provided to technology providers / dealers in order to (1) be able to realize promotion activities through publicity, local radio stations, fairs, etc. The goal is to generate knowledge among the population about the existence, use and benefits of SWH (awareness raising) and (2) be able to invest for innovation (new production equipment, professional design, etc.).

Incentive to the MFI for promotional activities: The primary objective is to inform potential customers and the low-income population in general about the possibilities for financing SWH, as well as demonstrating its benefits. As before, this incentive will start at a payment of 10 % of the reference price for each SWH installed and will then be reduced progressively.

Verification: Each payment by EnDev will be subject to the presentation of a file about the SWH showing that it has been installed in a rural area and for the target population of EnDev-Peru.

An evaluation will take place directly after implementation of the pilot project, verifying accomplishment of the activities and goals proposed (number of SWH installed), for a one-year period of time. From this analysis, it will be determined if a major nation-wide expansion for SWH through DFID would be viable.

3.5 Approach to provide access to modern energy services for social institutions

Same approach as for HHs.

3.6 Approach to provide access to modern energy services to SME’s

Same approach as for HHs.

4 Expected impacts of the project intervention

Impact	Possible indicators
Environment	The use of ICS and SWH for warming water will significantly reduce the amount of firewood and cattle dung traditionally used for cooking and warming water in rural areas. It will also result in an overall reduction of greenhouse gas emissions where bioenergy is not sourced sustainably, which is the case in many parts of rural Peru.
Health	ICS will reduce indoor air pollution and thus eye and respiratory diseases. SWH will allow HH members to more regularly wash, improving their sanitary conditions and comfort. Furthermore, it renders washing of food and vegetables more easy, which will in turn impact nutrition and reduce sicknesses, particularly diarrhoea and vomiting.
Poverty / livelihood	The improvement of health conditions through ICS and SWH will reduce the costs of health care and fewer workdays will be lost due to illnesses. This is of particular importance in the harvesting season when the workload is high and day labourer expensive.

5 Budget

	EUR
1 Human resources and travelling	245,000
2 Equipment and supplies	6,000
3 Funding financing agreements / local subsidies	2,904,000
4 Other direct costs	62,356
5 Total direct costs	3,217,356
6 Mark up costs / administrative overheads / imputed profit	232,644
7 Cost price	3,450,000

Rwanda

Project phase	old: 10.2009 – 12.2013			new: 10.2009 – 06.2017		
Project budget	old: EUR 7,200,000			new: EUR 12,491,000		
Target groups	Rural population of Rwanda					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HH appliances				19,700	918,450
	Cooking energy for HHs				20,544	20,544
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure				5 inst. biogas systems	5 inst. biogas systems
	Energy for productive use / income generation				30	30
Promoted technology	[×] Solar	[ ] Biogas	[ ] Stoves	[×] MHP	[ ] Grid	[ ] Other
Summary of key interventions and outputs	Through the RBF interventions in the PicoPV and minigrid sector, the following key activities will be added: • Promote access to electricity by PicoPV systems disseminated through an RBF mechanism; • Promote access to electricity by renewable energy village minigrids disseminated through an RBF mechanism All other key interventions remain unchanged.					
Coordination with other programmes	World Bank, ESME / GVEP, BTC, SNV, KfW					
Lead political partner	Energy, Water and Sanitation Authority (EWSA): Energy Sector / Ministry of Infrastructure (MININFRA)					
Implementing organisation	GIZ					
Implementing partners	EWSA / MININFRA, Private sector (MHP, PicoPV, minigrids), SNV (Biogas)					
Project manager	Name: Benjamin Attigah			Mail: benjamin.attigah@giz.de		

- RBF for solar lighting

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	880,000 people
EUR per person gaining access	3.86
T CO_2 emissions avoided (over the lifetime of products sold during project)	64,800
EUR per t CO_2 emissions avoided	52.47
Private sector leverage ratio	3
Jobs created	50
Enterprises created	10
Technologies deployed	160,000 task lights 192,000 room lights

1 Country and project area context

Rwanda‘s energy balance shows that about 85 % of its overall primary energy consumption is based on biomass (99 % of all HHs use biomass for cooking), 11 % on petroleum products (transport, electricity generation and industrial use) and 4 % on hydro sources for electricity[10]. In mid-2012 only about 16 % of the total population had access to electricity from the grid; about 2 % in rural areas[11]. Lack of access to electricity particularly affects economic sectors with the highest growth prospects like agriculture, tourism and IT. While bigger businesses resort to working with expensive diesel generators, most of the small businesses in rural areas are completely cut off from electricity supply. As a consequence, productivity and opportunities for growth are limited. Moreover, access to electricity would provide significant welfare benefits to HHs. The Government of Rwanda (GoR) aims to increase the total population with electricity access to 70 % by 2017. While this would be a significant achievement even when realized (which is extremely unlikely given the tremendous investment costs required and the challenges involved in reaching rural areas), this would still leave 30 % of the population without access to electricity. In order to reach these national targets and accelerate progress over past rates, the GoR is increasingly trying to engage the private sector. To this end, the GoR is implementing ambitious reforms to create a business-friendly and corruption-free environment. As one result of these efforts, Rwanda ranked 45th in the World Bank’s “Doing Business Report 2012”, moving up from 143rd position in 2009.

2 Sub-sector and technology focus and rationale

Two sub-sectors are planned to be included as part of the Rwandan RBF for the global DFID RBF programme: LED lighting and renewable energy-powered minigrids. Detailed project design has already been carried out and was discussed with the GoR, local and international organizations, and many potential private stakeholders. Due to the small size of the country, the project area for RBF eligible projects would extend over the whole country. This proposal only concerns LED Lanterns; there would be obvious scale economies on Fund management and GIZ management if the two proposed RBF would be jointly implemented as originally foreseen (see also budget estimate). The justification for choosing LED lanterns is twofold. Firstly, the market for such equipment is large but not developing by itself, and with limited financial inputs a major difference can be made towards establishing a sustainable market. Secondly, the benefits for users are enormous, in fact, it could be the first access to modern energy for the majority of rural HHs.

[10] AfDB, 2012. Rwanda Energy Review and Action Plan
[11] Source: Electricity Access Roll out Programme, Mid Term Review 2012

3 Outline RBF incentive design

The intervention is planned to last four years and consists of support to suppliers / importers of two categories of LED lanterns: (i) basic LED flashlights and task lights, for which the Lighting Africa "minimum criterion" applies (20 lm and 25 Lux at 2 sheets of paper, as well as overall quality as per Lighting Africa minimum requirements); and (ii) PicoPV products for general room lighting and basic ICT, where the criterion for the total system's illumination (by one or more light points – i.e., one system may have several light points) would be a typical benchmark value of about 300-500 lm[12], plus the option to charge a radio and / or cell phone. Private sector firms will be eligible to earn RBF support for the sale of up to 40,000 (task lighting category) or 48,000 (PicoPV, room lighting category) systems per year over four years, with caps of 10,000 (task lighting) and 8,000 (room lighting) for each individual firm. The RBF funding rewarded per firm would decrease with 20 % each subsequent year. For both categories, the participating firms would have to provide a full guarantee of at least 1.5 years. The approximate RBF contribution is EUR 0.15 per klmh (about EUR 4.6) for a standard task light and EUR 0.02 per klmh (about EUR 15.4) for a room light. The level of subsidy can be reviewed and revised on an annual basis based on market uptake to optimize the RBF incentives. Initially these levels are based on feedback from stakeholders in Rwanda with whom the proposed RBF structure was discussed. In order to not distort the market, the firms would have to provide basic evidence that the ex post subsidies are not used to lower end-user prices below levels that can be expected for RBF project end, but rather to re-finance the firm's cost of developing local demand for high quality, long-life LED lighting.

4 Impacts on people and the environment

The existing suppliers of lanterns and PicoPV systems with solid quality are operating in isolation and suffer from extremely small current local market volumes, because they are based in Kigali mainly, while the unmet demand is largely in rural areas. The RBF assistance is expected to give them enough incentives to invest in rural supply chains and inform users and small rural retailers on basic quality criteria, such as light output and system life. It is estimated that in total more than 350,000 HHs could be provided with access to improved and cleaner sources of energy as result of this RBF. The development benefits of a sustainable national market for LED-based lighting of appropriate quality would be immense, and would extend to HHs, small businesses, the macro-economy and the environment. LED lanterns and systems do not emit harmful emissions that cause respiratory and eye diseases and other negative health impacts of the indoor air pollution from the burning of kerosene, candles and biomass. Accidents involving kerosene lighting, which are a major cause of fires and burns in rural HHs, are likewise reduced. Reduction of kerosene use will thus result in lower overall indoor air pollution and less accidents involving burns and homes on fire. From a macro-economic perspective, the substitution of kerosene will save valuable foreign exchange given the reduction in kerosene demand (14,000 m^3 / y), and thus imports; a maximum reduction of 6-33 litres per HH could be obtained from using typical lanterns. Equivalent reductions in CO_2 emissions will result when kerosene is no longer used for illumination and could amount to 0.12 t per HH (depending on PicoPV product and baseline use, the displaced kerosene over system life can range from 1 to 100 "hurricane lamp years" worth of fuel – this will be described in more detail at full proposal stage, using recent data from GIZ and WBG PicoPV impact studies). HHs using LED lanterns will reduce their expenditures for kerosene (ranging from EUR 5.8 per year for task lighting to EUR 33 per year for room lighting)[13], candles (up to EUR 2.3 per year), dry cell batteries (for torches and radios; EUR 4.2 – EUR 8.4 per year) as well as for cell phone charging (up to EUR 13.3 per

[12] This is roughly the equivalent of a 40 W incandescent light bulb - systems would have to provide at least 200 lm (or ten times the light output of segment (i)) to qualify for segment (ii) and the amount of RBF unit incentive in this segment would be scaled depending on the actual lighting output proven by a lab test, so as to reward "lighting output" – i.e., 400 lumen would be set as 1 and systems with 400 (500) lumen as per lab specs would receive 25 % less (more) subsidy.

[13] Consumption Data from: IEN Working Papers - Energy series (R van der Plas) No. 6, June 1988; A Comparison of Lamps for Domestic Lighting in Developing Countries.

year), which can result in payback times of less than one year (depending on system type and baseline user spending). The new lights do not replace 100 % of the kerosene, candles, etc., since HHs use more than one light point per home. While substitutable lighting expenditures and reduced lumen costs are often cited as a direct benefit of PicoPV, GIZ has recently found in two EnDev projects[14] that savings from cell phone charging in rural areas have also become a substantial additional monetary benefit over the last few years: Depending on the country, HHs may save up to EUR 3 per month in addition to the lighting benefits. Room lighting lanterns and kits displace more kerosene than task lights. Dry-cell batteries are usually discarded with high environmental costs, and this will also be reduced when LED lanterns are used. **Enterprises** using LED lanterns rather than kerosene receive similar benefits as HHs in terms of improved room lighting. Access to improved lighting services may also allow enterprises to increase their operating hours which in turn leads to increased income. Enterprises selling the lanterns – the initial beneficiaries of the RBF – will obviously also benefit from the increased sale volumes; for example, a survey done by BTC in Rwanda showed that small retailers of LED lanterns receive profits in the range of 250 FRW / LED for smaller lights to 1,500 FRW / LED for the more expensive LED options per day. The number of suppliers strengthened or newly entering the market as a result of the RBF is estimated at eight to nine companies, with each likely strengthening up to 30 retailers in their rural distribution network. Improved lighting provides **children** with additional studying time in the evenings, and might also lead to more **productive time available for women**, for instance by making time available at night for HHs chores and use freed-up time for productive uses during the day time, such as vending, general services, agricultural work, etc. **Women, children, and the disabled** would benefit the most from an uptake of LED lanterns, or substitution of traditional lighting sources by LED lanterns for health, safety and welfare reasons: they spend an unproportionally large time right next to kerosene lanterns; thus they are more exposed to fumes and risk of burnings, and they take greater advantage of the aforementioned lighting benefits.

5 Strategic fit and alignment with national policies

The GoR assigns great importance to the energy sector as part of its development strategy and encourages greater private sector participation in the latter. In recent years, several forms of legislation, for instance, the Energy Policy, the Renewable Energy Feed-In Tariffs (currently approved for micro hydro only and under development for other technologies), and exoneration of VAT and import duties for (some) renewable equipment have been passed and affirm this support. The recent Energy Investor Forum in early 2012 is another example of the interest attached by the Government for private involvement in the energy sector. In order to promote the renewable energy sector, the Government recently commissioned the development of the Renewable Energy Strategy for Rwanda. In cooperation with GIZ, the GoR has also established a suitable framework for the micro hydropower sub-sector in recent years (which will be especially of importance to the minigrid component of the RBF programme). Complementary programmes for solar lanterns are in place by several donors, such as establishing support for marketing efforts and the expansion of rural distribution systems by World Bank / ESME trust fund / GVEP International (in cooperation with the Rwandan Private Sector Foundation (PSF)), and creating rural PV technician capacity by the Sustainable Energy Development Project (SEDP) implemented by the Rwandan Energy Water and Sanitation Authority (EWSA), which have also carried out market studies. There has also been a pilot programme for establishing solar energy kiosks by the Belgian Technical Cooperation (BTC), in cooperation with e.quinox. A number of coordination meetings have been held with all these programmes, government officials, and private firms / NGOs over the last two years to discuss the possibility of launching an RBF programme and its strategic fit with on-going activities (e.g. RBF stakeholder workshop, various meetings organized by a local DFID consultant as well as an EnDev consultant since late 2010). The stakeholders agreed that the on-going activities are complementing each other extremely

[14] Source: GIZ (2010) Uganda PicoPV Field Surveys; GVEO Uganda (2011).

well; especially the new WB / ESME / GVEP and the SEDP / EWSA programmes focus on needed capacity building efforts which are complementary to the financing provided through the RBF. The RBF would therefore form a crucial part in promoting the LED lantern sector as a whole.

6 Market analysis of technology and sector closeness to commercial viability

Evidence suggests that unmet demand for LED lanterns is present in rural areas of Rwanda because of: (i) lack of supply, as suppliers are not able to secure the credit necessary to import LED lanterns in volumes that would permit economies of scale; (ii) lack of scale economies, as it is expensive to maintain a rural retail infrastructure for such small volumes; and (iii) lack of awareness, as potential consumers are not aware of the options available to them. Unmet **demand** exists in the form of unfamiliarity of HHs about LED lanterns, which would increase demand for LED lanterns upon learning about them. With LED lanterns able to be introduced to locations more rapidly, early adopters will spread knowledge to other community members who, upon seeing the LED lanterns, will likewise want one. Several earlier schemes in different countries have shown early success, in the sense that tens of thousands of solar lanterns have been distributed by different organizations. However, the sustainability of these operations has never been demonstrated, as after the initial push, further dissemination trickled down to low additional numbers per year. At the same time, the market for low cost, poor quality lights never stopped. The potential market for the low-end product is thus in the hundreds of thousands, particularly if HHs start to use more than one light simultaneously, and the high end market could also approach the hundred thousand, commensurating the economic growth in rural areas and the establishment of a richer middle class. Regarding the **supply** side, there is currently a small and nascent private sector in Rwanda promoting LED lanterns and PV systems, and a catalyst for vitalizing and stimulating it would help Rwanda to indeed develop a more sustainable renewable energy market. There are several private companies involved in importing, installing and distribution of solar systems, including Great Lakes Energy, Nuru Energy, and more recently Pisat Solar, Toughstuff and Barefoot which focus on lanterns mainly. A number of other companies have also expressed interest in working in Rwanda. However, none of the companies has been able to provide a real market breakthrough as all are struggling with the difficulty of setting up rural distribution systems. Small import volumes translate into higher costs and thin margins, making it difficult for the supplier to make a return which allows import on a larger scale. Long-term economic viability is strong once economies of scale in import can be achieved. An RBF, in the form of a payment per LED lantern sold, would allow suppliers to accumulate the capital necessary for larger import shipments to achieve the necessary margins from which future import shipments could be self-funded, thereby eliminating the need for an RBF. It is expected that a sustainable market will be established if the volumes of lanterns sold increase as projected through the RBF involvement.

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

Structural barriers do not exist for the creation of a market for LED lanterns. However, there are some practical difficulties that are hindering the acceleration of this market creation: solar products are VAT exempt but some import clearing agents are still charging VAT while others are not; obtaining credit for bulk purchases / imports or working capital is difficult, and lack of readily available cash for the purchase of lanterns and inability to get credit for most rural HHs is a problem, even though the payback time is short for some products. Although the GoR and lantern suppliers are aware of these limitations, no systematic action has resulted yet. Nevertheless, several organizations are starting to address any remaining barriers toward the development of markets for solar lanterns, such as ESME / GVEP / PSF that creates capacity for marketing in rural areas and SEDP / EWSA that creates technical capacity in rural areas among PV technicians and installers. An RBF will provide additional incentives to resolve this. It is not clear whether RBF payments will be subject to taxation in

Rwanda. The expectation is that because the RBF payment presents financial benefits to HHs (subsidies), RBF payments will not be taxed. The experience of EnDev's PSP Hydro project, which also provides subsidy to private companies in the hydropower sector supports this case. However, this arrangement needs to be agreed with the GoR and will be clarified following approval of proposal stage.

8 Expected private investment and participation in the RBF

The RBF will enable private supply side investments through a variety of measures: creating distribution infrastructure, importing in volume, providing end-user financing using prospective RBF proceeds in order to create a sustainable market and obtain reduced long run unit costs (post-RBF) of lanterns. It is estimated that investment by the private sector will be large and could amount to about EUR 10 million (assuming a leveraging factor of 1:3), as imports are expected to increase and reach scale economies, which will need to be pre-financed by the companies. Extensive stakeholder consultations[15] showed that RBF may provide enough incentives for taking the risk to start increasing their level of sales and venture into rural areas. The stakeholders claimed that all capacity building and infrastructure development efforts by other donors can now finally be put to good use and they expressed their gratitude for the RBF opportunity. They have also inquired from the EnDev-Rwanda programme several times over the last year when RBF activities would finally start.

9 Implementation strategy and partnerships

The RBF will be managed by the on-going EnDev programme staff which will engage a local consultant for this purpose. Monitoring will be done by an FI, which will be selected through a Call for Proposals. Two stakeholder workshops among FIs have already been held, and several meetings were organized in light of the earlier idea that the global DFID RBF programme pilot would be launched in Rwanda; FIs have inquired several times from EnDev over the last year when the RBF will start. The FI will administer the RBF financing and all contractual arrangements with beneficiaries, and will carry out standard monitoring that will be used as the basis for results-based payments. Independent verification to verify the accuracy and reliability of the data generated by the FI will be subcontracted to an auditor once a year.

10 Sustainability and risk mitigation

The RBF is designed to promote sustainable business models for products with solid quality and limit risks as much as possible. To ensure sustainability, the design of the incentive structure includes diminishing financial contribution over time, annual caps for each company and a strong attention on avoiding end-user prices which would be below unsubsidized levels at project exit. There are incentives for the early subscriber to the RBF programme and in the RBF support is 100 % of the maximum total RBF incentive only in the first year, while each subsequent year the support is reduced by 20 %; so a company starting in year two can only receive support of 80 % of the maximum. The support per lantern sold is proportional to a standard value: for a task light, the standard RBF is EUR 4.5 per lantern relative to the performance in terms of lumen-hours for a single charge of the battery and the highest lumen setting of a standard lantern; the standard RBF for a room lighting lantern is EUR 15 relative to the lumen output on the highest setting of a standard lantern. In both cases, there is a limit to the maximum support per lantern (50 % of the lantern retail price). Since the maximum financial contribution for each lantern is limited, and end user prices shall be kept at undistorted levels as much as possible, market spoilage is not expected to occur. As the national market and local market packages will mature over the next five years (i.e. current inefficiencies from lack of information on all levels will be reduced via RBF-triggered additional sales of quality components as well as related information / sales campaigns by participating firms) and sales volumes will increase (i.e. the individual firms' transaction costs for marketing, container imports etc. will then be leveraged over higher volumes per firm), the

[15] Meetings were held in August, October and November 2012

provided financial RBF support can wane while lantern unit end user prices will remain stable or even decline and the distribution companies will have shifted their margins from high mark-ups to reduced mark-ups and lower import costs due to increased volumes. The involvement of the FI may be useful in the long-term to provide continuous credit for increasing numbers of container imports (especially for firms which enter after RBF support ends) – however, future shipments may be increasingly self-funded. Additionally, only lights approved by Lighting Africa or GIZ will be eligible for the RBF to limit the risk of poor quality LED lanterns swamping and spoiling the market. If certain lights have not (yet) been certified by Lighting Africa, the supplier will need to show reasonable proof of the quality of the light (such as the GIZ lab tests) and might be asked for harder terms of the RBF-implicit product warranty before it can be eligible for RBF purposes.

11 Summary of expected outcomes and impacts

There are different levels of benefits, some of which can be aggregated and some which cannot (probable indicators underlined):

- Access is provided to about 350,000 HHs or 1.7 million people;
- Although benefits of lanterns are not on par with those from a grid connection, and PicoPV products have lifetimes of only one to eight years, that is, less than a grid connection, it is still worth noting that there are currently only about 300,000 grid connections in the whole country, benefiting only 1.5 million people (i.e. the same order of magnitude that will be reached by the present project). The RBF programme can over four years indeed provide quite substantial contribution to modern energy access;
- Number of entrepreneurs (suppliers) strengthened or newly entering the market is estimated at ten companies, with each likely strengthening up to 30 retailers in their rural distribution network;
- Private sector investment will be large and could amount to about EUR 10 million (assuming a leveraging factor of 1:3); imports are expected to increase and reach scale economies, which will need to be pre-financed by the private companies. The average RBF subsidy per lantern over the life of the project is estimated to be about 26 % of the retail price and about EUR 7.3 per beneficiary;
- Required mark-ups due to low sales volumes are high, and it is expected that the sales price of an average lantern can be reduced by about 10-20 % in the last year of the project.
- CO_2 mitigation, up to 18,500 t per year, based on a HHs consumption of 0.5-2.7 litre per month depending on the type of kerosene lantern and 50 % fuel consumption reduction, with 2.5 kg of CO_2 emissions per litre (IPCC).
- Kerosene import savings – reduction of 19,300 m^3 over the first four years of the programme; savings of EUR 4.9 million per year
- There are additional benefits regarding health, education, more productive time during the day, environmental damage from battery disposal, etc. – as described above - but these have not been valued for the proposal. However, EnDev has started collaboration with the new WBG-led workgroup on quantification of off-grid PV impacts and results will be used to estimate those additional impacts at project end, based on project data (where applicable).

12 RBF-Budget

	EUR
1 Human resources and travelling	173,612
2 Equipment and supplies	20,000
3 Funding financing agreements / local subsidies	2,946,461
4 Other direct costs	45,678
5 Total direct costs	3,185,751
6 Mark up costs / administrative overheads / imputed profit	214,249
7 Cost price	3,400,000

- RBF for renewable energy village minigrids

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	18,750 people
EUR per person gaining access	100.85
T CO_2 emissions avoided (over the lifetime of products sold during project)	11,105
EUR per t CO_2 emissions avoided	170.28
Private sector leverage ratio	2
Jobs created	90
Enterprises created	16
Technologies deployed	25 pico-hydro minigrids Ten micro-hydro minigrids

1 Country and project area context

Rwanda‘s energy balance shows that about 85 % of its overall primary energy consumption is based on biomass (99 % of all HHs use biomass for cooking), 11 % on petroleum products (transport, electricity generation and industrial use) and 4 % on hydro sources for electricity. In mid-2012 only about 16 % of the total population had access to electricity from the grid of which about two % were in rural areas[16]. Lack of access to electricity particularly affects economic sectors with the highest growth prospects like agriculture, tourism and IT. While bigger businesses resort to working with expensive diesel generators, most of the small businesses in rural areas are completely cut off from electricity supply. As a consequence, productivity and opportunities for growth are limited. Moreover, access to electricity would also provide significant welfare benefits to HHs. The Government of Rwanda (GoR) aims to increase the total population with access to 70 % by 2017. While this would be a significant achievement even if realized (which seems unlikely given the tremendous investment costs required and the challenges involved in reaching rural areas), it would still leave 30 % of the population without access to electricity. In order to reach the set targets and accelerate progress the GoR is increasingly trying to engage the private sector. To this end, the GoR is implementing ambitious reforms to create a business-friendly and corruption-free environment. As one result of these efforts, Rwanda ranked 45th in the World Bank’s “Doing Business Report 2012”, moving up from 143rd position in 2009.

2 Sub-sector and technology focus and rationale

Two sub-sectors are planned to be included as part of the Rwandan RBF scheme for the global DFID RBF programme are LED lighting and renewable energy powered village grids. Detailed project design has already been carried out and was discussed with the Government of Rwanda, local and international organizations, and many potential private stakeholders. Due to the small size of the country, the project area for RBF eligible projects would extend over the whole country. This Proposal only concerns Renewable Energy (RE) powered village grids, which could considerably increase the number of people with access to electricity, particularly from isolated micro hydro plants. There would be obvious scale economies on fund management and GIZ management if the two proposed RBF were jointly implemented, as originally foreseen. The choice for RE village grids is simply justified by the opportunity it provides: until now, all distribution and connection work is done by the national electricity company Electricity Water and Sanitation Authority (EWSA), which is already fully occupied with extending the MV and LV grid throughout the country following high level

[16] Source: Electricity Access Roll out Programme, Mid Term Review 2012

political pressure for doing so. Connecting new clients could be increased substantially if private firms were engaged, with large economic benefits as a result.

3 Outline RBF incentive design

The intervention is planned to last four years and consists of support to project developers and investors to undertake the design and construction, as well as and operation and maintenance (O&M) of village grids in two different categories: (i) “pico grids” which typically include a new renewable energy source power plant (less than 50 kW) and a small low-cost distribution grid; (ii) “micro grids” which are rehabilitated and / or upgraded existing isolated village grids, or construct new village grids, around existing micro-hydro power plants that are privatized, and extend these grids to serve residential consumers in the vicinity of this plant. The idea behind the village grids is to advance electrification rates faster than the business as usual scenario, by engaging the private sector more.

RBF financing will be provided in the form of one-off payments for completion for connections of new customers, for setting up village grids including generation capacity (upon commissioning) and in the form of quarterly payments for all existing and new connections which are properly maintained. A proxy for a properly maintained connection is a consumption of on average 5 kWh per month per customer. An initial RBF payment for establishing the village grid and for creating new grid connections will be maintained at 35 % (70 % if it involves also generation capacity) of the total investment costs, to be paid on commissioning of the network. For the duration of the four year programme, quarterly O&M payments will be made. Quarterly payments in year 1 for connection maintenance will be EUR 15.4 (micro grid) and EUR 5.7 (pico grid) per client; these amounts will be reduced as follows for the subsequent years: 80 % of this amount in year 2; 60 % in year 3; and 40 % in year 4.

The RBF programme will serve to determine whether entrepreneurs can create viable business models to operate and manage village grids in Rwanda. Entrepreneurs could develop innovative new approaches to managing, operating and extending village grids. This is innovative for Rwanda and could advance the electricity access roll-out agenda substantially. To take this process even one step further, an innovation facility will be included in the proposed RBF programme, whereby limited support can be given to out-of-the box village electrification solutions that are not at all present or even planned in Rwanda. One can think of biomass-based electricity generation, or isolated solar (solar-diesel hybrid) village grids.

Currently, the construction of energy infrastructure is supported through up-front grants to private sector companies or subsidies to Government agencies. The RBF would transform this logic by providing the subsidy only upon delivery of services, thereby providing an incentive to companies to innovate and develop cost-efficient solutions adapted to the context. Especially the granting of a quarterly payment for operation and maintenance of the sites constitutes a novel approach to off-grid electrification, which has a function similar to a feed-in tariff, but for an off-grid setting in remote areas.

4 Impacts on people and the environment

The benefits of a sustainable village grid market in Rwanda would be substantial, for HHs, micro and small businesses, the local and global environment and the national economy. On the supply side, the RBF will further enhance on-going efforts **to strengthen the private sector** which is supplying the country with electricity. One privately developed and owned Micro Hydro Power Plant (MHPP), the MHPP of *Murunda* (96 kW) has been operating satisfactorily since March 2010. This is the first power plant built by a private company (REPRO) in Rwanda. A second privately owned hydropower plant, the MHPP of *Mazimeru* (500 kW) was completed by the private company ENNy in early 2012 and is now operational also. A third plant (by the private company SOGEMR) is currently (early 2013) being commissioned while tree further private developers are currently in the planning stages of

new projects; all of these projects were developed in cooperation with the *"Private Sector Participation in Micro Hydro Power (PSP Hydro)"* project implemented by GIZ. These plants are connected to the national transmission grid and do not serve the local population, although in the planning stages the communities were approached for their interest in a local distribution network. The local population therefore is at the discretion of EWSA for obtaining a connection, and since EWSA has not started to distribute to these communities, a new village grid might be a desirable option. Four isolated public micro hydro plants with village grids have been commissioned a few years back but experience operational difficulties due to a lack of ownership. Lessons would be transferred to the proposed RBF project. Several other public micro hydro plants are being constructed (ESME (Energy SME) / GVEP (Global Village Energy Partnership), EU-Energy Facility 2010, GoR). The GoR is planning to hand the management of all of these publicly owned hydro plants to the private sector in the near future (see also chapter 5), which could then install village distribution grids. Particularly when sources of supply already exist, village grids would help to increase capacity factors and thus profitability of hydro plants. Furthermore, efforts are on-going by the Government with support of donors to construct more pico hydropower plants, especially in off-grid areas. The RBF for operating, maintaining and managing village grids could therefore represent a significant encouragement for companies and investors to install village grids: it is estimated that the number of entrepreneurs strengthened or newly entering the market is at least 16 or more (with each likely employing six or more staff to maintain their networks), while construction crews would also locally sourced for the duration of the construction. Electrification would, in turn, result in a number of benefits to the local community, including better lighting and ICT, cooling, productive uses, better health, increased free HHs budgets (via savings and probably value added) and improved well-being.

It is estimated that up to 18,750 persons could benefit, or about 3,750 HHs. They would get access to improved and cleaner sources of energy as the main result of this RBF, through electricity from a maximum of 25 pico and ten micro grids. Benefits from the use of electricity are expected to be the larger for the minigrids, as grid stability is likely higher than for pico grids and the power to be provided by the pico grid will be limited by the capacity of the pico-hydro plant.

Access to electricity avoids emitting harmful **emissions** that cause respiratory and eye disease and other negative health impacts of the indoor air pollution from the burning of kerosene, candles and biomass for lighting purposes. **Accidents** involving kerosene lighting, which are a major cause of fires and burns in rural HHs, are likewise reduced. Reduction of kerosene use will thus result in lower overall indoor air pollution and less accidents involving burns and homes on fire. From a **macro-economic perspective**, the displacement of kerosene will save valuable foreign exchange given the reduction in kerosene demand (540 m^3 over four years), and thus imports; a maximum reduction of 56 (with pico grid, 66 with micro grid) l per HH could be obtained when no longer using lanterns. Equivalent reductions in CO_2 emissions will result when kerosene is no longer used for illumination and could amount to 0.59 t / HH or 11,102 t over 20 years. **HHs** will reduce their expenditures for kerosene (ranging from EUR 56 (pico grid) to EUR 66 (micro grid) per year for room lighting)[17], candles (up to EUR 2.3 per year), dry cell batteries (EUR 8.3 – 16.7) as well as for cell phone charging (up to EUR 24 per year). Grid electricity, in contrast to Light-Emitting Diode (LED) lanterns, can generally replace 100 % of the cost for kerosene, candles, and cell phone charging that was spent before the connection, simply because the quality of the light is much higher and the costs are so much lower[18]. In addition, the possibility to charge mobile phones saves time spent walking to the next charging station. Dry-cell batteries are usually discarded with high environmental costs, and this will also be reduced with access to

[17] Areas where the smaller grids will be installed are expected to have higher levels of poverty, which means that their initial consumption will probably be less. It is therefore assumed that in an area with a pico grid, HHs reduce the initial maximum kerosene consumption by 85 %; in an area with micro grids, a factor of 100 % is used.

[18] Nevertheless, a "security factor" is used to account for the differences in levels of poverty and quality of service provided for the different cases, as pico and micro grids might not be able to provide the same service, i.e. 24h hour supply, of electricity that ensures that all traditional energy sources will be replaced.

the grid. **Enterprises** in the electrified areas will benefit from using electricity for productive uses (hair salon, photocopying, bar with television, etc.). Electricity provides access to lighting that can extend their number of working hours, but also cost reductions when they avoid using battery power to maintain their business. Small enterprises using electric lighting to sell more products at night or to use for productive purposes would also benefit from the increased sale volumes. Improved lighting provides children with additional studying time in the evenings, and might also lead to more productive time available for women, for instance by making time available at night for HH chores and use freed-up time for productive uses during the day time, such as vending, general services, agricultural work, etc. **Women, children, and the disabled** would benefit the most from access to electricity by providing them with additional time to pursue other activities as they spend proportionally more time inside the home. Finally, **social benefits** accrue when institutions and community organizations also connect to the grid through lower service costs and better services provided (e.g. night time health service).

5 Strategic fit and alignment with national policies

The Government of Rwanda assigns great importance to the energy sector as part of its development strategy, particularly renewable energy, and encourages greater private sector participation in the latter. In recent years, several forms of legislation, for instance, the Energy Policy, the Renewable Energy Feed-In Tariffs (currently approved for micro hydro only and under development for other technologies), and exoneration of VAT and import duties for (some) renewable equipment have been passed and affirm this support. The Government also recently commissioned the development of the Renewable Energy Strategy for Rwanda. The recent Energy Investor Forum in early 2012 is another example of the interest attached by the Government to private involvement in the energy sector. A large electricity roll-out programme (EARP) is underway, focusing mainly on the most populated corridors connecting towns and large villages to provide rural electrification access. In cooperation with GIZ, the GoR has also established a suitable framework for the micro hydropower sub-sector in recent years which will be especially of importance to the village grid component of the RBF programme. Until a few years ago, capacity and knowledge within the hydro-powered village grid sectors was very low. Through the Energising Development (EnDev) programme “Private Sector Participation in Micro Hydropower Supply for Rural Development” (PSP Hydro) capacity of both the public and the private sector has been increased. Private companies operating in the hydropower sector, for instance, have started to independently design new projects and attract financing from international investors. As a part of the policy framework standard power purchase agreement (PPA) models, standard environmental and licensing procedures and feed-in tariffs for grid-connected MHPPs are now in place.

GIZ has further supported the Government in studying the feasibility of the privatization of several publicly managed micro hydro plants, as local communities did not have the necessary capacity, and EWSA concentrates its business strategy in the management of larger plants and expanding the national grid. The Government has declared its intention to privatize public hydro plants in Rwanda in the future and has started to actively invite private companies, including at the Energy Investor Forum, and the first private proposals have already come in. The recently established Energy Investment Unit in EWSA is tasked to pursue this task. The Government in its proposed ESSD would like to institutionalize this further in the future to reduce reticence from the private sector given the expressed risks involved. Especially for remote areas, EWSA is interested in pursuing micro and pico-hydro plants, possibly as part of the EARP. The development of the pico-hydro sector is also supported by several donor organizations; GIZ has assessed the capacity of pico-hydro manufacturers, the World Bank (ESME programme / GVEP) has analysed the pico-hydro market in Rwanda, and the Belgian Technical Cooperation (BTC) has held a pico-hydro workshop in May 2012 attended by targeted private entrepreneurs and sector specialists. At the workshop, the needs and planned activities for capacity building were discussed, and a

results-based financing mechanism was mentioned as the main missing ingredient for advancing the pico-hydro sector. As these capacity-building initiatives on the technical side (EWSA / BTC), as well as in business development and marketing (ESME / GVEP International) are coming closer to implementation. A number of coordination meetings have been held with all these programmes, government officials, EWSA, the Rwanda Utilities Regulatory Agency (RURA) and private firms / NGOs over the last two years to discuss the possibility of launching an RBF programme and its strategic fit with on-going activities. These meetings confirmed the excellent complementarity of these measures.

6 Market analysis of technology and sector closeness to commercial viability

Unmet demand for connections is large, simply because the grid infrastructure is not available in most places in Rwanda. In 2009, only 6 % of the population had access to electricity; this had increased to about 16 % in 2012, mainly as result of the EARP. The EARP initially focused on low hanging fruit, leaving out many areas, particularly those further from the backbone infrastructure. An RBF, in the form of a payment per connection made and maintained would allow project developers to raise the funds necessary for grid extensions, whether connected to EWSA or to local plants. The potential market for low-cost grid connections is in the hundreds of thousands, particularly in rural areas, and would stimulate economic growth and the establishment of a richer middle class. There is currently a small and nascent private sector in Rwanda developing pico and micro hydro plants and constructing lines for transmission and distribution. There are several private companies involved in the micro hydro sector, including REPRO, ENNy, and SOGEMR which all voiced a strong interest in managing public MHP or in buying them through the privatization process. They expressed a clear interest in extending or establishing more networks which would be required for a private sector driven, profitable management of the plants. A number of other companies, including foreign companies from Turkey, Sri Lanka, China, and India have also recently expressed interest in working in Rwanda in this sector, either by constructing new plants or taking over plants which are supposed to be privatised. There is strong interest by local private companies involved in the pico-hydro sector to scale up their operations, as evidenced in studies by GIZ[19] and World Bank / GVEP[20], as well as a pico-hydro capacity building workshop organized by BTC on behalf of EWSA.

With about 350 hydro sites known in Rwanda and less than 50 developed, there is no shortage of hydro sites. In addition, there are many undocumented sites for pico-hydro.

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

Structural barriers do not exist for the creation of village grids; the Electricity Law fully supports the concept as confirmed in discussions with RURA, although EWSA will need to get used to it. EWSA traditionally enjoyed the monopoly for generation, transmission and distribution of power, and it tries to hold on to the latter two, although it would not mind rolling out private village grids in isolated areas. The capacity of public institutions regarding promotion of RE through the private sector as well as the capacity of private companies themselves have increased considerably over the last years. Several organizations are working to address remaining issues related to electricity generation and distribution, including EWSA, EARP, GIZ / PSP Hydro, WB / ESME / GVEP. Amongst the open questions are tariff setting for village grid and whether RBF payments would be subject to taxation.

8 Expected private investment and participation in the RBF

The private investment to be expected under this RBF is considerable. The subsidy will cover only 36 % for pico-hydro power plants and 29 % for micro-hydro power plants of the investment cost, while large sums of money will be mobilised by both companies and private

[19] GTZ, 2010. Support to the Pico-Hydro Sub-Sector. Feasibility analysis and strategy
[20] GVEP International, 2011. Assessment of the Pico and Micro Hydropower Market in Rwanda

consumers. Upfront investment costs are expected to be footed by private companies investing in such a venture. Overall, it is expected that private sector investment will be large and could amount to about EUR 2.9 million, while the total RBF subsidy is EUR 1.3 million (with a leveraging factor of 2.2 to 1). The private sector contributes in total about 61 % of the investments.

The stakeholder meetings and bilateral discussions that have been held in preparation of this proposal, as well as previous meetings on privatisation and pico-hydro power, have demonstrated that there is a keen interest by firms to get involved in the construction and management of village grids. About 16 companies are expected to participate in this RBF.

Although the RBF initially does not involve a large number of companies or individuals, it will further enhance on-going efforts to strengthen the private sector by building capacity in the area of electricity distribution and generation in the country. As a conservative estimate, it is expected that about 64 additional technicians might be employed as a result of the RBF.

9 Implementation strategy and partnerships

The RBF will be managed by the on-going EnDev programme staff which will hire a local consultant as RBF project manager. Monitoring will be done by an FI, which will be selected through a competitive Call for Proposals.

The FI will administer the RBF financing and all contractual arrangements with beneficiaries, and will carry out standard monitoring that will be used as the basis for results-based payments. Two stakeholder workshops among FIs have already been held, and several meetings were organized in light of the earlier idea that the global DFID RBF programme pilot would be launched in Rwanda; FIs have inquired several times from EnDev over the last year when the RBF will start. They have also, thanks to the PSP project, taken a closer look at financing micro hydro investments and some six loans or leases have now been issued. Two banks showed a particularly keen interest in taking part in the RBF, as it would provide them both with a source of revenue, as well as venture into a new sector. Independent verification to verify the accuracy and reliability of the data generated by the FI will be subcontracted to an auditor once a year. Synergy and cost reductions could be obtained if the LED lantern RBF activity is implemented simultaneously.

10 Sustainability and risk mitigation

Most subsidies create the risk of attracting unsustainable business models, whether or not these were intended to obtain the subsidy as the primary goal. The RBF is designed to promote sustainable business models and limits this risk as much as possible as the subsidy is paid out only after the results are obtained. To further ensure sustainability, the design of the incentive structure includes diminishing financial contribution over time and annual caps for each company. There are incentives for the early subscriber to the RBF programme and in the first year RBF support is 100 %, while each subsequent year the support is reduced by 20. The support per connection is given only for as long as the connection consumes electricity, and there are standards for each of the different grids (pico, micro). In principle, the developer obtains EUR 9.2 per connection per quarter in the first year. The involvement of the FI may be useful in the long-term to replace RBF involvement by continuing to provide credit, thereby allowing project developers who have several village grids in operation to access financing for future networks, which under ideal conditions could eliminate the need for a continued RBF.

There is also a risk of climate change and environmental influences impacting on the sustainability of village grids. Hydropower generation is dependent on a reliable supply of water, which might be affected by changes in the rainfall regime. The National Green Growth and Climate Resilience Strategy of the GoR cites a maximum increase in annual rainfall of up to 20 % by the 2050s. This translates into a likely increase in rainfall intensity for both rainy seasons, while drought incidences might increase during the dry season. As part of the general risk assessment, projects will be encouraged to take into account this variability in

weather (for example in the hydrological assessment, or possibly by choosing turbines with high efficiency at different amounts of water flow). Furthermore, changes in climate extremes like increases in rainfall intensity might lead to more landslides, floods and soil erosion, which could damage infrastructure. Preventive measures will be encouraged, such as anti-erosion and slope stabilization measures, which could possibly receive financial support from local districts, e.g. through the Rwanda Local Development Support Fund (RLDSF).

11 Summary of expected outcomes and impacts

There are different levels of benefits, some of which can be aggregated and some cannot:

- For village grids 3,750 connections are expected to be realized that receive more than 5 kWh / month, which would equal 18,750 people; this will come from 25 pico grids and ten micro grids.
- Although benefits of these village grids are not necessarily on par with those from a grid connection, particularly for a pico-hydro plant with village grids, it is worth noting that there are currently about 300,000 grid connections in the country, or 1.5 million people. The RBF programme can over four years indeed provide a contribution to modern energy access, particularly when it can be demonstrated that it can be rolled out without RBF funding in the future.
- Number of entrepreneurs strengthened or newly entering the market is estimated at 16 or more, with each likely employing up to six staff to maintain their networks; in addition, construction crews are also locally sourced for the duration of the construction.
- Private sector investment will be large and could amount to about EUR 2.9 million, with a leveraging factor of 2:1; the average RBF per beneficiary over the life of the project is estimated to be about EUR 78.
- CO_2 mitigation, up to 613 t per year, based on a HH consumption of max 5.6 litre per month depending on the type of kerosene lantern, and 2.4 kg of CO_2 emissions per litre (IPCC).
- Kerosene import savings could be as much as EUR 153,000 in year 4; 540,000 litres over four years.
- Benefits accruing from small companies being more viable with the productive use of energy are quite specific for the type of company. For mills etc., the existing operational costs can be almost halved if they switch from diesel to electricity; for new companies. For saloons operating on batteries before, benefits lay mainly in time savings from not having to charge the battery regularly and some cost reduction.
- There are additional benefits regarding health, education, more productive time during the day, environmental damage from battery disposal, etc. – as described above - but these have not been valued at this stage.

12 RBF-Budget

	EUR
1 Human resources and travelling	180,812
2 Equipment and supplies	20,000
3 Funding financing agreements / local subsidies	1,513,378
4 Other direct costs	45,075
5 Total direct costs	1,759,265
6 Mark up costs / administrative overheads / imputed profit	131,735
7 Cost price	1,891,000

Tanzania

Project phase	old: 12.2012 – 12.2014			new: 12.2012 – 06.2017		
Project budget	old: EUR 500,000			new: EUR 2,041,000		
Target groups	Rural population of the Lake Zone in Tanzania					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HH appliances				0	181,970
	Cooking energy for HHs				45,000	45,000
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure				0	0
	Energy for productive use / income generation				80 producers; 1,000 food vendors	80 producers; 1,000 food vendors
Promoted technology	[×] Solar	[ ] Biogas	[x] Stoves	[ ] MHP	[ ] Grid	[ ] Other
Summary of key interventions and outputs	Through the RBF interventions in the PicoPV sector, the following key activities will be added: • Promote access to electricity by PicoPV systems disseminated through a RBF mechanism All other key interventions remain unchanged.					
Coordination with other programmes	Lake Zone Renewable Energy Programme Tanzania					
Lead political partner	Ministry of Energy and Minerals					
Implementing organisation	SNV in cooperation with GIZ office Tanzania					
Implementing partners	The Lake Zone Renewable Energy Consortium (LZREC); Anglican Church of Tanzania (ACT), Mara Diocese (Musoma); TSAEE, an agricultural extension society based in Mwanza; EMEDO, an NGO based in Mwanza; private sector solar firms					
Project manager	Name: Marco Hüls			Mail: marco.huels@giz.de		

- **RBF for PicoPV**

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	181,970 people
EUR per person gaining access	8.47
T CO_2 emissions avoided (over the lifetime of products sold during project)	57,000
EUR per t CO_2 emissions avoided	27.04
Private sector leverage ratio	2.7
Jobs created	90
Enterprises created	56
Technologies deployed	88,228 PicoPV desk lights 27,571 PicoPV room light kits

1 Country and project area context

Less than 14 % of Tanzania's 41 million residents have access to the electricity grid. In rural areas, where 75 % of people live, access is estimated at only 2-3 %. The six regions of Tanzania's Lake Zone (Kagera, Geita, Mwanza, Shinyanga, Simiyu and Mara Regions) are home to ca. ten million people, of whom 8.5 million are without electricity access. The Lake Zone urban capital of Mwanza City, Tanzania's second largest city, hosts a variety of solar suppliers including some of the largest and most reliable dealers in the nation. Despite indications of strong potential for expansion of solar to under-served rural and peri-urban areas, the absence of viable distribution chains in the Lake Zone effectively limits the diffusion of quality solar options from urban Mwanza.

2 Sub-sector and technology focus and rationale

The objective of the RBF for Rural Market Development of PicoPV Solar (RBF RMDPS) is to improve market access to and use of quality pre-electrification pico-solar devices (lanterns, phone chargers, small multi-room lighting kits) for poor rural and off-grid HHs in the 28 districts of Tanzania's Lake Zone via strengthened import supplier to end retailer distribution.

The Tanzania RBF scheme would focus on the Solar PicoPV subsector with an initial geographic area of the Lake Zone. Recent market intelligence by SNV shows strong demand for entry-level solar systems (small SHS below 50 W, as well as solar lanterns as basic entry product). The targeted consumer group would be rural and peri-urban HHs who are not connected to the grid and who have the potential to switch from CO_2-emitting kerosene lamps and candles to solar lanterns and small SHS. Current HH expenditures on kerosene, candles, batteries and cell phone charging are quite high compared to other parts of Africa (EUR 10 per month on average). Taken together with the relatively low prices (compared to traditional SHS) of the latest generation of reliable PicoPV products, this allows for sound return-on-invest and very short break-even times (i.e. time until actual kerosene and battery charging savings equals end price) of 3-7 months for solar lanterns and 7-14 months for small SHS. However, exact (financial and economic) benefits are highly variable amongst segments and individuals of the target group, and access to affordable high-quality solar PV solutions is limited (demand side constraints).

The biggest supply side constraint concerns the retailers' lack of access to capital to invest in the build-up of a basic stock of products at reasonable procurement prices which in turn results in marginal sales-turnovers. The limited stock and the lack of scale lead retailers to increase their profit mark-up to make up for the low turnover rate, triggering a vicious cycle. The resulting high sales prices (i) deter possibly interested consumers from purchasing

PicoPV, (ii) thereby reducing the local spread of knowledge about this very new energy option, and (iii) limiting additional sales which would increase sales volumes and allow to further reduce the mark-ups per sold unit at constant profit.

3 Outline RBF incentive design

The four year RBF RMDPS will facilitate the establishment of a temporary financial product within mainstream banking that is accessible to import-suppliers actively engaged in distribution chain development. The nature of the financial product will be to provide after delivery incentives, as based on a pre-defined percentage by the programme, that are applied to each unit of verified PicoPV solar units sold by RBF programme certified import-suppliers.

RBF incentives valued at EUR 1 million will be hosted by an FI and disseminated in two equal instalments as (i) a product bonus to retailers, (ii) a capital bonus to import-suppliers. The RBF incentives are intended to offset the cost invested by suppliers in rural retail distribution chain development while simultaneously boosting end-retail working capital and cash flow levels by means of higher pico-solar stock turnover ratios. This will create economies of scale throughout the supply chain to the ultimate benefit of consumers via reduced product pricing and increased local availability of quality pico-solar options in the longer term.

The RBF incentive to retailers will be topped up to enable them to pay for business training. Through this, the project will safeguard good business performance from the smaller retailers, enhancing the chances of success of the RBF. Avoiding exploitation of the retailers by the much stronger suppliers / importers will be safeguarded through sound RBF contracts with the suppliers and including checks in the verification structure of the project.

4 Impacts on people and the environment

Amongst the 1.1 million HHs who are currently without electricity access in the Lake Zone, use of the RBF facility to satisfy about 10 % of HHs will realise **modern energy for lighting and charging services** benefitting more than 181,000 men, women and children (EnDev counting methodology) throughout more than 115,000 family HHs.

SNV Market Intelligence is indicative that an average family in the Lake Zone consumes about five litres of kerosene / month. The pico-solar products promoted under the RBF are conservatively estimated to reduce kerosene consumption by 60 % (3 litres / month), which will result in **carbon savings** of an estimated total 57,000 t CO_2 eq over the lifespan of the products.

Kerosene, batteries, candles and phone charging in the Lake Zone typically cost a family an average of EUR 10 per month. Pico-solar applications to be promoted in the RBF are anticipated to save about 60 % of these costs resulting in a de facto **increase to HH income** of about EUR 70 per year. The majority of beneficiaries using pico-solar with charging / small electronic facilities will also enjoy the benefits from other low-wattage electricity appliances like cell phones, and radios and will be able to participate in the world of communication without high expenses on non-rechargeable batteries. This will have a further positive impact on the environment as far less batteries will be dumped.

While in most districts there is presently only a single retailer dealing in quality solar products, the RBF project would **expand the network of reliable retailers** to at least two to four enterprises per district for an estimated participation of about 80 to 90 entrepreneurs in total. The RBF is anticipated to support the **growth of these enterprises** to increase their turnover by about 30 units per month (equivalent to EUR 1,000 to EUR 1,250, depending on actual systems sold).

The RBF fund will facilitate the **entry of additional import-suppliers** for an improved competitive landscape and increased array of quality IFC-LA approved pico-solar options. The RBF is anticipated to support the growth of five to six import suppliers to increase their

turnover in distribution to an expanded and reliable retail base by about 500 units per month (equivalent to approx. EUR 7,500 monthly, or EUR 90,000 annually, depending on actual systems sold).

Taken as a whole, the RBF fund is anticipated to contribute to supporting means for the **reduced costs of pico-solar products** by an estimated 20 % as the realization of incentives requires increased import volumes and sales turnovers. This will widen access to modern energy products to poorer consumers and open a door to other socio-economic and health and safety, energy benefits.

5 Strategic fit and alignment with national policies

The use of solar energy technologies for both domestic and productive use has gained increasing relevance amongst policy makers over the past decade. In 2005, Tanzania lifted sales tax and reduced import-excise duties on solar products and accessories to make entry into the sub-sector lucrative to local entrepreneurs. This has been followed by increasing directions by the Prime Minister's office for local governments to support means of solar applications in public institutions (e.g. dispensaries, water pumps or schools) and improve means of domestic solar applications for rural communities that are unlikely to see grid expansion. In the 2012 National budget, solar was explicitly identified as a main modern energy alternative to be promoted throughout government operations and programmes.

6 Market analysis of technology and sector closeness to commercial viability

Based on SNV Market Intelligence research in 2012 and indications of current operational outreach by import-suppliers operating in the Lake Zone, an estimated 10,500 pico-solar applications (8,000 desk light / chargers, 2,500 room light / charging kits) annually enter local markets.

According to import suppliers, present annual growth in solar PV sales in Tanzania is largely restricted due to the lack of retail capacity in the rural areas. Upon the entry of the product to the local market, the import-suppliers report that growth flattens at an estimated 3 % annually due to retailer inability to expand their stock or marketing base. Import-suppliers are further constrained in assisting retailer growth as the initial engagement of a reliable retailer typically results in a loss of one to two year net profit, implying break-even at best, by the suppliers. Under this scenario, growth of the pico-solar sub-sector is occurring at a minimum level; a rate that is insufficient to meet articulated consumer demand levels.

Under this scenario, the value of the RBF incentives, when coupled with their limited time market availability, current retail levels and chain expansion, is anticipated to facilitate a doubling of volume in the pico-solar in local markets in the first year. As the RBF progresses, 30 % growth from year one levels are estimated in the second year. As the RBF continues and the supply chain begins to achieve economies of scale and deeper market reach, growth is predicted to continue at an annual 15 % throughout the remainder of the intervention.

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

Since 2005 there are no major governmental policy gaps that would obstruct the development of the PicoPV market. Additionally some development of this market already has been achieved by past UNDP / GEF, GVEP and Lighting Africa efforts in support of putting a technician and retail base in place. Recently TEDAP opened a credit line for increasing energy access of productive enterprises and service delivery organisations as well as HHs that can afford to pay for electricity. Most of these programmes included awareness building activities, business enterprise training and temporary financial mechanisms (individual loan guarantees).

The modern lighting market in Tanzania is at the brink of opening up. In this market the 'traditional' solar companies that have been operating for the last seven years tend to focus

on large projects and equipment sales. During the last two to three years the market for lighting products is fast moving and largely unregulated. LED torches, fluorescent lamps, and multiple-purpose lighting / radio / cell phone charging devices are increasingly common in retail shops. This market is mainly supplied from the Far East with low quality goods that are sold against low prices. The supplies in this market concentrate more on low cost lighting devices than the aforementioned 'traditional' solar companies normally do. These shops sold products that were increasingly in demand by consumers, but were limited in only being able to carry a small range of low quality product as being offered by their current suppliers. Often the shop owners showed limited basic awareness about the technical quality of the lighting products they sold. Price proved to be a key factor in product choice by the consumers; however, REA and Lighting Africa in Tanzania succeeded in gradually raising awareness about the importance of the quality of the lighting products.

8 Expected private investment and participation in the RBF

The RBF pico-solar project in the Lake Zone is anticipated to facilitate a temporary means of accelerating sustainable sub-sector growth. The RBF incentives are intended to offset the costs of import-distributors in the development of rural retail distribution chains while simultaneously boosting end-retail working capital and cash flow levels by means of higher pico-solar stock turnover ratios (faster / shorter stock accumulation and liquidation periods). This will allow import-suppliers to increase both the volume and rate of import supply orders as the supply channel is capable of handling real growth. Private sector investment will be further facilitated by the natural stimulation of the local consumer market via lowered end retail pricing on quality solar products of the RBF. As a whole, the RBF RMDPS is anticipated to leverage a private sector to RBF programme cost ratio of 2.7:1.

9 Implementation strategy and partnerships

The RBF RMDPS will be driven by three main sets of actors: (i) an FI, (ii) Pico-Solar Import-Suppliers, and (iii) End Retailers. SNV will facilitate their linkages to consortia of public and private sector based local capacity building agencies specializing in private sector development and renewable energy for effective, transparent and verifiable RBF implementation.

The RBF RMDPS Programme will support the transparent and equitable operation of the RBF fund in a manner that ensures verifiable and quantifiable results in the private sector delivery of EnDev endorsed IFC-Lighting Africa approved pico-solar products with 50 lumen output and manufacturer warranties.

Import-Supplier Application and Admission to the RBF Fund

- Multi-stakeholder selection committee to assess and review RBF import suppliers in a transparent and competitive process of shortlisting and onsite due diligence;
- RBF planning, monitoring and performance review services to participating RBF suppliers.

RBF Fund Transactions

- Quarterly import supplier RBF incentive application as based on documented and verified transactions with end retailer sales to end consumers (paper trail and onsite inspection).

RBF Verification

- Annual financial auditing, quarterly financial summaries and monthly reports of hosting FI;
- Full statutory, business and financial documentation plus regular on-site physical inspections (inclusive of independent visitations to randomly selected retailers and consumers) for each RBF supplier.

10 Sustainability and risk mitigation

RBF Uptake: The sales projections taking the two incentives into account were made with the best possible knowledge on expected consumer demand, statements by importer suppliers and retailing market scans on the movement of PicoPV products. If the import supplier is not responding to the offered RBF Import-Supplier Capital Incentive, then this has immediate consequences for the retailers. Even if retailers would react positively on a possible Retailer Bonus Product Incentive, they cannot go forward, as the import supplier does not offer them this possibility. *Mitigation: In case there are clear signals that after one year of operation of the RBF project the import suppliers are not taking up the offered incentive, the project should either be drastically restructured based on first year's experiences or it should even be considered to not proceed the RBF project, in order to minimise financial risks.*

It is also possible that the import suppliers respond positively, but that the retailers are not using their Retailer Bonus Product Incentive for lower pricing of the PicoPV products they sell, and the PicoPV end market risks to get congested. This will in second instance negatively impact the sales from the import suppliers to the retailers and to more reluctance to take a capital risks in view of future Import-Supplier Capital Incentives. *Mitigation: In the current project setup, the reaction of the retailers appears to be the most uncertain part and also hard to tackle. Earlier projections (see Section 5) show however that even without incentives the market would not dry up: PicoPV products would still be sold, but at a much slower pace. Reason for this is that the clear demand for PicoPV products will continue to be thwarted by consistent price barriers as shown in SNV IRES' market intelligence.*

Finally it may occur that both import suppliers and retailers are responding positively to the Import-Supplier Capital Incentive, respectively the Retailer Bonus Product Incentive, but that at the same time at both levels failures in delivery happen. *Mitigation: For the import suppliers this may mean revised yearly pre-RBF planning levels i.e. lower planned RBF incentives for the next year. For retailers this may mean lower Retailer Bonus Product Incentive given by the import suppliers, but also losing end consumers. RBF TA funds in marketing development for better retailer uptake will be given extra attention through SNV core funds (end of 2014) and pending donor programmes (2015-17)*.

Capacity for RBF uptake: The delivery of good quality PicoPV products with proper warranty and after sales services is essential for retaining consumer confidence in PicoPV products. Without such confidence RBF incentives will not have the effects that were originally envisaged. Capacity strengthening at the retailer level is very much needed. *Mitigation: The RBF incentive to retailers will be topped up to enable them to pay for business training. Through this, the project will safeguard good business performance from the smaller retailers, enhancing the chances of success of the RBF. Avoiding exploitation of the retailers by the much stronger suppliers / importers will be safeguarded through sound RBF contracts with the suppliers and including checks in the verification structure of the project.*

Rent-taking / distortion from RBF set too high: The possibility that the setting of the RBF incentives in this project are too high or else that the incentives are too attractive and provoking rent taking behaviour. In the current project RBF levels were set in advance, as well as the expected sales levels as a consequence of RBF mobilization. The expected sales levels were estimated in a slightly conservative way and are based on the indications provided by the import suppliers. According to limited sales information from the import suppliers, the sales increase can be absorbed without much trouble. The picture for increased sales of small / multi-room lighting and charging kits shows a sales increase of 17,113 units over four years and an average of 4,278 units per year. Here, the sales increase can be well absorbed. *Mitigation: When the number of import suppliers would however rapidly increase to six or seven already in the first year of the RBF, or when one or more import suppliers tends to exceed the annual RBF incentive subscription cap that was set at*

45 %, the proposed RBF incentive policy has to be reviewed: a lowering of the RBF percentage for the remaining years to 20 % of the realised sales turnover is then to be considered.

Distorting effects on markets: It is expected that the market will not collapse on withdrawal of the RBF after four years, because the RBF values will decrease sharply for the last two years (from 40% in the 1st two years, to 20 % in the 3rd year and 10 % in the 4th). *Mitigation: At the same time, a degree of flexibility in modifying RBF incentives year on year, alongside on-going stakeholder dialogue, will be built in the RBF modality.*

Insufficient benefit flow to poor people: Two alternative PicoPV product packages are geared to serve the poor rural people that have no grid connection and will not have this later. Both packages do not represent typical rich people's consumer goods, but are geared to provide in-house lighting at low cost. The SNV IRES' market intelligence reporting indicates clearly that PicoPV light appliances are very much in demand by the rural poor. Demand for these products can also be expected from HHs that seek a backup in case their grid connection is not functioning, but this demand is expected to be superseded by the demand from the poor rural HHs. *Mitigation: In the monitoring of the project results, not only physical checking of sales has to take place, but also regarding the income position of consumers / HHs to whom these sales were realised. In case it appears that RBF incentives are not mainly benefitting the rural poor, rescheduling of the RBF modality should be considered by approaching more explicitly the rural poor.*

Policy environment: Major obstacles as a consequence of governmental policy are not present in the market for PicoPV products. The government announced VAT and import duties holidays for PicoPV products and was increasingly promoting and supporting the spread of SHS in off-grid areas. *Mitigation: The fact that the RBF is not directly operating through governmental channels like MEM or REA, has not resulted in actions by these bodies that may frustrate in the near future the advancement of the RBF project.*

11 Summary of expected outcomes and impacts

- 182,000 persons in 115,000 rural HHs will have access to clean solar energy;
- 22.8 million litres of kerosene (with an estimated value of EUR 22.8 million) in HH fuel savings over the lifespan of the products, resulting in the avoidance of 57,000 t CO_2 eq emissions;
- 90 new and / or improved import-supply and retail energy enterprise employment opportunities;
- EUR 3.1 million in private sector investments (NPV) relative to EUR 1.14 million in RBF programme costs (NPV) generating a private sector leverage of 2.7:1.

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	1,401,970
4 Other direct costs	49,693
5 Total direct costs	1,451,663
6 Mark up costs / administrative overheads / imputed profit	89,337
7 Cost price	1,541,000

12.2 SNV budget

	EUR
1 RBF incentive	1,007,030
2 FI allowance	125,878
3 SNV Management Fee	141,610
4 Technical Assistance and Capacity Development Funds	127,452
5 Total costs	1,401,970

G. New country proposals

Vietnam

Project phase	07.2013 – 06.2017					
Project budget	EUR 3,740,000					
Target groups	Small-scale farmers in Vietnam					
Expected outcome at project end					old target	new target
Number of people	Energy for lighting and electric HH appliances					275,000
	Cooking energy for HHs					
Number of institutions or enterprises	Electricity and / or cooking energy for social infrastructure					
	Energy for productive use / income generation					
Promoted technology	[ ] Solar	[×] Biogas	[ ] Stoves	[ ] MHP	[ ] Grid	[ ] Other
Summary of key interventions and outputs	EnDev will implement an RBF mechanism in the domestic biogas sector in Vietnam. The RBF is aimed at facilitating sector transformation away from subsidies, and thereby the creation of the market-driven domestic biogas sector in Vietnam					
Coordination with other programmes	Asian Development: Quality and Safety Enhancement of Agricultural Products and Biogas Development Project (QSEAP) World Bank: Livestock Competitiveness and Food Safety Project (LIFSP) Gardening Association of Vietnam (VACVINA): Biogas promotion activities					
Lead political partner	Ministry of the Agriculture and Rural Development (MARD)					
Implementing Organisation	SNV in cooperation with GIZ office in Vietnam					
Implementing partners	National Biogas Programme (BP)					
Project manager	Name: Christoph Messinger Mail: christoph.messinger@giz.de					

- RBF for domestic biogas

RBF Key Performance Indicator (KPI)	Target
People gaining access (EnDev counting method)	275,000 people
EUR per person gaining access	13.60
T CO_2 emissions avoided (over the lifetime of products sold during project)	4,469,000
EUR per t CO_2 emissions avoided	0.84
Private sector leverage ratio	7
Jobs created	960
Enterprises created	160
Technologies deployed	55,000 biogas digesters

1 Country and project area context

Vietnam continues to be one of the fastest growing economies in the world, having sustained an average growth rate of 6.8 % over the last seven years. In 2011, Vietnam's nominal GDP per capita reached EUR 1,374. However, this statistic masks a growing divide between rich and poor and a strong bias towards job creation and living standards improvement in the urban areas. The rapid development has been driven by production and accompanied by rapid industrialisation and the associated negative impacts on the environment.

Vietnam is one of five countries most affected by climate change and it is believed this vulnerability may eliminate the achievements made in poverty reduction and development. The expected increased frequency of floods, typhoons and droughts will push thousands of coastal and farming communities, with weather dependent livelihoods, back into poverty.

Vietnam has a rapidly growing pig sector, with over eight million HHs deriving an income from it. While the current Biogas Programme has reached 130,000 pig farming HHs since 2003, the estimated market for domestic biogas is over two million small holder farmers. The HHs that would benefit from the proposed project in this concept note are low income, rural HHs, who have not benefitted from the economic growth.

2 Sub-sector and technology focus and rationale

Since 2003, SNV has supported the Ministry of the Agriculture and Rural Development (MARD) in Vietnam with the establishment and implementation of BP. To date, this programme has facilitated the construction of over 130,000 small-scale bio-digesters in 52 of Vietnam’s 63 provinces, thereby benefitting over 600,000 individuals. An improved livelihood is created through the provision of access to inexpensive, sustainable and most importantly clean fuel for cooking, lighting and other income generating activities. While at the same time an improved manure management system, access to organic fertilizer also is valued highly. Limited financial incentives have been used to reach this coverage; the programme provides HHs with a subsidy that accounts currently for about 10 % of the average cost of a domestic bio-digester. Although the programme has exceeded its original expectations, a major share of the potential market for small-scale biogas plants remains unserviced. This is due to the large size of the market as pig farming is one of the main sectors in Vietnam (over six million pig farmers). To further develop the sector, and place it on a commercial footing, it is deemed necessary to transform BP in several major ways:

- Stimulate further market growth through acceleration of access to biogas technology
- Reduce dependency on external financing
- Reduce dependency on government support

- Collaborate with FIs to improve access to microcredit to potential biogas users.

3 Outline RBF incentive design

The RBF project design will ensure transition from an externally supported biogas programme to a market-driven sector. All stakeholders, including owners of biogas enterprises acknowledge that the time is ripe to increase the roles and responsibilities of the enterprises. MARD concurs that the dependency of the sector on external financing is not sustainable in the long term. With enterprises active in the market for over ten years, there is now sufficient technical experience to construct the biogas units, and to operate independently.

The proposed RBF mechanism consists of several components aimed at acceleration of market growth by increasing Small-scale Biogas Plants (SBP) deliveries by biogas enterprises, both those currently supported by BP (at least 10 % growth planned annually) as well as not-donor supported digesters in the commercial market (increase from 40 % outside of the programme to 70 % outside of the programme by 2017). The main parts of the RBF mechanism are:

- [A] Stimulate risk taking by the enterprises: Financial incentives (or fee for service) will be paid to biogas enterprises after delivering a result: a functioning bio-digester that meets pre-agreed quality standards.
- [B] Stimulate market growth: by providing performance-related bonuses to private enterprises, meaning the more SBPs they build, the higher their financial return.

It was not deemed necessary to provide financial incentives to FIs, although the project will cover their incremental training and reporting costs.

RBF incentives will be fixed, i.e. the amount is not linked to the digester size, as (additional) risks taken and additional costs for the enterprises are not larger when the size of the digester is larger.

[A] Financial incentives for biogas enterprises: As part of the new strategy a financial incentive will be provided to the enterprises to stimulate them to accelerate their construction figures. The financial incentive is provided as a result-based fee for successful risk taking and own investment. In other words, this RBF is to stimulate enterprises to invest in their own development by overcoming the financial barrier preventing them from growth. It is foreseen that the immediate tangible benefit (cash in hand) as a result of their efforts will initiate a change in mind-set and / or a behaviour change resulting in increased risk taking. Furthermore it is acknowledged that as the enterprises take more responsibility and act more independently (from the government), they will feel a resulting increased sense of ownership.

As part of the proposal the financial incentive will now be disbursed (through the Vietnamese post office banking system) to the biogas enterprises after the actual construction quality and commissioning has been verified by an independent, certified Quality Controller.

End-buyers prices are set by the enterprise. BP does not interfere with market prices of digesters, resulting in large price differences countrywide.

[B] Performance-related bonuses: The financing of bonuses to well-performing private enterprises is solely to give additional stimulus and reward growth. This type of reward system is a proven, successful tool in the Vietnamese context (often done by Government staff), and it is known to stimulate enterprises and other players to reach their goals. The bonus is for enterprises that reach and / or exceed their growth target. Biogas enterprises will be requested to register, and provide their production figures for the past two years. Companies that are able to increase their production by over 10 % from the average of the past two years will qualify for a bonus of VND 100,000 (EUR 4) per biogas plant in excess of the 10 % growth target. This to induce a behavioural change that the responsibility of the sales efforts has shifted to the enterprises themselves and that their efforts will pay off.

4 Impacts on people and the environment

Lower environmental pollution. If untreated, animal waste is malodorous and acts as a constraint to the expansion of small pig farmers (which is often opposed by neighbours because of the accompanying smell).

Untreated animal waste directly harms the environment. Notably by polluting groundwater and causing eutrophication of water bodies. Small biogas plants therefore help small farmers to expand their businesses, and reduce environment pollution.

Lower cost of cooking gas. When properly operated, a SBP produces sufficient gas for HH cooking, thereby reducing or eliminating the need to purchase or collect firewood or other fuels. In 2012, average cost savings were estimated at VND 336,000 (about EUR 13.5) per HH per month. If cost savings generated by the use of bio-slurry as a fertilizer are added, an SBP has an average payback period of approximately 2.5 years.

Time savings. Annual Biogas User Surveys (BUS) undertaken by BPD indicates that HHs using SBPs save up to two hours per day on cooking, fuel collection and cleaning.

Bioslurry use and Lower fertilizer cost. Bio-slurry can be used to replace chemical fertilisers. In 2011-2012, the resulting cost savings were estimated at VND 84,000 (EUR 3.4) per HH per month. Bio-slurry reportedly also results in higher agricultural yields than chemical fertilizer.

Improved health. BUS and other surveys also indicate that SBPs have resulted in noticeable reductions in respiratory health and eye problems, partly because cooking with biogas does not result in the release of toxic emissions and soot (as is the case with firewood, the most common alternative to biogas). Better hygienic conditions are also achieved by attaching a sanitary facility to the bio-digester. The number SBPs that include a hygienic toilet has rapidly increased in recent years, and now account for over 65 % of SBPs built in 2011 (up from about 15 % in 2006).

Reduced impacts from power failures. Although over 97 % of Vietnamese HHs are connected to the national electricity grid, power failures remain common, especially in rural areas. Biogas can meet energy needs at such moments.

Reduced cooking time. Biogas allows women to start cooking immediately, without having to start a fire and wait for it to reach optimum temperature. Furthermore, biogas is smokeless and does not require constant attention or aeration.

Reduced time to collect fuel. HHs using biogas for cooking do not need to collect or buy traditional fuels such as firewood or rice husks.

Reduced cleaning time. Cooking with biogas is cleaner (producing less soot) and more convenient than cooking with firewood, as it also saves time in cleaning cooking gear and kitchens.

According to BPD's latest BUS, these time savings are mostly used for education, self-development, social activities, and additional income generating activities. It is also important to note that cooking with biogas has no adverse health impacts (unlike cooking with firewood).

Benefits to the poor include all the benefits listed above, with a particular overlap with those experienced by women. It is acknowledge that in most cases biogas technology does not directly benefit the poorest of the poor, as this group in general they do not have the required number of animals (around six pigs or equivalent) necessary to make biogas economically interesting. However access to micro credit could lower the barrier for poorer farmers to access biogas technology and potentially buy additional animals.

Environmental benefits. In addition to direct environmental benefits at the HH level, SBPs help to reduce deforestation. It is estimated that the use of domestic biogas reduces the

consumption of firewood and other agricultural waste (mainly straw and rise husk) respectively on average 685 kg and 456 kg per year per digester. In addition, the use of bio-slurry reduces the consumption of chemical fertilizers (which are relatively expensive and non-organic) and can also be used as fish food. By returning slurry to the fields, depletion of nutrients and organic matter in the soil is reduced. This, in turn, reduces pressure to expand the land area to be cleared for agriculture.

GHG emission reductions. Biogas is produced on a sustainable basis as the methane produced with the degradation of the manure is part of a closed carbon cycle. Therefore, by substituting traditional and fossil fuels and by reducing the need for chemical fertiliser, biogas reduces GHG emissions. Each bio-digester reduces the amount of GHG emissions by 6.3 t CO_2 equivalent per year (Source: PDD registered with the Gold Standard). Upon completion of the proposed project, which envisages the construction of 55,000 SBPs, the annual reduced GHG emission reductions will therefore be at least 300,000 tonnes CO_2 equivalent. BPD is registered under the Gold Standard programme for Voluntary Carbon Credits, and was the first Vietnamese entity to do so. The sales of carbon credits from the existing and new SBPs is foreseen, but actual revenues from this source are unclear since the collapse of prices in the carbon market and the continuant delays in verification and issuance.

Increase in rural employment. At present, the domestic biogas sector employs approximately 1,000 (rural) people on a permanent basis. The proposed project aims to increase the demand for SBPs, and increase the involvement of the private sector in SBP construction. Rural employment in the domestic biogas sector is therefore expected to double in the medium and long term. With the increase in responsibility for the enterprises, and the additional support from BP, increased capacities in business skills and commercial trade are foreseen, resulting in increased sales and improved commercial operation.

5 Strategic fit and alignment with national policies

MARD's strategy aims to have 500,000 digesters built by 2020, an increase in the amount of renewable energy being produced and used within the country, and a decrease in greenhouse gas emissions, although there haven't been accompanying actions to achieve this goal. MARD welcomes support from donors, in both grants and loans, and in turn supports the Biogas Programme which would help them to reach their target by catalysing the shift into a self-sufficient market. MARD also welcomes the continuation of support from the Netherlands Ministry of Foreign Affairs (DGIS), which, in combination with future carbon financing, would be used for partner activities not funded through RBF, like entrepreneur-training and marketing.

MARD has indicated that without external funding, they can no longer perform the many tasks that they are assigned to now at the national and provincial level, like awareness raising, marketing, training etc. The present set-up has created an unsustainable situation. The RBF is seen as the intermediate phase in which MARD's role is reduced and biogas enterprises increasingly develop their business skills (through capacity building activity that will take place outside of this proposal) and prepare themselves for a market with no financial support from third parties.

6 Market analysis of technology and sector closeness to commercial viability

The first signs of a commercially viable market are evident. Masons trained by the programme are starting to construct biodigesters without subsidy and institutional support; and semi-commercial companies are entering into the market offering other digester technologies. Even though the quality of other models and market approaches can be questioned, its development does signal a growing commercial market. Nevertheless, the scale is limited in comparison to the potential market (estimated at more than two million HHs). The programme aims to support these entrepreneurs so they can provide improved

models, guarantees, after sales training and support. The challenge is to have commercial activities country wide.

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

To creation of a market-driven domestic biogas sector in Vietnam requires time and (temporary) external funding. It does not require a change to current government policies. The Government of Vietnam is fully committed to promoting domestic biogas and to encourage a private market for the construction, financing and supporting services for bio-digesters. Stated differently, there are no known policy gaps.

8 Expected private investment and participation in the RBF

At present, the private sector already finances most of the investments in the domestic biogas sector in Vietnam. On average, 90 % of the cost of a domestic bio-digester is financed by the end-user; the remainder is financed by a subsidy. At present, the management cost of BP are borne by the Governments of the Netherlands and Vietnam, but even after taking these costs into consideration, the share of the private sector remains above 80 %, implying a leverage ratio of 1:6. At the end of the four-year implementation period of the proposed RBF, it is foreseen that the financial incentive will be phased out and sector management will be financed from financial contributions from biogas enterprises rather than external financing from development partners. At that point, the private sector will, in effect, finance 100 % of all investments in the sector. As will be shown, there is substantial scope to reduce the total cost of the provision of SBPs, and these cost reductions are expected to offset the withdrawal of financial incentives and external financing in the long term moving the operation to fully commercial market operations.

9 Implementation strategy and partnerships

The Project will be implemented from mid-2013 until mid-2017. The four-year project implementation period is divided in two phases. Phase 1 (mid-2013 to mid-2015) is dedicated to incentivizing private biogas enterprises and modifying the RBF mechanism in five provinces to accelerate sales of digesters together with capacity building of the VBA and the enterprises (non-EnDev Funded). Phase 2 (mid-2015 to mid-2017) will focus on applying the lessons learned from the pilot onto the rest of the country, and starting the phasing out of the RBF component of the new strategy in the same pilot area (2016).

10 Sustainability and risk mitigation

Sustainability strategy

Managing integration of RBF with carbon financing. All digesters build as part of BP are logged in an extensive database capturing baseline data, HH information, construction information and more. The BP project is the only HH biogas project with that is registered for carbon under the Gold Standard. Under the UNFCCC an additional project is registered, but is using a technology that is unlikely to be accepted in BP in the EnDev timeframe.

Exit and sustainability strategy. The proposed RBF is designed to create a market-driven domestic biogas sector that is financially sustainable without external support. It is expected that this objective will be achieved in the five pilot provinces within the project and will initiate an exit there in 2016. By the end of the four-year implementation period, other provinces will also be phased out, likely financed by Carbon Revenues.

Main risks and mitigation strategy

Risk of corruption and fraud. This risk is rated low to medium, given the substantial experience and long lasting cooperation between SNV and BPD, with verifying claims for subsidies, the absence of claims to be submitted by FIs, and an extensive system for

monitoring and evaluation. The sample based verification will increase the risk slightly, but will only be done for experienced enterprises.

Risk of limited effectiveness of RBF. The risk was rated low to medium. Enterprises have expressed their interest in the new set-up, the market is ready for acceleration and growth. The risk will be mitigated by close monitoring, the mid-term review and adjusting the approach if necessary.

Climate and environmental risks. The project is expected to make a major positive impact on the environment (by converting animal waste into energy) and on climate change (upon completion, the project is expected to reduce GHG emissions by 330,000 tCO_2 equivalent per year in year four). The risk of adverse climate or environmental impacts was deemed negligible. For the issuance of carbon credits (which will be used for reporting purposes) potential project related emissions are already reduced of the total CO_2 equivalent emission reductions (First Monitoring Report available upon request).

11 Summary of expected outcomes and impacts

There are two impacts defined:

- A commercially viable domestic biogas sector in Vietnam
- Improve the livelihoods and quality of life of farmers.

The following impact indicators are expected to be achieved:

- 960 additional jobs created related to biogas construction and services in rural areas. Due to the larger number of plants constructed in the market, enterprises need additional staff. Furthermore, as on average 30 % of the enterprises stop operation and the demand on the market is larger than the current enterprises can serve, additional enterprises are trained.
- 330,000 domestic biogas plants will be constructed in the total market.
- Average farming domestic savings on energy and fertilizer of 250,000 VND per digester per month are expected to be realised.

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	3,455,000
4 Other direct costs	72,504
5 Total direct costs	3,527,504
6 Mark up costs / administrative overheads / imputed profit	212,496
7 Cost price	3,740,000

12.2 SNV budget

	EUR
1 RBF Payments to Private Sector	2,750,000
2 Fees/ TA for FIs	41,000
3 Capacity Building	605,596
4 Independent verification	50,000
5 Contingencies	7,404
6 Total costs	3,455,000

Annexes (full RBF proposals)

See ZIP file.