Annual Planning 2016 Update

Energising Development – Phase 2

Draft Version for the Governing Board

energising development

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A. Introduction

The Governing Board of EnDev approved the Annual Planning 2016 during the 13th meeting on November 16th and 17th 2015. The approved Annual Planning 2016 document had been prepared in October 2015, when the Swedish International Development Cooperation Agency had not yet joined the EnDev partnership and the additional funding from the Netherlands and Germany had not been agreed yet. Meanwhile, Sweden is a member of the partnership, the Netherlands approved additional EUR 30 million for EnDev and the German BMZ committed additional EUR 10 million for 2016. As a result of the grown partnership and the additional funding up-scaling of country projects, that are in urgent financial needs, has become possible. An update of the Annual Planning 2016 document is therefore necessary.

To strengthen the performance-based approach of the programme, the EnDev management applied a more sophisticated screening process for the assessment of up-scaling concepts and proposals. The screening process is described in detail in chapter B.

Chapter C summarizes the key data of planned country activities in 2016. Chapter D provides a short forecast of country projects that shall be up-scaled in 2017. Chapter E comprises the up-scaling proposals of the different country activities.

B. Screening procedure for up-scaling country projects

B.1 General description of the screening procedure

To further strengthen the programmes orientation towards scale and impact, and to increase transparency in decision making for both donors and implementing partners, EnDev management revised the screening process for up-scaling of country measures. The revised process supports EnDev in making strategic choices for investments while balancing future funding challenges, safeguarding programme infrastructure, and good opportunities to achieve high impact results.

In the revised process, criteria for performance and potential to scale markets/sectors are applied more thoroughly. Although outcomes and cost-efficiency remain the most important indicators, compared to previous (regular) up-scaling rounds projects are required to provide more information on the way they envisage to reach scale in the (sub-)sectors, i.e. concrete strategies for market/sector development, and ways to cooperate with other key actors in the sector. Projects are also invited to elaborate on the evidence base of claims on for instance market/sector development, impacts, and sustainability. In addition the format takes into account the indicators that have been agreed with the Governing Board for EnDev phase 3, and introduces an additional bonus criterion for concrete gender strategies.

EnDev is not abandoning its basic philosophies or outcome orientation. Coming to scale however requires continuously evaluating and tuning the programmes role in the market. Appreciating differences between markets and countries, Endev's role in some countries remains that of a market initiator whereas in others EnDev needs to take – in cooperation with other actors – a much more facilitating role. By introducing this in the proposal format EnDev management aims to further strengthen the performance of the programme.

From 2016, projects in need of (or seeing good opportunities for) up-scaling are invited by EnDev management to fill in a short proposal format (5 – 7 pages). In this short proposals the projects are requested to explain their views and plans for the up-scaling taking the up-scaling criteria duly into account. The projects receive support from their respective country managers at EnDev Head Office (GIZ and RVO). EnDev head office (management and country managers) jointly evaluates all short proposals and provides feedback and recommendations to the projects that are either selected or not to submit a full proposal for the EnDev Governing Board. EnDev head office will financially balance its recommendations according the available funding. On the basis of the recommendations the project prepares a full up-scaling proposal to be included in the (updated) annual planning for board approval. Country managers assist in the process, assuring that major recommendations are taken into account. Responsibility for the proposals lies nevertheless with the country projects.

B.2 Up-scaling criteria

For the proposals, next to the general criteria for EnDev engagement in a country (documented in the EnDev strategy paper), the following up-scaling criteria apply. Two new criteria are introduced, one conditional requiring country projects to have a clean track record with respect to administration and finances, and a second providing a bonus to projects that included a clear tangible gender strategy.

Up-scaling criteria
Cost efficiency (current and anticipated)
Sustainability (proven/expected)
Impact (proven)
Degree of market/sector development & scalability
Conditional criteria
Administrative & financial clean track record (per GIZ standards)

Bonus criteria
Least developed countries
Strategic importance for (individual) EnDev donors
Electrification activities
Higher service level access
Remote areas
Concrete gender strategy

B.3 Assessment of up-scaling concepts of country projects

Eleven projects were invited to submit a short proposal for evaluation because of a) a shortage of funds related to the current project end-date in mid/end of 2016, or b) the opportunity (Ethiopia, Mozambique) to receive substantial co-funding on the country level (or a combination thereof). Two projects (Central America and Peru) were invited to present an up-scaling proposal for their regional funds as they received a pre-financing from EnDev management budget that originated from a special budget line of BMZ.

The quality of the short proposals varied. Whereas for instance some projects demonstrated a very good understanding and market development vision, others appeared to focus more on achieving concrete numbers of outcomes at lowest possible costs without explaining the long term strategy. Assessing the short proposals in an early phase of the up-scaling process proved therefore valuable as it offered the opportunity to provide feedback and guidance to the projects on the basis of a coherent and transparent comparison between all submitted proposals. In this round, the selection process was not aimed at selecting certain projects at the expense of other projects having to close down. It did, however, aim for a stronger competition for the available funds. EnDev management had capped the overall budget for this up-scaling round at EUR 16 million, less than the total amount of shortly over EUR 25 million, in order to have a second up-scaling round in the second half of 2016. This resulted in project budgets being cut and/or made partially conditional to additional core-funding, on the basis of the quality of the proposal and their performance in the past.

Of the **eleven** submitted short proposals, **one** was evaluated of too low quality and rejected. **Three** expressed a high quality of market development strategy, based on experience and performance so far. These were invited to present a full proposal without budget cuts or stringent recommendations. **Four** proposals were selected with recommendations for the full proposal and conditional (only if EnDev secures new additional core funding) parts of the budgets varying between 17% and 25%. **Two** more projects were recommended for both; a budget cut of 8% and 25%, and conditional funding of 16% and 10%, respectively. Finally, **one** project was recommended with a 60% cut in the proposed budget. The total amount of the full proposals amounts to EUR 18 million, of which EUR 2.5 million is conditional to secured core-funding for EnDev.

B.4 RBF round one up/downscaling

In addition to screening the up-scaling of “classic” projects, EnDev management and DFID evaluated the RBFs projects of round one regarding their current status and performance expectations. As a result, it is proposed to reallocate funds between RBF round one projects. Three projects are proposed to be scaled down, one to receive additional funding, and for five projects the project end date was extended. The proposed budget and timeline changes, as well as readjusted KPI’s are provided and briefly commented in either the up-scaling proposals or, where this is not applicable, in separate country sheets. A summary of the evaluation, as well as more elaborate justifications for up- or downscaling are available with EnDev management.

C. Overview about planned country activities in 2016 under EnDev 2

The total budget of the second phase is currently EUR 290.7 million. Below, an overview of country activities is provided. Table C.1 gives an overview of ongoing and unchanged projects (compared to the previous Annual Planning 2016 document), including regional RBF projects. Country activities that are foreseen to be extended without up-scaling are presented in table C.2. Table C.3 presents the country activities that are proposed to be scaled up or down (condition to availability of funding) and table C.4 presents country activities that are intended to be scaled up or down and extended.

Table C.1: Ongoing 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
Burkina Faso	stoves	10/09	03/17	5,785[1]	1,000,000[2]
Burundi	solar, stoves	09/10	06/18	3,200	130,000
Cambodia	biogas	12/12	12/16	2,300	60,000
Ghana	solar, stoves, grid	01/10	12/16	3,150	1,200 (+ 1,180 SMEs)
Indonesia	biogas	12/12	12/16	1,500	25,000
Indonesia	solar, hydro	05/09	07/18	11,960	172,000
Kenya	solar, biogas, stoves, mini-grid	07/09	06/18	19,435	6,550,000
Liberia	solar, solar dryer, stoves	05/12	05/17	3,200	50,500
Mali	solar, mini-grid	01/13	12/17	3,000	100,000
Nepal	stoves, hydro, grid	05/09	06/18	6,965	399,337
Senegal	solar, stoves, mini-grid	04/09	03/17	up to 14,201[3]	1,000,000[4]
Vietnam	biogas	07/13	06/17	3,740	275,000
RBF Mekong (Cambodia, Laos, Vietnam)	stoves	03/15	02/19	4,096	600,726
RBF Kenya, Tanzania, Uganda	biogas	03/15	02/19	3,870	128,940
RBF Malawi, Mozambique	stoves	03/15	02/19	1,258	640,000
RBF Bangladesh Kenya	off-grid solar	03/15	02/19	4,110	1,111,200
RBF Mozambique, Uganda, Sub-Sahara Africa	grid densification	03/15	02/19	4,421	200,000

1 Including up to EUR 485,385 contribution of EU to ProCEAO Burkina Faso.
2 Not including the targets of the contribution of EU to ProCEAO.
3 Including EU co-financing budget: PASES up to EUR 2,370,000, ProCEAO Senegal up to EUR 531,354.
4 Not including the targets of the contribution of EU to ProCEAO.

*Table C.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
Malawi	solar, stoves	12/12	12/16	06/17	2,500[5]	725,000

*Table C.3: Country activities intended **to be scaled up or down***

Country	Activities	Project Duration		Funding in EUR 1,000		Planned outcomes on HH level in persons	
		Start	End	Old funding	New funding	Old target	New target
Central America	solar, stoves, hydro, grid	09/09	12/18	16,260	16,790	451,420	451,420
Peru	solar, stoves, grid, SWH-RBF, stoves-RBF	06/09	06/18	16,390	16,920	1,206,500	1,231,500

[5] EUR 500,000 might be added pending a contribution from Irish Aid.

*Table C.4: Country activities intended to be **scaled up or down 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	solar, stoves, solar-RBF	06/09	06/17	05/19	22,714[6]	25,250[7]	5,800,000	7,050,500
Benin	stoves grid, solar-RBF	10/09 10/09	12/17 06/17	08/18 06/18	5,257[8] 7,160	7,757[9] 7,160	1,000,000[10] 406,415	1,400,000 538,689
Bolivia	solar, stoves, grid	10/09	12/16	08/18	13,000	15,000[11]	730,000	886,100
Ethiopia	solar, grid stoves, hydro, stove-RBF	01/10	06/17	04/19	19,137	29,393[12]	1,612,750	2,119,250
Madagascar	stoves	12/12	12/16	06/18	300	800	47,500	130,000
Mozambique	solar, stoves, hydro, grid	10/09	12/16	02/18	12,500	14,500[13]	420,000	549,000
Rwanda	solar, biogas, hydro, solar-RBF, mini-grid-RBF	10/09	06/18	06/19	15,490	15,140	1,028,634	701,884
Tanzania	stoves, solar-RBF	12/12	06/17	06/18	2,571	5,660[14]	245,000	560,000
Uganda	stoves, SHS, picoPV, hydro, grid	04/09	12/16	08/18	9,250	12,250[15]	534,000	707,800

[6] Including EUR 3.2 million earmarked for solar lanterns.

[7] This includes an up-scaling of EUR 3,991,515 for stove activities and a downscaling of 1,455,515 for the RBF component. Only EUR 3 million of the additional general funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

[8] Including up to EUR 456,790 contribution of EU to ProCEAO Benin.

[9] Only EUR 2,069,000 of additional funds are guaranteed, remaining is subject to availability of EnDev Global funds. Including up to EUR 456,790 contribution of EU to ProCEAO Benin.

[10] Not including the targets of the contribution of EU to ProCEAO.

[11] Only EUR 1,800,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

[12] New funds to be made available from the following sources: EUR 9,000,000 by the EU, EUR 1,500,000 by EnDev global both for overall up-scaling of EnDev Ethiopia, and EUR 418,000 by NORAD for school electrification. In addition, the RBF component has been downscaled by EUR 662,000.

[13] Only EUR 1,800,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

[14] Contains EUR 1,998,030 additional funds for the RBF plus EUR 59,970 additional GIZ budget for RBF as well as EUR 1,031,000 additional funds for general EnDev activities. Only EUR 831,000 of the additional general funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

[15] Only EUR 2,500,000 of additional funds are guaranteed, the remaining fundingis subject to availability of EnDev Global funds.

D. Forecast for Annual Planning 2017

This Annual Planning 2016 Update focusses on those projects that have been of urgent need for additional funding to be able to continue their activities in 2016. Some projects which received a bridge funding or still have sufficient financial resources for 2016 will be candidates for up-scaling in 2017. The screening process for selecting and assessing up-scaling concepts and proposals will start in August and be summarized in the Annual Planning 2017 document. 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 concepts and proposals or at least extensions will be presented to the Governing Board in autumn this year:

- Benin
- Burkina Faso
- Cambodia
- Central America
- Ethiopia
- Indonesia
- Kenya
- Liberia
- Malawi
- Mali
- Nepal
- Peru
- Senegal

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

E. Up-scaling proposals

Bangladesh

Promoted technologies		solar / stoves			
Project period	old	06.2009 – 06.2017	**Budget (EUR)**	old	22,714,000[16]
	new	06.2009 – 05.2019		new	25,250,000[17]
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		2,300,000	2,622,500		people
Cooking / thermal energy for households		3,500,000	4,428,000		people
Electricity and/or cooking / thermal energy for social infrastructure		0	0		institutions
Energy for productive use / income generation		0	100		SMEs
Lead political partner		Bangladesh Ministry of Power, Energy and Mineral Resources			
Implementing organisation		GIZ			
Implementing partner		Solar: Infrastructure Development Company Limited (IDCOL), solar companies; stoves: Bangladesh Bondhu Foundation, Ministry of Environment and Forests			
Coordination with other programmes		Renewable Energy and Energy Efficiency / Sustainable Energy for Development (SED) project (BMZ), GEF, KfW, IDA, GPOBA (DFID), GPOBA (SIDA), ADB, WB, IFC			
Key interventions		• picoPV (>= 1200 lumen hours) RBF component with IDCOL • picoPV (< 1200 lumen hours) RBF component with solar companies • Support of sales and installation of improved cookstoves that are suitable for indoor cooking and promotion of clean kitchen environment through BBF • Support of sector coordination for cooking appliances and fuels through the national household energy platform (HEP)18 and Sustainable and Renewable Energy Development Authority (SREDA) • Capacity building for SREDA			

[16] Including EUR 3.2 million earmarked for solar lanterns.

[17] This includes an up-scaling of EUR 3,991,515 for stove activities and a downscaling of 1,455,515 for the RBF component. Only EUR 3 million of the additional general funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

[18] The national household energy platform (HEP) is a platform to coordinate activities of international organisations active in the field of cooking energy such as the Global Alliance for Clean Cooking, SNV and EnDev as well as activities of national organisations. The platform will be launched in May by SREDA which is part of the Ministry of Energy

Main strategic changes introduced with up-scaling	The main strategy so far has been very successful and consequently will not be changed. The project concept will be amplified through a closer alignment of activities with those of other partners and by strengthening the household energy platform. In addition EnDev will pilot the introduction of new stoves if they fulfil the established health and clean kitchen standards.
Project manager	Jan Söhlemann, Jan-Hendrik.Soehlemann@giz.de

1. Situation analysis

1.1 General energy situation in the country

Bangladesh is one of the world's poorest and most densely populated nations. The last Household Income and Expenditure Survey (2010) classified 32% (from 56.6% in 1990/91) of the country's population as "poor". 17% of the population is considered "extremely poor" having income below the lower poverty line. In rural areas, where more than 70% of the population lives, 35% are "poor" and 21% "are extremely poor".

Lack of access to modern energy services is one of the reasons for poverty and low economic development. According to recent estimates 74% of the population have access to electricity. However, the electricity supply is not reliable and supply does not meet the demand. Load shedding occurs up to 14 hours a day. Households without access to electricity generally use inefficient, kerosene lamps as sources of light. The kerosene price has almost doubled in the last five years.

Only about 6% of the entire population has access to natural gas for cooking, primarily in urban areas. Biomass such as wood, cow dung and agri-cultural residues are the dominating fuel for cooking. In rural areas they are collected mainly from the local environment. In urban and peri-urban areas they have become a traded commodity with increasing prices as access to biomass becomes continuously more difficult. The supply of new gas connections to industries have been suspended in 2009 and resumed in April 2012. Also new gas connections to household were suspended for a certain time.

a. Access to modern cooking solutions

The most important staple food in Bangladesh is rice in combination with various kinds of lentils (locally known as daal). Also common are wheat, meat, eggs, and different vegetables. In regions near the sea or lakes households eat also more fish. Meals are generally prepared by women on fixed stoves indoors or in a semi-enclosed shelter. Portable stoves are also common but used more occasionally. Most Bangladeshi households in rural areas (99%) as well as urban areas (60 - 66%) use biomass such as wood, cow dung, jute sticks or other agricultural wastes for cooking. The fuel is used in traditional stoves which consist of a hole in the ground with a raised clay lip to rest the pot, with a separate fuel entry hole. Many households cook large volumes of food in large pots. Stoves are often fed with bigger pieces of wood or dungsticks. Households are unaccustomed and/or unwilling to chop wood into small pieces. In addition, traditional stoves are constructed in a way that the fuel naturally slides further into the combustion chamber as it burns. This allows multi-tasking during cooking.

The traditional clay stoves are inefficient and generally poorly ventilated so that they produce smoke and soot. Housewives are exposed to high levels of air pollutants between three and seven hours a day. The World Health Organisation (WHO) estimates that more than 49,000 women and children are affected by premature death each year as a direct result of exposure to indoor air pollution, with more than 30 million households impacted by exposure to household air pollution each year.

The rapidly expanding population and heavy reliance on biomass has put pressure on Bangladesh's limited forest resources. Fuelwood is becoming increasingly scarce and more expensive, which has pushed many consumers towards other forms of biomass such as crop residues, rice husk briquettes and cow dung.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans

The Government of Bangladesh has the ambition to achieve universal access to modern energy technologies and services by 2030. To reach this goal the government has defined the following targets:

- Grid extension: between 2016 and 2020 the percentage of households connected to the grid shall increase from 72% to 96% according to the five year plan of the government.
- The total accumulated number of SHS sold through the IDCOL programme including pico and small systems shall reach 6 million by 2017, with an estimated generation capacity of 220 MW of electricity.
- In the Country Action Plan for Clean Cookstoves (CAP) the Power Division of the Ministry of Power, Energy and Mineral Resources defined the target to disseminate cookstoves to over 30 million households by 2030.

1.3 Institutional set-up in the energy sector

For the present up-scaling only the cooking subsector is relevant. Most important institutions are:

Government:

- The Bangladesh Ministry of Power, Energy and Mineral Resources (MPEMR) is in charge of electrification activities as well as of improved cookstoves. The Power Division is responsible for the Country Action Plan for Clean Cookstoves.
- The Sustainable and Renewable Energy Development Authority (SREDA). SREDA is part of the MPEMR and placed under the Power Divison. SREDA is a kind of coordinating agency acting as a focal point for sustainable energy promotion and development of suitable policy frameworks, 'sustainable energy' comprising renewable energy and energy efficiency. SREDA is also hosting the National Household Energy Platform (see footnote).
- The Bangladesh Standards and Testing Institute is currently in charge of defining standards and testing technologies including for clean cookstoves. The responsibility for stoves may change in future.
- The Bangladesh Council for Scientific Industrial Research is the institution that came up with the original design of the Bondhu Chula improved cookstove and are part of the testing committee under the IDCOL/World Bank stove programme
- The Ministry of Environment and Forests (MoEF) is supporting improved cooking promotion through provision of a subsidy component.

Civil society organisations:

- More than 40 organisations, among them big NGOs like Grameen Shakti and BRAC, as well as NGOs specialised on stoves such as Bangladesh Bondhu Foundation, which provide different services to the stakeholders along the value chain of solar products and improved cookstoves.

Private sector:

- At least 5 companies producing so called advanced stoves
- Around 5,000 sanitary shops producing Bondhu Chula stoves

1.4 State of market/sector development

a. Solar

In the last 10 years 49 companies and NGOs disseminated SHS and SSHS on a commercial base in cooperation with IDCOL. The biggest organisation is Grameen Shakti with a market share of around 30% of the "IDCOL sales". An unknown number of companies is selling solar systems outside the IDCOL approach among them BRAC, the biggest NGO of Bangladesh. According to estimates the share of the SHS sold outside the IDCOL approach is roughly 50% of the total market.

Since October 2013 sales figures of SHS (system size: 30 W and above) were going down gradually to a level of 20,000 to 25,000 systems per month. Several reasons contribute to this tendency. The main ones are:

- the increase of the price due to the end of the subsidies;
- the existence of competing products on the market which are of lower quality and up to 50% cheaper than products provided by the IDCOL partners
- the decreasing willingness of households to pay their instalments
- inefficient collection practices contributing to the higher prices of "IDCOL" SHS
- grid extension
- decreasing service levels of partner organisations to save costs
- political unrests and
- last but not least, the introduction of the SSHS which are becoming increasingly popular and are still subsidized.

The existence of cheaper products on the market contributes to the decreasing willingness of households to pay their instalments as many households have the impression that NGOs are betraying them with the high prices. NGOs explain the higher prices with the high costs for maintenance services and instalment collection. In addition, they invest a significant amount of time in awareness creation and customer relation.

The sale of SSHS as part of the IDCOL programme was introduced in 2007/2008. Sales of SSHS reached a maximum in September 2013 with more than 50,000 per month. Since December 2014 figures decreased to 20,000 to 30,000 sales per month. It is assumed that some of the negative factors mentioned for SHS are also valid for SSHS. Small solar systems are also sold by rural informal shops, in most cases using low quality components. As these small shops cannot offer credit facilities, systems have to be sold cash. Even with an IDCOL subsidy of 20 USD the SSHS systems are relatively expensive compared to these products imported from China. While sometimes such vendors offer warranty of one year, the products are often of very low quality and customers as well as vendors appear to have higher expectations regarding their lifetime. Furthermore some companies raised concerns that IDCOL's certification procedure forces suppliers of systems to pick and choose system components from a list of preapproved products which are often more expensive than alternatives. While the non-IDCOL sector is lacking a central quality control mechanism, it cannot be said in general that all those products are of lower quality.

Small rechargeable LED lamps and lanterns are broadly available on the market for even lower prices, and with even lower lifespan, adding to Bangladesh's environmental problems. Producers of new picoPV systems around 10 W_p nowadays also look into ways to include efficient TVs and fans as appliances in their systems. Almost all of the systems offered include options to charge mobile phones. However, the smallest systems which have rather low light levels anyway, often force the households to make a choice either to charge the mobile phone or to use the light of the system.

The commercialization of high quality picoPV systems certified by Lighting Global is still in an initial stage. Several organisations and companies (among them BRAC, JITA and Total) have started to sell solar lanterns, but the success has been limited. In 2012 GIZ carried out a survey in the Shatkira district, a hurricane and flood prone area with high rates of extreme poverty. Over 85% of households without a solar lighting system expressed the desire to purchase one but for almost all of these households "price" was the reason for not owning one already. In terms of their purchase-motivation three answers stood out: "money savings", "improved illumination" and "improved study conditions". Mobile phone charging was the 4th most mentioned reason for purchase motivation.

b. Stoves

Over 90% of the 35 million households of Bangladesh use traditional biomass for cooking (60% of the urban households and almost all rural households), whereas only 7%-8% use natural gas. As a whole, Bangladesh has a great market potential for ICS, estimated at more than 29 million households. As 67% of households use more than one stove, the total number of stoves that could be sold would be

over 50 million. With the decreasing availability of gas in urban areas, the use of stoves other than gas stoves will increase also in urban areas. This represents an opportunity for higher tier fuel efficient stoves to enter the cookstove market in urban areas. That would have to be advanced biofuel stoves since electric stoves are not considered an option by the government to avoid an overload of the grid.

The promotion of improved cookstoves (ICS) already started in the early 80s, but the dissemination rate is still low, merely 3-4%. Presently several donor agencies, local, and international NGOs are coming up with promotional programme on clean cookstoves. As a result, several NGOs and entrepreneurs developed new ICS and are trying to commercialize them. Most common are fixed stove models with or without chimney called Chula. They are either made with clay or concrete. Around 1 million households are using such a fixed Chula stove. Portable ICS do not play a major role in the market. Also, penetration rate of portable gasifier stoves is still very low with a few thousand pieces sold. The vast majority of people (more than 90%) still use traditional stoves that are inefficient and emit significant amounts of indoor air pollutants. However, they are easy to construct with locally available materials and can use any type of biomass as fuel.

The type of biomass fuel is very diverse. Families are often using whatever they can collect to fuel their stoves. For households with improved cookstoves, it is not uncommon to have a traditional backup stove. In rural areas, more than 90% of the households use biomass to cook all or part of their meals. 76% of households use some form of 'leafy biomass' to cook, while 55% of households use dung cakes and sticks. Many households use both biomass and dung cakes. Agricultural residues, leaves, and grass account for 39% of cooking energy, while animal dung makes up around 17% of the cooking energy. About 40% of all fuelwood is purchased from local markets. The price of dry woody biomass is EUR 0.08 - 0.11 per kg, depending on the quality, while the price of charcoal is EUR 0.14 – 0.16 per kg. The majority cook indoors in the rainy season and outdoors during the summer. In urban areas, natural gas plays a much larger role although current supply is unreliable and many are still not connected to the gas grid, hence commercial operations (hotels, food shops, bakeries etc.) mostly use rice husk and sawdust briquettes. Street food vendors use twigs, cow dung, leafy biomass and briquettes. Fuelwood traders sell wood in bundles (50-60 kg) costing around EUR 2.74 – 4.39.

The main **barriers** for the dissemination of ICS are:

- Lack of awareness by the population on the negative effects of the traditional cooking practices including the harmful effects on health and environment, resulting in a lack of interest in ICS technologies and in a low willingness to pay more than a few EUR for a stove.
- Un-aligned ICS donation and subsidization practices which hamper market strategies if they are not designed and coordinated in an appropriate manner.
- Lack of regulation framework for ICS, especially no ICS quality certification and lack of capacities in testing institutions.
- Lack of capacity to pay by the poor.
- Cultural and geographic diversity of the country. Among other challenges, difficulty of promoting ICS in remote poor areas.
- Lack of support for the research and development of ICS.

1.5 Relevant activities of other donors and implementers

The World Bank is currently financing a household energy component of the Rural Electrification and Renewable Energy Development project to help the dissemination of 1 million improved cookstoves and 20,000 biogas plants by 2018 (100,000 in 2015; 200,000 in 2016; 300,000 in 2017 and 400,000 in 2018). The programme is managed by IDCOL and implemented by currently 42 organisations so called partner organisations (POs). Under the program, IDCOL provides EUR 5.54 per ICS as grant to the POs for awareness and capacity building. Besides the grant, IDCOL assists the POs in their capacity building through regular arrangement of technician training, mason training, field promotion training, IT training, management training etc. On the other hand, IDCOL is going to run a countrywide promotional campaign of its ICS programme. Furthermore, IDCOL provides various

promotional materials like leaflets, user manuals, calendars etc. to its POs. Currently six stove models are being disseminated under the programme which are made of concrete. These stoves are produced by POs and local entrepreneurs. The thermal efficiency of the selected stoves ranges from 20% to 25% while the efficiency of the traditional stoves is around 8%. Recently IDCOL invited national and international stove manufacturers to certify their stoves with higher levels of thermal efficiency (above 25%), which in turn -if certified- will be disseminated under IDCOL's ICS programme. On the other hand, IDCOL has a continuous effort for research and development in this sector. IDCOL engaged the 'Department of Chemical Engineering' of the Bangladesh University (BUET) to develop improved models of ICSs and low cost clean fuels such as briquette and pellet. For the ICS programme, an independent Technical Committee (TC) is formed to determine the technical standards as well as approve the eligible models.

The Global Alliance for Clean Cookstoves (GACC) started working in Bangladesh in 2011/2012 and assisted in developing a Country Action Plan. In collaboration with Accenture Development Partnerships and USAID, GACC has conducted a larger ICS market sector study and carried out business training for stove producers. GACC supports the strengthening of industrial (national and international) production of portable gasifier stoves and subsequent distribution channels, and the development of national policies, standards and regulations. GACC also supports the establishment of reliable testing methods and facilities in the country as well as raising awareness, while building the evidence base for a comprehensive clean cooking agenda. GACC also initiated the idea of the Household Energy Platform, which will now be launched by SREDA in May 2016. The HEP will provide a forum for relevant ministries, development partners, private sector and academia to coordinate and align better and plan activities jointly.

SNV has been working in the field of stove standardization and testing and drafting of the Bangladesh Country Action Plan for Clean Cooking.

USAID has in the past supported the distribution of ICS with GIZ through the "Integrated Protected Area Co-management" project. Further USAID interventions are WASHPlus and "Catalyzing Clean Energy in Bangladesh", both of them include ICS components. USAID originally planned to invest 15 million USD into the stove sector, but will probably reduce its activities in the sector as the promotion of industrially produced advanced stoves was not successful. USAID tested the marketing of these stoves through WINROCK, however, the stoves were not accepted by the customers as they were too expensive.

UNICEF with financing from Marks and Spencer bought carbon credits from the Bangladesh Bondhu Foundation (BBF) for 40,000 stoves. These stoves have to be used for at least 1 year. The total contribution is 728,118 EUR. UNICEF plans to extend the cooperation with BBF.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

The project expects that the demand for improved cookstoves will increase in the coming years due to increased consumer awareness about the harmful effects of the traditional cooking systems. The main challenges will be to develop the supply side in a way that manufacturers and retailers provide a sufficient number of high-quality stoves at affordable prices, which are convenient and meet the specific demand of the different customer groups. So far, the project has focused its activities on the Bondhu Chula stove, a fixed stove with chimney made with concrete that is relatively cheap and significantly reduces indoor air pollution. Currently no other stove type on the

Bondhu Chula stove

Bangladesh market has similar benefits at comparable, affordable prices. The project aims at strengthening production and marketing resulting in an annual growth of sales figures for the Bondhu Chula stove by roughly 20% on average (from currently 12,000 to 20,000 per month). It will be important for medium to long term stability of the market that the profitability of the Bondhu Chula business is comparable to other products of sanitary shops.

The Bondhu Chula stove is especially suitable for rural markets. In densely populated urban and peri-urban areas, advanced biomass stoves that emit almost no smoke may be an interesting alternative to LPG stoves or traditional and improved cookstoves. EnDev will explore the potential of this market and pilot support of the advanced biomass stoves.

2.2 Specific intervention strategies per (sub)sector

Solar: EnDev will continue to implement the two picoPV projects, one RBF project with IDCOL and another one with local partners outside the IDCOL approach. In the latter project subsidies are linked to performance of the systems (lumen-hours per solar day). A subsidy of EUR 0.014 per lumen-hour is paid. Both components have been described in detail elsewhere and are not part of the requested additional funding.

Stoves: EnDev will continue to support around 5,000 sanitary shops to build, promote and sell improved cookstoves with chimney. Endev's support is mainly channelled through the Bangladesh Bondhu Foundation (BBF). BBF provides technical training to the stove builders to promote high-quality stoves at affordable prices. BBF will also support the stove manufacturers (sanitary shops) in marketing their products through sales and marketing staff (roughly 480 people) employed by BBF. These so-called promoters have the task to approach local governments, provide trainings to users and create awareness amongst the population in community meetings and in similar settings. In addition, female volunteers receiving allowances do promotional work in their home villages and assist families in using the new stove. Endev's strategy for market development is aimed at establishing a nationwide network of small-scale manufacturers each serving a certain number of communities comparable to the network of different craftsmen which provided basic services in rural areas in Europe for decades. In parallel EnDev will explore whether an industrial mass production of stoves is feasible so that the role of the local stove fitters would be focused on installation and repair work. Other cooking system technologies (other stove types, hot bag, etc.) have been piloted and receive support to scale up their business in case of promising results.

Endev's activities in the coming two years will be largely built on results achieved so far. Thus far, EnDev has facilitated total sales of 1.8 million stoves. Out of these 730,000 are assumed to be still operational, based on an estimated lifetime of 5 years, benefitting 3.26 million people. To date, market development is still in an unsustainable state, where sales are supported by awareness campaigns and buy-down grants so that stoves are in a price range of EUR 6 - 10. Sales of products of a higher cost range of 1500-2500 taka (EUR 17-30), produced by 5 local companies have begun to take up over the last year, yet the sales figures of the organisations involved are still low and unstable. EnDev is cooperating closely with the MoEF and SREDA. The MoEF provides a stove subsidy of BDT 250 (EUR 2.75) for every installed stove to producers to make stoves more affordable and the stove business more profitable.

EnDev together with its partner organization Bangladesh Bondhu Foundation are in regular exchange with the Ministry of Environment (Department of Environment), the Sustainable and Renewable Energy Development Authority (SREDA) of the Ministry of Energy's Power Division, IDCOL, partner organisations of IDCOL (such as Grameen Shakti), UNICEF, Winrock, GACC, SNV, and USAID. It is planned to intensify cooperation with these organisations, especially to strengthen the "Household Energy Platform" and to support the country action plan for clean cook stove. EnDev is currently already providing staff to the platform and capacity development to support the setup.

2.3 Sustainability of the intervention

In 2015 EnDev had to reduce its stove activities due to financial problems. Also the government stopped for several months their contribution to the stove programme (EUR 2.74 per stove) as the corresponding budget was approved with significant delay. Despite these shortfalls sanitary shops continued to produce and sell stoves, however at a lower scale (roughly 50% of previous sales). It means that a certain degree of sustainability has already been achieved. Project activities mainly help make the stove known to a broad number of households. Thus, the marketing and promotion activities of EnDev are an add-on for the stove producers and retailers to stimulate market growth but not necessary to ensure a self-sustainable market.

Another key role of EnDev is to assure a high quality of stoves. EnDev has established a quality check system and is providing training to the manufacturers. It is expected that both measure contribute to ensure that low quality products get no chance to spoil the market.

EnDev has supported the creation of the Bangladesh Bondhu Foundation (BBF). BBF is foreseen to become a key organisation to promote modern indoor cooking systems and healthy kitchen environments and to develop innovations in the sector. BBF is a Non-Governmental Organisation that has access to national as well as international grants. Endev's target is that BBF does not depend on EnDev financing or any other single donor.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	Reduction of the use of (non-renewable) biomass in households will benefit the local biodiversity by reducing the pressure on natural resources and forests.
Health	Less diseases caused by indoor air pollution; customers of improved cookstoves will be less exposed to harmful indoor air pollution and benefit from improved health.
Poverty/livelihood	• Less expenditures through fuel saving • Less collection work • Creation of 200 jobs along the value chain
Education	Better environment for learning, saving of time for learning
Governance	The project will contribute to a better coordination of activities among organizations active in the cooking sector
Climate change	Annual reduction of CO_2 emissions by 118,000 t CO_2e
Gender	Gender balanced access to modern cooking, gender balanced job creation; - Especially women and children in households will benefit from the improved cooking conditions, on the one hand through less exposure to smoke and pollutants, on the other hand by reduction of labour required procuring cooking fuels.
Market development	• Increase of sales figures of 15% per year • Profit margin in the stove business is comparable to those of other products on sale in the sanitary shops • At least one additional stove or other cooking system component has been thoroughly tested and introduced

4. Possible risks and potential ways to mitigate them

EnDev Bangladesh is implementing general risk management measures covering privacy protection as well as financial, integrity, information technology, organisational, human resource, political, legal and reputation risks.

In addition, EnDev Bangladesh is specifically observing the following risks:

- lack of skills, knowledge of technology among the stove producers and key stakeholder affecting market development;
- price of stoves are too high or quality too low leading to a lack of interest and trust of consumers;
- entering of other actors and programmes with concepts that affect EnDev approaches;
- changing or insufficient demand for promoted stoves reducing the motivation of the private sector to invest in the stove sector;
- unfavourable framework conditions that hamper the development of the stove sector;
- unacceptable security situation making it impossible for EnDev to work in rural areas of Bangladesh

EnDev Bangladesh analyses the market situation for stoves on a regular basis. This includes the skills and capabilities of the stove manufacturers, the awareness and level of information of customers, affordability and quality of products, activities of other donors and other public and private actors, and the general frame conditions. The project concept is continuously adapted to the results of this analysis. In case that the project success is seriously affected EnDev will reduce or completely terminate its activities in Bangladesh and invest remaining funds in other country projects.

5. Budget

		EUR
1	Human resources and travelling	508,800
2	Equipment and supplies	28,000
3	Funding financing agreements/local subsidies	3,000,000
4	Other direct costs	171,935
5	Total direct costs (sub-total)	**3,708,735**
6	Mark up costs/administrative overheads/imputed profit	282,780
7	Cost price	3,991,515

RBF Bangladesh: Output-based Pico-PV System Development

1. RBF project revision

In the annual RBF review meeting, it was recommended that the project will be:

- Extended time wise until: **06.2018**
- Downscaled budget wise to: **EUR 1,758,485**

As there have been no significant movements on the Bangladesh market for picoPV systems, a downscaling of the project is recommended. It is suggested though that a reassessment of the situation and a potential decision to reallocate funds to the project should be taken in early 2017, since the project has raised expectations within partner organizations, that funds would be available, should the market in Bangladesh finally pick up. As per projection, the first contract with IDCOL covers a period, longer than the current project period and a time extension of the project until 06/2018 is requested.

Downscaling with one year extension is a valid option in view of risks (uptake of grid-electrification), period (only 17 months left) and current progress. Yet, there are certain risks associated with that: In the case of small solar home systems, 116,000 were sold in the first 27 months of the IDCOL project, while it is assumed that within the same timeframe 75,000 picoPV systems would be sold. So in reality market take up could be faster than foreseen.

2. Adjustment of KPIs

With cancellation of budget, comes a reduction of targets accordingly. It is to be noted that targets projections have already changed and have increased in the course of finalizing the programme setup (more and larger systems, increase number of potential beneficiaries and kerosene/ CO_2 savings). The projected target under downscaled budget is given in below table.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	738,255	322,500
EUR per person gaining access	4.35	5.44
t CO_2e emissions avoided (over the lifetime of the products sold during project)	56,952	13,797
EUR per t CO_2e emissions avoided	56.43	127.09
Private sector leverage ratio	2.5	2.5
Jobs created	350	10
Enterprises created / improved	20	5
Technologies deployed	255,000 picoPV	75,000 picoPV

Benin

Promoted technologies		solar / stoves / grid; up-scaling only on stoves			
Project period	old	Stoves: 10.09 – 12.17 Solar/grid: 10.09 – 06.17	**Budget (EUR)**	old	Stoves: up to EUR 5,257,041[19] Solar/grid: EUR 7,160,000
	new	Stoves: 10.09 – 08.18 Solar/grid: 10.09 – 06.17		new	Stoves: up to EUR 7,757,000[20] Solar/grid: 7,160,000

	old targets	**new targets**	
Energy for lighting / electrical appliances in households	406,415	538,689	people
Cooking / thermal energy for households	1,000,000	1,400,000	people
Electricity and/or cooking / thermal energy for social infrastructure	100	100	institutions
Energy for productive use / income generation	100	100	SMEs

Lead political partner	Ministère de l'Energie, de l'Eau et des Mines (MEEM)
Implementing organisation	GIZ
Implementing partner	Stoves: Direction Générale de l'Energie. Solar/grid: Société Béninoise de l'Energie Electrique (SBEE), Agence Béninoise pour l'Electrification Rurale et la Maitrise de l'Energie (ABERME) and Agence Nationale de Développement des Energies Renouvelables et de l'Efficacité Energétique (ANADER)
Coordination with other programmes	Stoves: Promotion de l'Agriculture (ProAgri / GIZ) Solar/grid: ACP – EU Energy Facility, Agence Française de Développement (AFD), BMZ - GIZ Agriculture Programme, BMZ - GIZ Decentralisation Programme and BMZ - GIZ Water Programme
Key interventions	Stoves: • Key Intervention 1: Professionalization of ICS production • Key Intervention 2: Professionalization of ICS marketing • Key Intervention 3: Integration of the "Cooking Energy System"-approach into the ICS sector of Benin.
Main strategic changes introduced with up-scaling	Stoves: • To develop a small number of large producers/-groups to become the backbone of the ICS sector; • To introduce the "semi-industrial production concept" for ICS; • To "incentivise" larger ICS producers to invest more of their revenue into own marketing, and reduce programme investments into marketing gradually • To integrate the "Cooking Energy System" –approach into the ICS-Sector in Benin
Project manager	Peter Förster peter.foerster@giz.de

[19] Including up to EUR 456,790 contribution of EU to ProCEAO Benin.

[20] Only EUR 2,069,000 of additional funds are guaranteed, remaining is subject to availability of EnDev Global funds. Including up to EUR 456,790 contribution of EU to ProCEAO Benin

1. Situation analysis

1.1 The situation of biomass energy for cooking in Benin

The population in Benin is using relatively little energy per person (2010: 0.4 ton equivalent petroleum per year). Nearly half of this energy comes from biomass, the other half from petroleum. Only 2% is based on electricity. For the domestic use of energy, biomass contributes over three quarters of the energy. Large parts of the population (2012: >70%) are not connected to the national grid, particularly in rural areas (2010: >95%).

The use of forest-based wood fuels (firewood and charcoal) is intense and is leading to overexploitation and a continuous reduction of the annual sustainable woodfuel offer. On the other hand, (agricultural) biomass residues are not yet much used as an energy source.

For more than 20 years improved cookstoves and alternative cooking energy solutions have been promoted in Benin to address this situation. A survey conducted in 2011 revealed that:

- Most households were using some kind of traditional or semi-improved cookstove for to burn biomass.
- Less than 5% of the households were using the most common ICS (Nansu), while other ICS in specific and marginal areas.
- Only 5% of the households (mainly in urban and peri-urban areas) were using some LPG for cooking. However, the average amount of gas consumed by these households (48 kg/year) was less than a third of what a household requires if all the food is to be prepared using gas (170 kg/year).
- Electricity was only used in less than 2% of the households for cooking purposes.

Hence despite all the efforts, there has been – until 2011 - no significant change in the sector since the beginning of household energy interventions in the mid 1990s.

Five years later, the ICS sector has grown tremendously (see section 1.3). This is mainly due to the interventions of the Energy Service Delivery Program PFSE (World Bank) and to EnDev. While the use of woodfuels for cooking is still far from sustainable levels, there has been progress in the application of more fuel-efficient cooking devices for woodfuels.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans.

In response to the SE4All initiative, the Ministry in charge of the Environment defined at the COP21 the following targets:

- 140,000 additional households shall replace their traditional biomass cookstoves with more fuel efficient improved biomass cookstoves;
- 275,000 households shall change from cooking with biomass to cooking with LPG.
- 270,000 additional households shall be connected to the national grid in order to replace the use of kerosene lamps with electric lighting;

1.3 Institutional set-up in the energy sector in respect to biomass energy for cooking

The **Ministère de l'Energie, de l'Eau et des Mines (MEEM)** is responsible for managing the energy sector, in particular the renewable energy subsector. It guides the national energy policy and supervises all the entities that directly intervene in the sector with the exception of the Electricity Regulating Authority.

The Direction Générale de l'Energie (DGE) proposes, in conjunction with the other relevant national entities, the government's energy policy and ensures its implementation, monitoring and evaluation.

1.4 Status of the (biomass fuel) ICS market/sector development for ICS

The sector of ICS for biomass fuels can be structured in different ways:

- Firewood and Charcoal are the main biomass fuels used for generating heat in the ICS. For each of these fuels, different ICS with different performances are on the market.

- Firewood burning ICS can be divided into fixed installed ICS and portable ICS. All charcoal stoves are portable.
- Most ICS models of the sector are based on designs developed latest in the 1980s and 1990s. Their main purpose is the reduction of fuel use. The introduction of the éclair charcoal stove (through EnDev) is the first large scale innovation (> 80.000 stoves sold) of a new stove design in sector. Imported industrially produced stoves (e.g. envirofit, stovetech, RocketWorks etc.) do not (yet) play a significant role.
- ICS in Benin are built from mud, fired clay, metal or a combination of metal casing with ceramic liner:
    - Mud stoves are fixed installed ICS mostly for firewood fuel and mainly promoted in rural areas. It is an 'on site' production of artisans.
    - Metal stoves are produced in (relatively small) artisanal workshops.
    - Ceramic ICS and liners for charcoal stoves are mostly produced in larger groups of artisans. These products can be sold either unfired (and be cured during the use of the stove) or they are fired in a kiln before they enter the market.
- Charcoal is mainly, though not exclusively, used in urban households. However, more and more peri-urban and better off rural households are using charcoal for parts of their cooking needs.

At the start of EnDev Benin, the sector of improved biomass cookstoves was in a poor state. Some types of artisanal stoves using firewood and charcoal were available, but only the Nansu (Kenya Ceramic Jico-design) was based on a defined, specific design. All other stoves were produced with large variability of design and performance amongst the individual stoves of the same type. The total volume of Nansu sold per year was estimated below 1,000 stoves, produced by less than 50 artisans and sold in only 2 (out of 77) communes. The NGO ATI was the only active player in the sector, but not with a sector-wide ambition. The general public was not aware of the benefits of using an ICS.

EnDev started in 2006 with a small intervention zone with a rural target group. At the end of the first phase in 2009, it became clear that this approach was too limited in scope and success. In 2010, a reorientation towards a new approach was initiated, with the intention to create more technology choices, to achieve higher market volume, to extend geographical outreach and to increase public awareness.

In a study on the promotion of improved cookstoves (Ministère de l'Energie et de l'Eau, 2012), the ICS sector has been described as being almost entirely informal (99%), with simple artisanal production systems and with a very low level of organisation. With such production systems it will be difficult to bring down wood fuel consumption to a sustainable level. In the document it has been recommended among other things to establish quality standards for ICS production and a sustainable market-based approach in ICS promotion. This includes enhancing the attractiveness of the products (ICS), increasing production to meet the demand and establishing healthy competition amongst stove producers. The production, distribution, and marketing of good quality ICS for wood and firewood must be achieved at a massive scale. For this to happen it is necessary to identify among the small and medium ICS producers those who demonstrate high management skills in line with the new requirements of the market.

EnDev Benin has addressed some of these recommendations in the second phase. New products have been introduced; a family of eight ICS (with brand name "ANFANI") has been established and made popular. ICS producers have been assisted to be registered by the authorities and supported in their effort to organise into cooperatives. Well performing ICS-producers have been supported to improve their tooling and their workshop organisation. A fast-track approach was adopted whereby the project was to play a very active role in the development of the sector and of the market. This was done assuming that – when the market has grown – more investments into the consolidation of the sector would be made to improve its sustainability. Since the beginning of EnDev more than 1.3 million ICS have been sold and more than 700,000 are estimated to be still within their lifespan.

About 600 producers and more than 200 retailers are selling about 300,000 ICS annually, covering nearly half of the country (33 out of 77 communes). This market volume is significant, especially in relation to the estimated 2 million households countrywide. However, it is not exhaustive considering that there are usually two stoves in every household.

However, EnDev did not address all of the recommendations yet. The volume of sales has been mainly achieved by creating a large number of small producers who are meeting the needs of clients in their neighbourhood. In average, each of the 600 producers manufactures approximately 40 stoves per month. This is not sufficient to create an income base that would encourage enterprises to invest massively into manufacturing capacity, marketing, public awareness and quality control. So far, EnDev has been the main driving force of the sector and has been assuring these important functions.

An important limiting factor is the low purchasing power of potential clients. Most ICS are sold for about 6 EUR, and the most expensive biomass stove on the market, the Eclair, is sold at 15 EUR. New technological developments (advanced clean cookstoves) are so far found to be too expensive for the majority of the clients, particularly in rural areas. As very little is known about the actual cooking systems (e.g. the ventilation of the kitchens) in the country, it is hard to say if there is need for these more advanced stoves in order to address Potential health hazards related to exposure or not. This can only be assessed based on knowledge on the ventilation system.

1.5 Relevant activities of other donors and implementers.

MEEM, being the ministry responsible for the biomass energy sub-sector, is "observing" the development, rather than supporting it proactively. One exception from this passive role was the promotion of 20,000 Kenya Ceramic Jiko charcoal stoves within the PFSE programme funded by the World Bank. However, this programme has been phased out. Therefore, EnDev remains at this stage the sole actor with a wide outreach.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

Five to ten years from now, the volume of the market is still increased beyond the current stage. More than 1 million stoves are within their lifespan reaching households in at least 80% of the communes of Benin.

After a process of concentration, consolidation and professionalization, the sector is dominated – though not exclusively serviced – by a number of large-scale cookstove producers (or producer groups), each of whom is reselling more than a thousand stoves per month in many communes. Thus, most parts of the country will be covered. Production systems have become sufficiently profitable (for example, through mechanisation) to allow for investments that go beyond production, such as marketing and public awareness.

Quality control is addressed mainly through the use of production tools (e.g. moulds/dices) which reduce the risk of design drift. These companies are operating in the formal private sector and are connected to business banks.

The cooking systems in the different communes throughout the country are well known. The different kitchen types are investigated in relation to the effect of their ventilation system on exposure. With that knowledge, all ICS on the market have been labelled based on their application in different kitchen types.

The main role of government, donors and researchers in Benin is to monitor and further professionalise (where found necessary) the sector and to link it with the global cookstove sector. Depending on the results of the cooking system analysis there might be additionally the need to introduce cooking energy solutions for the use of biomass fuels in less ventilated kitchens (e.g. advanced clean cookstoves, chimney stoves or hoods).

2.2 Specific intervention strategies for each (sub) sector.

The up-scaling activities for two years will be used to pilot concepts for the concentration, consolidation and professionalization of the cookstove sector in Benin. The up-scaling is focused on growth (through more efficient production) while working towards reduced dependency of the sector on project funds.

Key intervention 1: Professionalization of ICS production

FABEN (EnDev Benin) is already working with 25 producers (or producers group) of ceramic and metal stove producers in order to increase their productivity and develop their business capacity. While some first results are encouraging, there is still room for improvement during the extension period until December 2018. FABEN is also planning to pilot and start implementing additional new approaches:

- EnDev Senegal has been piloting an advanced tooling approach (e.g. use forming tools for metal stoves) for two semesters and it is yielding positive results. FABEN will benefit from these experiences, by adapting the concepts and materials to the specific conditions. Based on a "conditional self-selection" process, enterprises which fulfil certain minimum criteria on performance track records can apply for investment support for different levels of production technology. They may be individual producers or well-organised producer groups. However, it is key that there is a significant monetary contribution from the producer and that there are requirements for the future performance of the producer attached to this support. An assessment will be carried out in order to determine to what extent the financial sector (e.g. MFIs) can be involved to support the investments of the ICS enterprises.
- A new technical concept for the metal stove production shall be tested for the Eclair stove. Dices will be developed to cut and form all parts of the stoves mechanically. Different types of presses shall be tested to learn about cost-efficiency effects and if producers in Benin can adapt to this level of production technology. It will be useful to see if this step is already feasible in the market environment. If found effective and efficient, this component will be moved from pilot phase to implementation.

Key intervention 2: Professionalization of ICS marketing

ICS producers have benefited a lot from FABEN's investment into stove marketing. EnDev's current investment into capacity building and provision of marketing assets shall be continued. FABEN shall continue to facilitate the interactions between ICS producers and potential dealer networks. As part of the activities under key intervention 1, it is planned to include conditions in the contracts for supported producers to target their investments on marketing and distribution. In this context, the applicability of a "result-based approach" will be explored. This could for example be included in the contracts on co-financing investments into production equipment. As a measure to motivate producers to invest into marketing, bonus payments could be envisaged based on the amount of marketing interventions implemented by the producer or sales documented and verified.

FABEN shall also continue to prepare the small producers for the transition towards a producer-based marketing of ICS. This means a gradual phasing out of project based marketing combined with support to the small producers for self-organisation in groups and the capacity building on marketing activities.

Key Intervention 3: Integration of the "cooking energy system"-approach into the ICS sector

EnDev Benin has already advanced in the identification of kitchen types and started to quantify their distribution in the country. These efforts shall be further intensified to generate a solid understanding of the status of cooking systems in various parts of the country. Benin will first focus on charcoal stoves to investigate the link between charcoal stove types and exposure levels in different kitchen types in the country, as charcoal stoves mainly emit CO which is easier to measure in the field. Based on the results, recommendations will be formulated on the appropriate use of the

stoves and a label will be developed to inform the users. FABEN will engage with stakeholders of the ICS sector in Benin to make sure that this label is applied throughout the sector.

2.3 Sustainability of the intervention

In the current phase, FABEN tested an approach in which the project plays an important role in the marketing of stoves. While not directly involved in the buying and selling of ICS, a lot of project resources were invested to successfully increase stove sales from a few thousand per year to a few hundred thousand per year, through intense marketing and public awareness. However, these high sales levels in the sector are still vulnerable. Recent efforts to scale down project financial and organisational involvement in ICS marketing activities led to sharp reductions in stove sales in the last reporting period.

It is intended in this up-scaling phase to initiate a transition towards a more sustainable market structure where marketing will increasingly be the responsibility of the producers themselves. The steps that will enable to achieve this change are outlined in the key interventions 1 and 2 under section 2.2 of this proposal. It is assumed that the funding until August 2018 will not suffice to fully convert the sector. However, at the end of this transitional phase important lessons will be learned to assess the operationality and scalability (or not) of the new strategy. The pilots will increase the sustainability of ICS production and dissemination, the quality assurance and the market sector development.

Key intervention 3 is designed to bring a focus on the cooking system in the sector and its stakeholders. In this context the programme will determine which kinds of innovation are required for the Benin market. With the participation of MEEM and the University Laboratory, key stakeholders of the sector in Benin are involved in the process and will be supervising it in the long run.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	• The specific use of wood fuel [kg firewood or charcoal / day / person] in the households which are only using wood fuel for cooking is at least 20% lower in households with an ICS than in households without ICS [KPT results]
Health	• Occurrence of eye infections and/or respiratory infections in households using predominantly ICS is lower than in households using predominantly basic stoves. [household surveys]
Poverty/livelihood	• The monthly average wood collection frequency is at least one point lower in the households that are using ICS than in those using traditional stoves. [based on ranking in EnDev Cooking Energy Evaluation System] • The main actors of the ICS value chain have improved their income by at least 10% compared with their initial situation [value chain assessment] • The urban households that are using ICS have reduced by 20% their expenditure on wood and charcoal for cooking purposes, as compared with the situation without ICS.
Governance	• At least 5 communes have mainstreamed ICS promotion in their annual plans of action (baseline : 0)
Climate change	• Contribution to the reduction of greenhouse gases by 21.4% by the year 2030, through a contribution to the reduction of the annual deforestation (natural forests) rate by 41.7% (INDC target)
Gender	• At least 50% of the leaders of ICS producer interest groups are female (baseline: 25%)

Impact	Possible indicators
Market development	• At least 18 enterprises/producer groups are selling stoves in two or more communes through their own dealer networks (baseline = 0) • ICS are sold in at least 40 communes of Benin (baseline = 33)

4. Possible risks and potential ways to mitigate them

External risks:

- Fluctuation of input market prices, which could directly affect producers;
- Requirements for access to external funding, which tend to become more stringent

Internal risks for project implementation and proposed corrective action:

1. Limited purchasing power of most households
   Corrective action: Promotion of credit purchase schemes.
2. Limited financial capacity of producers
   Corrective action: Facilitation of producers' access to micro credit with decentralised financial services.
3. the durability and performance of ICS is limited due to low maintenance
   Corrective action: Intensification of awareness campaigns on best practices with respect to ICS utilization.

5. Budget

		EUR
1	Human resources and travelling	810,000
2	Equipment and supplies	590,000
3	Financing agreements/local subsidies	75,000
4	Other direct costs	683,000
5	Total direct costs (sub-total)	**2,158,000**
6	Mark up costs/administrative overheads/imputed profit	342,000
7	Cost price	2,500,000

Lifting up 3 off-grid PV market segments to the next level, Benin

1. RBF project revision

In the annual RBF review meeting, it was recommended that the project will be:

- Extended time wise until: **06.2018**

Start and implementation of RBF partially took longer than expected due to legal validation in Benin and GIZ HQ, since no suitable financial institution could be identified and this role needed to be assumed by the project. Some more delay was incurred due to slow response by private sector on the calls issued. Identification and contracting of suitable companies therefore took longer than planned. The **picoPV component**, started with a "trial phase" with low quantities being imported. Afterwards it took companies quite long to identify the sources of financing for larger imports and set up distribution systems. Now the implementation is picking up, but more time is required to allow companies to fully make use of the newly established distribution structures and benefit from the incentives. The **street lamp component** of the project was put on hold for a while due to an announcement by Government to launch a broad streetlamp financing scheme. It has become clear in the meantime that there is still room and necessity for an EnDev intervention in this sector. Companies were at first reluctant to apply for the **solar pump component**. The situation changed after the communal election and the appointment of new mayors. Many of them are interested in solar pumps for drinking water. However other donors, such as the World Bank and the Netherlands, question the RBF approach in the water sector, despite the fact that it had been previously agreed upon.

2. Adjustment of KPIs

KPIs have been adjusted to EnDev counting methodologies. The number of picoPV systems was corrected downwards as the type of systems that are now being imported are of higher quality and price than originally assumed, resulting therefore in a higher number of beneficiaries.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	343,415	475,689
EUR per person gaining access	8.91	6.69
t CO_2e emissions avoided (over the lifetime of the products sold during project)	215,000	33.288[21]
EUR per t CO_2e emissions avoided	14.23	91.93
Private sector leverage ratio	3.2	3.2
Jobs created	Not quantified	Not quantified
Enterprises created / improved	10	10
Technologies deployed	440,234 picoPV 2,500 streetlights 262 solar pumps	187,000 picoPV 2,500 streetlights 262 solar pumps

[21] Calculation based on EnDev standard lifetime for picoPV products of 2 years.

Bolivia

Promoted technologies		grid / solar / stoves / other: productive use			
Project period	old	10.2006 – 12.2016	**Budget (EUR)**	old	13,000,000
	new	10.2006 – 08.2018		new	15,000,000[22]
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		400,000	501,500		people
Cooking / thermal energy for households		330,000	384,600		people
Electricity and/or cooking / thermal energy for social infrastructure		2,700	2,700		institutions
Energy for productive use / income generation		11,200	11,680		SMEs
Lead political partner		Vice-ministry of Electricity and Alternative Energy (VMEEA) of the Ministry for Hydrocarbons and Energy (MHE)			
Implementing organisation		GIZ			
Implementing partner		Private companies and individual entrepreneurs; programme "Electricity to live with dignity – PEVD" of VMEEA; NGOs; local governments; communities; utilities; cooperatives and associations			
Coordination with other programmes		"Program for Rural Electrification – PER" (IADB); ITDR II (World Bank); PER (Renewable Energy programme of the Nordic Development Fund); Ministry of Rural Development and Lands through its programmes EMPODERAR, CRIAR, PAR, DETI; Ministry of Environment and Water			
Key interventions		• Initiate market for portable ICS: technology development, training, awareness raising; distribution based on last mile entrepreneurs • Foster market for fixed ICS through individual entrepreneurs and NGOs; ensure sustainability of existing Malena stoves. • Foster market for picoPV through entrepreneur training and awareness raising, set-up of new points of sales through PPPs. • Support to utilities in capacity building (for technicians and users) and co-financing of grid connections of rural households, SI & PUE • Productive use promotion through technical assistance for government programmes and MFIs			
Main strategic changes introduced with up-scaling		• There will no longer be technology-based work units. Regional multidisciplinary teams will be established in target markets. • Work increasingly with private sector actors, such as importers, manufacturers, distributors and last mile entrepreneurs. • Pilot the use of incentives to lower the entry barriers for private companies into new markets or new products (RBF-like). • Develop *Energy Promoters* (individual entrepreneurs) with a sales portfolio that combines picoPV and various ICS products.			
Project manager		Mariana Butrón Oporto; mariana.butron@giz.de			

[22] Only EUR 1,800,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

1. Situation analysis

1.1 General energy situation in the country

Bolivia, with a population of approximately 10.5 million inhabitants, is one of the poorest countries in Latin America. The national electrification rate (according to the National Statistics Institute) is 88% (98% in urban areas, 57% in rural areas). Access to electricity is a basic right in Bolivia's 2009 constitution. Furthermore, 43% of the rural population use biomass fuels for their daily cooking.

In spite of advances made in recent years to reduce rural poverty, there are still regions which have little access to markets, basic public services, and energy. Because of the difficult topography of Bolivia, communication and transport are a challenge in general and there are regions that are completely isolated during the rainy season. This situation is gradually worsening due to the impacts of climate change in Bolivia.

a. Lighting

The electricity tariffs in Bolivia are lower than average tariffs in Latin America. The average residential tariff in 2011 was EUR 0.08 per kWh (compared to EUR 0.16 per kWh weighted average in Latin America). Some distribution companies do not only sell electricity to end users, but also to smaller rural electricity cooperatives who, in turn, resell the electricity to the end-users. In March 2006, the Bolivian government approved the *Tarifa Dignidad* ("Dignity Tariff"). This tariff grants a 25% discount in the electricity bills to those consumers whose monthly consumption is below 70 kWh. This tariff (which applies to both urban and rural areas) will be in place at least until mid-2018.

There is an incipient but growing market for picoPV systems. A handful of commercial distributors sell their products on market terms in suburban and rural regions around medium sized towns. Local distributors market and sell the products, but they only have a limited outreach into the rural areas outside towns. Due to this lack of rural distribution network, their businesses may not be commercially viable in the medium-to-long term.

b. Improved cookstoves

In 2005, when EnDev began in Bolivia, there were only a small number of local stove manufacturers who tried to sell "improved cookstoves" near larger towns and cities. In general, however, the concept of ICS and its positive effects on health and environment were still unknown. The three ICS producers were offering rocket-type metal ICS but some of them were also working with solar stoves (of the box type). From 2007 onwards, rising metal prices have constituted a barrier to continuing growth for these stove producers. The solar stove market is growing only slowly, today promoted by a single NGO only. EnDev has since 2007 been promoting the Malena stove, an improved adobe-based biomass stove. The stove has a high degree of acceptance by beneficiaries due to its functionality, durability and cultural acceptability. Parallel to the introduction and dissemination of the Malena stove, EnDev also managed to increase awareness and positioning of the subject of ICS, both within rural communities and within government at different levels, to an extent that local government today is supportive of the subject. There has been some uptake of Malena stoves outside of EnDev; however, generally the whole ICS sector remains very much driven by EnDev.

The Malena stove has a higher local content and is therefore cheaper than the metal stoves. Because it is constructed in the house with the assistance of the family, logistic costs are comparably low (transport of the metal chimney, transport of clay for adobe). Since the introduction of the Malena this technology has evolved with regard to design, construction materials, dissemination strategies, and market focus. Initially, there was an EnDev subsidy of about 50 EUR. This subsidy has been reduced by more than 90% over the years as part of EnDev's sustainability strategy. Local stove promoters, trained by EnDev, receive their payment from the beneficiary families and from municipalities. Preliminary assessments show that the Malena stove has a great demand potential and possibilities are ripe for diversifying the supply by promoting related products (stoves with in-built oven, ovens, special stoves for Chicha brewing, etc.).

The government promotes the expansion of the natural gas network and access to natural gas cookstoves but the work is progressing slowly and many remote communities will never be reached for economic reasons.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans

The energy sector in Bolivia, in the framework of SE4All presents the following goals[23]:

Improved cookstoves: The Bolivian government has not defined any overarching policy goals or objectives related to improved cookstoves, and there are not concrete activities planned. There have been some activities on cookstoves in the past but these have been on one-off occasions.

Access to electricity: The "Plan for Universal Energy Access 2010 – 2025" published by the VMEEA end of 2010 establishes the overarching objective to reach 100% of Bolivian households with electricity access by 2025. The government subsequently incorporated the target into the "Patriotic Agenda 2025", which is a plan on how to reach Bolivia's development goals by 2025. It is foreseen to invest into **(1)** grid densification, principally in urban areas, into **(2)** grid extension, and into **(3)** renewable energy (solar, hydropower, wind, and biomass) to reach isolated communities outside the reach of the national grid. The investment, which amounts to roughly EUR 1.2 billion, will be made by the electricity utilities in different regions of the country using their own funds, co-financed by the governments at national, decentralized and local levels.

1.3 Institutional set-up in the energy sector

The energy sector is almost completely nationalised. It is headed by the Ministry of Hydrocarbons and Energy, with three Vice Ministries: **(1)** Vice Ministry of Energy Development, **(2)** Vice Ministry of Electricity and Alternative Energies, **(3)** Vice Ministry for Exploration and Exploitation of Hydrocarbons. A number of strategic state enterprises are under the direct responsibility of the Minister, including the National Committee for Charge Dispatch (CNDC) and the national electricity utility (ENDE). ENDE has 11 subsidiary companies (electricity generators, transporters and distributors) of which CORANI S.A. (Cochabamba) is responsible for all wind energy projects and Guaracachi (Santa Cruz) is responsible for solar and biomass projects.

The Bolivian **electricity** system consists of the national interconnected grid and isolated systems. Every region has its own public electricity distribution company (the abovementioned subsidiaries to ENDE), except for the largest region Santa Cruz where the so-called Rural Electricity Cooperative (CRE) handles electricity distribution.

Major rural towns are serviced by cooperatives. These typically used diesel-powered generation plants, some of which are now being complemented with renewable energy to form hybrid plants. A large number of rural communities are neither covered by the national grid nor by decentralised generation from stand-alone plants.

With regard to **ICS**, there is no single government entity which promotes these. Also, there is no specific public funding available for ICS. However, departmental and municipal governments may allocate funding in their annual activity budgets. Because of the benefits of ICS (reduction of firewood consumption, health benefits) the Ministry of Environment and Water (MMAyA) and the Ministry of Health would logical collaboration partners for EnDev Bolivia. They have repeatedly been approached in the past. In 2012, EnDev Bolivia developed a national norm for ICS in collaboration with the Ministry of Health, the Vice Ministry of Housing, the public university UMSA and IBNORCA (the Bolivian Institute for Norms and Standards). The norm comprises and defines technical criteria that an improved cookstove must comply with in order to be labelled and improved cookstove. The norm still needs to be backed up by subsidiary legislation, ideally a presidential decree.

[23] Source: Sustainable Energy for All, Rapid Assessment and Gap Analysis for Bolivia. Enrique Gómez, IDB, January 2016.

The more than 300 Bolivian municipalities are very important stakeholders when it comes to working with the rural communities. The municipalities can consolidate the demand for ICS by the rural communities, can provide technical assistance to aspects of the work with ICS, and have both the legal and the financial means to support the dissemination/construction of ICS, either through financing of non-local materials or through financing of labour and/or transport. EnDev Bolivia will actively seek collaboration with an increasing number of municipalities during the up-scaling .

Private sector participation both in rural electrification and in ICS is still incipient. A handful of companies imports and distributes PV systems of different sizes and magnitudes but their reach does not go far beyond cities and towns. Two to three companies work with metal ICS and local artisans produce ceramic cookstoves that do not qualify as ICS.

1.4 State of market/sector development

There are some specific **challenges** when EnDev tries to work with and through the market:

The government has nationalised the entire electricity sector and has embarked on large public programmes for rural electrification. As mentioned above, there are no government programmes to support improved cookstoves. The government is portraying itself as socialist and has nationalised several strategic sectors and businesses since coming into power. The political environment is very fragile and not favouring development of the private sector. In fact, the government does not view a strong private sector as desirable. The prevailing view is that of a socialist state-directed economy, with focus on mega-projects such as large hydroelectric power plants or thermoelectric power plants with little regard for environmental, social and cultural consequences. The government is paternalistic and through its various government programmes in many cases it hands out machinery and equipment (including picoPV and other PV systems) free to rural communities.

It is estimated that 55,000 small and medium sized companies have had to close down during the last three years due to measures introduced by the government: hefty annual salary increases by presidential decree including a jump in minimum salaries; introduction of a 14th salary supposedly to reward employees for a high growth rate of the GDP; etc. These measures have aggravated the economic situation of the entire private sector and have added to the cost of living by stimulating growth in the inflation.

Nevertheless, there are **windows of opportunity** for EnDev:

a. Lighting

In rural electrification, the government continues to request technical assistance and advice from EnDev to identify appropriate technologies for dissemination and to develop implementation strategies including capacity building of stakeholders. In this way, grant assistance by the government is complemented by technical assistance and advice from EnDev Bolivia on proper use and maintenance of the equipment and on ensuring sustainable access. This opens up opportunities for EnDev Bolivia to make an impact with limited funding. The grant-based dissemination of PV systems by the government to isolated rural communities can have a negative effect on private sector efforts to build up rural markets for these products (‘dumping’ effects), but it may also have positive effects since the first dissemination of free PV products creates awareness and additional demand, both for services and spare parts as well as for larger/next generation systems.

The penetration of picoPV systems is so far very limited. Some five private companies import and distribute picoPV systems, but neither has a local network of distribution/service points to support customers in rural markets. There is an interesting market potential in rural off-grid areas for private operators, both with regard to sale of PV systems and with regard to provision of spare parts and services. Distributor networks need to be established and different business models (franchise-based, PPPs, *Energy Promoters*) need to be tested and further developed.

b. Improved cookstoves

Rural communities in the Andean plateau and the valleys are very familiar with the fixed Malena stove and demand is steadily increasing. Over the last couple of years, demand has increased and diversified: the rural families are now demanding more and different products. New products include

stoves with inbuilt oven, freestanding ovens, and stoves for brewing chicha, a local drink based on maize. Some time ago, the national government showed interest in the development of portable ICS for the lowlands where seasonal flooding and migrations are common. Responding to this demand, EnDev Bolivia has developed a portable metal ICS appropriate for the conditions in the lowlands (in collaboration with EnDev HQ). The aim is for this stove to be manufactured and disseminated by private market actors under market conditions. The market potential for this kind of stove is assessed by EnDev as medium to large in the medium term. Interest among local and national stakeholders is increasing continuously, related to an ever-increasing awareness for the impacts of climate change (for example, highly publicised disappearance of Lake Poopó[24] thought to be linked to climate change). A realistic future source of financing for ICS in Bolivia will be the funding related to climate change measures.

c. Productive use

Many private companies across Bolivia offer agricultural machinery and equipment for improvements in farmers' primary production and transformation of products. The penetration rate is overall good, although limited to rural towns and not reaching into rural communities. The main barriers to increased and/or sustained use of energy for productive uses are **(1)** little demand from and low purchasing capacity of rural producers, **(2)** the wide-spread restriction to low-tension electricity, **(3)** the lack of electricity transformers (in order to connect to medium-tension lines), **(4)** lack of skills and knowledge by rural producers on how to operate and maintain energy-dependent agricultural machinery and equipment. Another market barrier is the generally limited presence of micro financing entities in the rural areas, and the lack of appropriate credit and financing products.

The national sector ministries (agriculture, productive development) manage large programmes in support of rural producers and (as is the case for PV systems) these programmes disseminate different kinds of agricultural machinery and equipment on a grant basis or heavily subsidised. The dissemination is accompanied by, at best, very rudimentary introduction to operation and maintenance of the equipment. In general, energy needs of the producers are not considered in the dissemination. The result is that the access to energy for productive use is not sustainable. This offers an opportunity for EnDev Bolivia to engage with the government programmes to increase outreach, reduce cost and improve sustainability in order to address the weaknesses identified.

1.5 Relevant activities of other donors and implementers.

The multilateral banks IDB and World Bank support rural electrification actively, both through grid extension and densification and through support to renewable energy solutions for isolated rural communities. Programme volume is EUR 53 million and EUR 44 million, respectively. The programmes focus on the supply side, for example, through grid extension. The Nordic Development Fund (NDF) supports PV and thermo-solar systems in isolated rural communities and social infrastructures through grant financing.

The government implements various rural electrification initiatives that aim at servicing these communities under its umbrella programme PEVD ("Electricity to live with Dignity"). The major initiatives are:

- Rural Electrification Programme (PER), financed by IDB
- Access and Renewable Energy Project (IDTR II), financed by the World Bank
- Rural Electrification Programme for Renewable Energies (PERER), supported by the Nordic Development Fund
- "Sowing Life – Harvesting Light", financed and implemented by the government

[24] http://www.theguardian.com/world/2016/jan/22/bolivias-second-largest-lake-dries-up-and-may-be-gone-forever-lost-to-climate-change

These programmes work with a mixture of grid extension and densification, household connections, PV systems (both SHS and picoPV) and thermo-solar systems. EnDev Bolivia already works with these initiatives through PEVD will intensify collaboration in the up-scaling .

In addition to supporting EnDev, Germany also provides grant funding to promoting and creating an enabling environment for the introduction of renewable energy in Bolivia through studies and consultancies. The German development bank KFW provides financing to the construction of six micro hydropower plants. A new bilateral renewable energy programme financed by Germany and implemented by GIZ will begin in 2016 with focus on grid integration of large renewable energy.

EnDev Bolivia supports the programme PEVD in its implementation of rural electrification initiatives financed by the IDB, the World Bank and NDF. Whereas these initiatives focus on the supply side, EnDev carries out complementary activities that focus on the demand side. The type of support may vary but typically comprises modest subsidies, technical advice and training.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

Rural electrification is dominated by the state and the national grid will be further extended over the next five years. Grid densification will focus mainly on urban areas but with significant activities in the rural areas as well. Off-grid areas will be serviced by a combination of state-funded grant assistance to individual household PV solutions (or to larger hybrid systems) and private sector commercial activities based on imported PV technologies, predominantly picoPV systems.

The **ICS market** for rural households will continue to develop and expand. There is growing interest from private companies to get involved in manufacture or import of portable ICS. Rural households are continuing to demand the fixed ICS and there is an increasing demand for maintenance and repair services. The development of maintenance and repair services for fixed ICS is expected to improve the useful life of these, thereby enhancing the sustainability of the access.

Under this up-scaling proposal, EnDev Bolivia will primarily work through the market and with the relevant market actors. This means that focus will be on private sector approaches, working simultaneously with established private companies[25] and with rural micro entrepreneurs. Different approaches and support instruments will be tested with the aim to motivate (push and pull) the private companies to enter into rural markets or to expand their presence in rural markets, for example, through analysing and improving private sector business models. Sustainability of access will be given high priority in EnDev's work, both for private sector and for public sector approaches. Given the dominant role that the state plays in the Bolivian energy sector, EnDev Bolivia will work along a continuum of fully private-sector to fully public-sector approaches, seizing opportunities where they present themselves:

Private sector approaches: These approaches will build on EnDev's experience with last-mile stove promoters and picoPV PPPs. EnDev will train existing stove promoters and new candidates to become *Energy Promoters*. These *Energy Promoters* who are essentially rural micro entrepreneurs will offer both ICS and picoPV systems. EnDev will support the *Energy Promoters* in all aspects of business development: continuous coaching, awareness raising, user training (for example, on the necessity of splitting and drying firewood for smoke reduction and better combustion), agreements with private companies selling renewable energy solutions, set-up of sales/service points, contact to finance institutions, etc. At the same time, EnDev will work with energy companies in regional cities or towns, which either manufacture products (portable ICS, spare parts for ICS) or import products (portable ICS, PV and picoPV systems). The support by EnDev will focus on brokering commercial relationships between private energy companies and the *Energy Promoters*. The *Energy Promoters*

[25] These need not necessarily be renewable energy companies. Companies from related fields such as agricultural machinery, metalworks, etc. may be drawn into the sector.

will offer products that they obtain from these energy companies employing different business models: franchise, commission-based, product agent/representative or retail seller. Parallel to the development of *Energy Promoters*, EnDev will also support the establishment of sales and service points for picoPV systems and ICS within rural communities.

EnDev will work in markets within five defined market regions with a high, yet unattended potential. The specific intervention regions will be defined through detailed market studies at the commencement of the up-scaling . Initially, EnDev will provide a small incentive (up to 6 EUR) for each stove installed / sold. This incentive will be phased out over time. EnDev will approach municipalities to develop models in which these subsidise part of the energy access, for example, by paying the energy promoter for transport or for non-local materials. This strategy includes also ICS for productive uses (large ovens, ICS for chicha brewing) in areas where there is demand.

Mixed approaches: These approaches are based on EnDev's experience with NGO's on ICS promotion and on experience with agricultural producer associations. EnDev will train NGOs in new market regions on ICS construction and maintenance. Many NGOs are interested in ICS as part of their health, gender, education or development portfolio. EnDev will seek to work with new NGOs in the new regions. Typically, NGOs charge beneficiaries a small fee in the range of EUR 6 for an ICS. The remainder is covered by the NGOs own funds, which in turn could come from government funds on climate change or household improvement. EnDev will also work with agricultural producer associations, private sector companies and government programmes on promotion of PUE, predominantly but not exclusively in the La Paz and Oruro regions. EnDev Bolivia will train producer associations and government technicians in choice of appropriate technology, in how to negotiate purchases from private sector technology providers, in how to connect producers and associations with micro financing entities, and in proper operation and maintenance of the energy-dependent agricultural machinery and equipment. EnDev Bolivia will collaborate with private companies through PPPs with the aim to improve outreach and coverage of services such as spare parts, warranties, and repair, in order to improve sustainability of the PUE.

Fully public-sector approaches: In grid densification, EnDev will continue to work with rural electrification programmes up to end of 2017. EnDev will provide a subsidy to lower the costs of household connection for rural households in poorer regions and will accompany this subsidy with activities that aim to increase the sustainability and safety of household connections and internal wiring.

Cooperation with others: EnDev will work, as described above, with a number of partners from the public and private sectors and from civil society. Some are already EnDev partners; others will be asked to join as the opportunity arises.

- private sector partners: *Energy Promoters*/micro entrepreneurs (for last mile distribution); energy companies (picoPV and ICS wholesalers; ICS part and spare part wholesalers); importing companies (ICS and picoPV importation); agricultural machinery and equipment importers/distributors.
- public sector partners: local governments; utility companies; universities
    - ministries and government programmes:
        - ICS: stove testing centre CPC (Universidad Mayor de San Andrés, La Paz)
        - rural electrification: PEVD
        - productive uses: MDRyT (Ministry of Rural Development and Lands), MDPyEP (Ministry of Productive Development and Plural Economy)
        - micro finance institutions such as FIE and PROFIN to support access to energy for the productive sector.
    - development agencies: DANIDA; Swiss Contact; UNDP; IICA
    - other GIZ programmes: PROAGRO; PERIAGUA; PROBOSQUE
- civil society organisations (CSOs/NGOs): local health, gender, education, environment or development focused CSOs in selected market regions

a. Energy technologies and services promoted by the EnDev project

EnDev Bolivia's **setup** will be completely reorganised and restructured in order to address the challenges of this up-scaling, to improve economic efficiency (cost per beneficiary achieved) and to increase regional outreach. The main office will move from La Paz to Cochabamba, the regional capital of the Cochabamba region, with the aim to reduce transport distances, costs related to fieldwork and fixed costs in general – office rent, for example, is much lower.[26] The administrative team will be reduced and some staff will be shared with the two new bilateral GIZ programmes NEXUS and Renewable Energies. Technical aspects of the different technologies promoted by EnDev Bolivia will be covered by a team of three technical advisers: one for photovoltaic systems, one for ICS, and one for grid densification. In general, the organisational setup will be flatter and lighter, with direct linkages between the fieldwork and office. EnDev will work in areas with a good market potential within five **market regions** across the country. The technology-based work units (into which had been organised since the start) will be discontinued. Instead, multidisciplinary teams of 1-2 persons, with one team per market region, will undertake work in the field. There will be one head of operations, responsible for the multidisciplinary field teams. Each of these teams will have access to a four-wheel drive vehicle and motorcycles, laptop, internet access and cellular phones but there will be no regional offices, thus increasing rural outreach without increasing fixed costs.

These **multidisciplinary teams** will promote all the technologies that EnDev Bolivia will work with under this Up-scaling proposal. These technologies include: **(1)** improved cookstoves, both fixed adobe (Malena) and portable metallic, and related products such as ovens and special-purpose ICS; **(2)** household-based PV and picoPV systems for rural families; **(3)** grid densification and connections; **(4)** energy for productive uses (with a special focus on the market region La Paz and Oruro).

EnDev Bolivia will offer the following **services** in the up-scaling :

- business training and advice for private sector players including development of business plans, continuous coaching, financing aspects and support for marketing materials
- technical training and advice for private sector players (*Energy Promoters*, energy companies based in regional capitals)
- strengthening of local actors, including NGOs and local governments on both technical aspects of energy access (for example, training of municipal staff) and financial aspects of energy access (for example, inclusion of energy access in municipal budgets)
- gradually decreasing subsidies to (a) motivate rural households to purchase energy access products and to (b) motivate energy companies and rural micro entrepreneurs to go the last mile and enter into new markets or to expand existing ones
- testing and – if necessary – certification of new technologies, market and sustainability studies, support to development of monitoring platforms

EnDev Bolivia will work with a number of strategic partners, selected based on shared goals and the outreach and coverage of the potential partner. Partners include **(1)** national and local governments and programmes, **(2)** private and state energy companies, **(3)** civil society organisations, **(4)** donor agencies and programmes, and **(5)** universities and other learning institutions, **(6)** *Energy Promoters* as individual entrepreneurs/micro companies.

2.2 Specific intervention strategies per (sub)sector

a. PV systems and Portable ICS

EnDev Bolivia will pursue two strategies for dissemination of picoPV and PV systems and portable metallic ICS: **(1)** support to development and strengthening of the capacity of *Energy Promoters* (rural micro entrepreneurs, selected based on interest and demonstrated skills), **(2)** support and

[26] The present office in La Paz will be taken over by the two new bilateral programmes NEXUS and Renewable Energies. Some EnDev staff will remain in La Paz to ensure that close links with the public sector are maintained.

technical assistance to private energy companies to enter rural markets with relevant energy projects.

The *Energy Promoters* will be linked up with energy companies in a business arrangement (representative, agent, commission-based, retail, other) and will offer a variety of energy products and services, including PV systems and accessories, portable ICS for rural homes, spare parts and maintenance. As part of the strategy, *Energy Promoters* will receive training and continuous coaching in the skills necessary to support their businesses (technical, business planning and management, marketing, etc.). EnDev will assist the *Energy Promoter*s and interested energy companies to connect through formalised relationships. To motivate the *Energy Promoters* to go the last mile various **incentives based on performance** will be tested (e.g. reward for achieving the highest monthly sales or for continuously solid performance).

Private energy companies from rural towns and provincial capitals will receive technical assistance to develop their product portfolio further (for example, by linking them to technology producers and stove and picoPV importers) and to facilitate their entry into rural markets. Focus will be on establishment or development of networks of local technology suppliers and sales points in the new markets. A variety of approaches has been tested since 2014, including a franchise-based arrangement and recruitment of commission-based local distributors. Additional approaches will be piloted during the up-scaling . Particular emphasis will be placed on creation of sales points in rural areas, run for example by micro entrepreneurs who can stock and sell the energy products locally, who can provide maintenance and repair services to household customers and who can sell spare parts and accessories.

The collaboration with private energy companies will be based on instruments such as franchise arrangements and integrated private-public partnerships (PPPi). RBF-type arrangements will also be tested during the up-scaling , in order to encourage the energy companies to expand their outreach into new markets in the rural areas.

In order to facilitate the payment for the energy products and services by the rural customers, pay-as-you-go systems will be piloted. Already, EnDev Bolivia has received expressions of interest from the private PV companies PowerMundo and FOSERA. The demand side will also be supported through development of better user manuals and through better information about and follow-up on product warranties.

b. Fixed ICS (Malena stove)

The fixed ICS and related products, such as freestanding ovens, Malena with inbuilt oven and special-purpose ICS will continue to be disseminated in alliances with NGOs and municipalities. Some of the *Energy Promoters* will offer the construction of the fixed ICS and related products as part of their product portfolio. The present *promotores estrellas* (‘star promoters’, dynamic stove promoters) will continue to offer these products in and around their rural communities. These promoters will be trained to diversify their product portfolio and to improve the turnover and profitability of their businesses (Malena stoves made to order, other kitchen equipment and installations, etc.). Particular focus will be put on developing the market for maintenance and repair of existing Malena stoves and ovens, in order to extend the useful life of these and improve the sustainability of the access.

c. Productive Use of Energy

PUE will continue through the up-scaling with a particular focus on the Andean high plain (market region La Paz and Oruro). Experience has shown that subsidising electrical transformers is a successful and viable approach and this will continue. The implementation strategy will increasingly focus on collaboration with private companies, suppliers of agricultural machinery and equipment, where the support by EnDev will focus on training and capacity building of beneficiaries (customers) and on facilitating the provision of post-sale services, spare parts, warranties, etc. The main instrument for this support will be integrated public-private partnerships, either directly with the private companies or with involvement of government programmes and micro financing entities.

d. Grid densification and household connections

EnDev Bolivia will continue its support interventions in grid densifications and household connections up through 2017. The work will build on the experiences gained up to 2016 i.e. through agreements with utility companies and private installation companies. The subsidy will be reduced by buying materials for the household connections in large quantities, achieving significant discounts through economies of scale. Recent experiences with this approach indicate that the subsidy can be reduced to EUR 10-12 per household. Contracts with installation companies will include training and awareness raising of rural beneficiaries in the safe and correct use of electricity and in possibilities for household PUE.

e. Studies and tests

EnDev Bolivia will accompany its work during the up-scaling with different studies aiming at generating new knowledge and information in aspects such as, climate change (reductions in use of firewood, in deforestation rates, in consumption of kerosene and diesel, etc.), household health (reductions in indoor contamination, norms and standards, improvements in combustion, separation of kitchen from other parts of the house, etc.), gender (disaggregation of statistics, improved ergonomics, reduction of household work burden, creation of income opportunities, improved nutrition and cleanliness, etc.), market development (number and composition of market actors, demand/supply aspects, turnover and income, import vs. local manufacture, etc.) and creation of employment.

Development and/or introduction of new energy products in the market will, where necessary, be accompanied by testing according to international standards and norms to ensure that the products are of an appropriate quality and comply with the international standards and norms (Lighting Global; GACC, ISO, national norms, etc.). The testing will be done partly by EnDev and partly by the Stove Testing Centre at the UMSA University in La Paz.

2.3 Sustainability of the interventions

PV systems at household level: Experiences by EnDev Bolivia and other EnDev countries demonstrate that picoPV systems can last 2-3 years. Local availability of spare parts (particularly new batteries) as well as maintenance and repair services increases the durability of the systems. Similarly, if households are trained and instructed in the correct use and maintenance of the PV systems, the useful life of the systems increases. In rural electrification, only Lighting Global approved products will be promoted. Interventions by EnDev will focus on facilitating the establishment of local PV sales/service points and on training of beneficiaries. These will also sell replacement systems for repeat customers in the future.

Portable ICS: Experience from other EnDev countries shows that portable metallic ICS have a limited lifespan, depending on the quality of the materials used, the design applied, and the use of the stove by the beneficiaries. A typical lifespan is 2-4 years. Since the technology is new, EnDev Bolivia will conduct studies to cast light on the durability of portable stoves and the factors that enhance/reduce this durability in the specific Bolivian context. Sustainability of access is addressed through development of the market (manufacture/import, design/testing, establishment of sales/service points).

Fixed ICS (Malena stove) and related products: EnDev Bolivia studies demonstrate that Malena stoves are durable; with proper maintenance they can last five years or more. The same can be assumed for the related products. The continued monitoring by EnDev, the interventions by the stove testing centre (CPC) and studies of the stoves have in the past allowed EnDev to adjust its intervention strategies and measures, for example in the improvement of didactic and support materials for the use and maintenance of Malena stoves and in the various training workshops for stove promoters and users. There is currently increasing co-financing by rural municipalities and through climate change funds, particularly for the purchase of parts that are not locally available (e.g. chimneys) and for payment of services of promoters.

Quality assurance: The cornerstone of ICS implementation so far has been the Malena fixed stove. All stoves must conform to a standard. Quality assurance focuses on two aspects: quality of the local material and local construction, and quality of the non-local material. In addition, continuous training and re-training of *Energy Promoters* is provided by EnDev Bolivia.

Sustainability of market development: The business environment in Bolivia has gradually become more difficult since 2006 and even more so in recent years. The government distributes picoPV products free of charge in rural areas, often in connection with political campaigns, thus threatening market development. The positive side, however, is that the government-distributed products serve to create a demand for more products, services and upgrades, which can be utilised by private entrepreneurs. Experience with purely market-based approaches in EnDev so far is slightly positive.

Grid densification and household connections: Household connections are a form of sustainable access to modern energy. Once connected, it is rare for a rural household to disconnect from the service again. The correct and optimal use of the electricity is a challenge that will be addressed through training and instruction of beneficiaries.

Energy sector innovation: Technology faculties in public and private universities experiment with locally adapted energy solutions in PV systems and thermo-solar systems. Energy companies promote most up-to-date technologies in PV solutions with better batteries, exchangeable batteries and more powerful lamps. The Bolivian Association for Renewable Energy promotes innovation among its membership through energy events in different parts of Bolivia.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	Reduced emissions noxious fumes due to reduced firewood and kerosene consumption. Reduced consumption of firewood. Reduced contamination from used batteries.
Health	Reduced exposure to kitchen smoke, reduced exposure to kerosene lantern smoke, better ergonomics.
Poverty/livelihood	• job creation for the *Energy Promoters*, in the regional energy companies and the importing companies • reduced workload for women in firewood collection and cooking • reduction of household expenditures due to reduced firewood consumption (in cases where firewood is bought)
Education	More time for studies and homework, and increased access to information (TV, radio) because of electricity access.
Governance	No
Climate change	Reduction in CO_2 emissions. Reductions in tree felling for firewood, with particular importance for rural communities living within the borders of protected areas.
Gender	• Reductions in the impact on the health of women because of reductions in emissions of noxious fumes from ICS and from PV systems (as compared to traditional cookstoves and kerosene lamps). • Involvement of more women in training and capacity building activities and as '*Energy Promoters*' and sales/service points. • More and better statistics and information about perceptions and participation by women in the technologies and markets promoted. • Gender-disaggregated information on training and capacity building measures will be collected.
Market development	65% of outcomes achieved through market mechanisms

4. Possible risks and potential ways to mitigate them

Some factors that could negatively influence outcome/cost efficiency are natural disasters (flooding and drought exacerbated by the El Niño phenomenon), increases in salaries, increases in transport cost, a devaluation of the national currency and political instability. EnDev will monitor these risks and will adjust if necessary, for example, by scaling down or rescheduling activities in areas affected by natural disasters. (On the other hand, special funds may become available for disaster relief.) There is relatively little that can be done about rising staff costs caused by mandated salary increases. However, the government seems to have reached a point where further increases seem less likely than in the past.

Another risk is a further deterioration of the business climate. Should this happen then EnDev will have to re-design its intervention strategies (for example, by targeting NGOs and municipality-led implementation) or, should this not prove feasible, phase out implementation.

Some factors that could positively influence the outcomes/cost efficiency are high political commitment to energy access (e.g., through the availability of funds at local level), potential removal of fossil fuel subsidies and cooperation with neighbouring countries on technology development.

5. Budget

		EUR
1	Human resources and travelling	**900,000**
2	Equipment and supplies	**155,000**
3	Funding financing agreements/local subsidies	**460,000**
4	Other direct costs	**250,000**
5	**Total direct costs (sub-total)**	**1,765,000**
6	Mark up costs/administrative overheads/imputed profit	**235,000**
7	**Cost price**	2,000,000

Central America (Guatemala, Honduras, Nicaragua)

Promoted technologies		solar / stoves / hydropower / grid			
Project period	old	09.2009 – 12.2018	**Budget (EUR)**	old	16,260,000
	new	09.2009 – 12.2018		new	16,790,000
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		178,120	178,120		people
Cooking / thermal energy for households		273,300	273,300		people
Electricity and/or cooking / thermal energy for social infrastructure		985	985		institutions
Energy for productive use / income generation		1,315	1,500		SMEs
Lead political partner		National Sustainable Electrification and Renewable Energy Programme (PNESER-FODIEN) in Nicaragua, Forest Conservation Institute (ICF) and General Directorate of Energy / Secretary of Environment and Natural Resources (SERNA) in Honduras, Ministry of Energy and Mines (MEM) in Guatemala.			
Implementing organisation		GIZ			
Implementing partner		Central American Sustainable Energy Access Fund for Poverty Reduction (FOCAEP), associations, cooperatives and SMEs			
Coordination with other programmes		Rural Development Programme in Guatemala (GIZ), Scaling Up Renewable Energy Programme (SREP) in Honduras and Nicaragua (IDB), HIVOS, Energy Efficiency Program in Artisanal Brick Industries in Latin America programme (EELA) by COSUDE-SWISSCONTACT and others			
Key interventions		• Grid based electricity supply for households, social institutions and SMEs • Installation of pico and micro hydropower plants (300 W – 10 kW) and solar home systems (30 - 50 W_p) • Installation of solar dryers for productive use • Training courses to improve knowledge of cooperating institutions, local technicians and user groups • Promotion and dissemination of improved cookstoves for households • Supporting technology transfer and provision of financing and technical assistance for efficient firewood use in productive processes (new)			
Main strategic changes introduced with up-scaling		Reduction of firewood use in SMEs for productive use by offering financing solutions and technical assistance to companies and cooperatives, enabling them to increase efficiency of firewood use and/or substitute firewood use with other technologies.			
Project manager		Klaus Hornberger klaus.hornberger@giz.de			

1. Situation analysis

1.1 General energy situation in the country

This up-scaling proposal focuses on productive use of firewood only. The energy situation will therefore be described only for the firewood energy subsector.

In the member countries of the Central American Integration System (SICA), firewood continues being one of the most commonly used source of energy. It is estimated that 45% of the population of this region depends on firewood as the main energy source. The highest concentration of firewood users is found in three countries: Guatemala, Honduras and Nicaragua. The firewood consumption in these countries makes up 80% of the regional consumption, while the remaining 20% is distributed between El Salvador, Panama, Dominican Republic and Costa Rica. Firewood consumption is principally concentrated in rural areas. The prevailing socioeconomic conditions in terms of low-income levels, scarce or sometimes non-existent physical infrastructure, low levels of electricity access coverage and cultural factors contribute to the situation. Nevertheless, the Latin American Energy Organisation OLADE estimates that also about 40% of the urban population in these three countries uses firewood for cooking, heating and productive use as drying of agricultural crops, baking, ceramic handicrafts, etc. In Honduras, the percentage of firewood users who has to buy firewood is estimated at 56%; while in Guatemala, 71% of the urban users depend on buying firewood. This percentage of users who buy firewood combined with projections indicating that the consumption might increase by 15% in the next years, imply a risk for the few forest resources of the region, especially if no programmes are implemented that ensure the sustainable use through promotion of energy efficiency measures, renewable energy plantations and control or supervision of the firewood market.

Although most of the information available about firewood consumption is concentrated on household use, other sectors exist that are crucial to consider when characterizing firewood consumption in the three countries: OLADE calculates that in Guatemala 2.3%, in Honduras 12.5% and in Nicaragua 11% of the total firewood demand stems from its use in commerce and industry. However, the availability of data is severely restricted due to the informality of the small and medium enterprises (SMEs) using firewood as their main energy source. Especially since most programmes in the sector concentrate on lowering the demand of firewood at household level, the commercial and industrial sectors need to be taken into account to tackle the problem of inefficient firewood consumption comprehensively. Opportunities to decrease firewood consumption in these productive sectors through the use of more efficient technologies are manifold but largely unknown. Many of the SMEs using firewood are generally located and linked to households and some products are difficult to distinguish between residential and entrepreneurial, as for example traditional bakeries and “tortillerías” that usually belong to women of scarce resources in rural and urban areas.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans.

The **political support** for the productive sectors that are using firewood as their main source of energy and that are to be targeted by the funds made available through this up-scaling (such as the agro- and food, and construction industry or artisanal production of pottery) is given by the relevant sector ministries and by the Ministries of Environment or Energy. They have normative responsibilities regarding the strategies and policies within the biomass sectors of their countries. EnDev has cooperated with these entities in the development of the National Strategies for the Sustainable Use of Fire Wood and Charcoal in Honduras and Nicaragua. The objectives and activities of this proposal are fully aligned with these strategies and national policies.

SE4All Rapid Assessment and Gap Analysis Studies have been prepared for the three countries. However, the productive use based on biomass resources is neither mentioned in these studies nor there are SE4All Action Plans yet defined for any of the three countries.

1.3 Institutional set-up in the energy sector

The activities with biomass energy resources are coordinated by the Ministries of Energy and Mines (MEM) in Nicaragua and Guatemala and by the Secretary of Natural Resources and Environment (SERNA) in Honduras. These coordinating public agencies are delegating and/or cooperating with the national forestry institutions as the Institute of Forestry Conservation (ICF) in Honduras, the National Institute of Forests (INAB) and the National Forestry Programme (PFN) in Guatemala and the National Forestry Institute (INAFOR) and the Ministry of Agriculture and Forestry (MAGFOR) in Nicaragua. In Guatemala a roundtable (*Mesa Interinstitucional*) is organized for coordinating the sustainable use of firewood and other biomass issues in an integrated way with various other public institutions as the Ministries of Education and Health. In the private sector there are several NGOs working on issue of energy efficiency in productive use of biomass resources working with small and medium enterprises.

1.4 State of market/sector development

In Central America, especially in Nicaragua, Honduras and Guatemala, the use of firewood for productive purposes of household enterprises and small scale industries is manifold and in most of the cases highly inefficient due to prevailing traditional technologies. Firewood is mainly used by SMEs in the following productive sectors:

- Agro- and food industry (curing and drying of crops, baking and food processing)
- Construction industry (production of chalk, bricks and tiles)
- Artisanal production of pottery and other ethnic handicrafts.
- Preparation and sale of food products mainly by women.

The main market development barriers for a more energy efficient traditional use of firewood in productive processes are:

- Its “informal” character: because the small scale industries that use firewood as its main energy source often operate in the informal sector, very little is known about the their real economic importance as they are usually not attended by government programmes.
- Lack of knowledge about efficient, proven and easily replicable technologies on larger scales.
- Lack of knowledge and technical assistance for the introduction of energy efficiency measures in the production process.
- Lack of access to appropriate and inclusive financing services as market driven co-investments.

1.5 Relevant activities of other donors and implementers.

The Energy Efficiency Program in Artisanal Brick Industries (EELA) financed by the Swiss Agency for Development and Cooperation (SDC) and implemented by Swiss Contact has valuable information and experiences of the artisanal brick production sector in several South American countries with some work implemented in Nicaragua and Honduras, mainly on the production and market characteristics and other aspects related to good productive practices, improvement of the product quality and viable technological innovations for improving the energy efficiency of the sector. Their information network and working experiences will be made use of in the project identification, selection and implementation process. Several NGOs are working with SMEs in areas of ethic pottery, tile and brick production and rural bakeries.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

The Central American Sustainable Energy Access Fund for Poverty Reduction (FOCAEP) has been established in 2013 between EnDev, BUN-CA and HIVOS. Through FOCAEP, EnDev contributes to market development of ICS in the three countries by attending the value chain from demand as well

as supply side. Co-financing with grants allows the allocation of stove products with small subsidies and the development of technical and entrepreneurial capacities of the market actors and financial intermediaries. Beneficiaries of the grant funds are NGOs, associations/cooperatives, or other private actors looking for leveraging their activities in allocating ICS with their beneficiaries or members. Technical assistance measures for the development of micro finance products with financial intermediaries or improving the technical and business capacities of stove manufacturers and distributers are also eligible for grants. **Reimbursable funds** are applied to strengthen the market by developing inclusive financial services with MFIs, stove manufacturers and stove distributers. Clients of both financing lines are identified by their strategic position in the value chain and by specific calls for proposals. The deployment of FOCAEP has been supported by EnDev with technical assistance and organisational development.

The market development vision for energy efficiency technologies in productive processes based on firewood, on which this proposal is focussing, is the utilization of inclusive financing models by SMEs to be able to lower the firewood demand and/or substitute the use of firewood with other technologies. This is to be achieved by opening a new line of financing within FOCAEP that goes beyond the use of firewood at household level for cooking. As this up-scaling is to provide a special focus on carbon emission reduction activities, the suggested approach is to establish a new financing line for selected projects of **Efficient Fuelwood Use in Productive Processes** within the Fund.

2.2 Specific intervention strategy

The establishment of the proposed financing line with a specific focus on reducing carbon emissions in productive use of energy is a new strategy within EnDev Central America. However, over the last years EnDev already gathered experiences with the introduction and wider dissemination of two technologies for productive use in Honduras. These experiences will feed into the new line of financing to be provided by FOCAEP:

- In cooperation with the Honduran Coffee Institute (IHCAFE) and the National Coffee Growers Association (AHPROCAFE), EnDev supported the installation of more than 500 **solar dryers for small coffee producers.** EnDev contributes financially for the purchase of plastic sheets for the dryers and the small farmers are contributing with the local materials and labour for installing the dryers. AHPROCAFE selects the small farmers (0.3 to 5 ha) in 15 departments and technicians and farmers are trained by EnDev in the construction of the dryers and aspects of business management. With the improved drying technology farmers can increase their coffee for sale by 46.6% and coffee prices by 15.7% due to the better quality they obtain. Dryers are also used by the families for drying staple grains and firewood.
- In cooperation with the local partner MAPANCE, EnDev facilitated the installation of 50 **improved kilns for small sugar cane farmers**. With the new kilns the bagasse of the sugar cane is used for cooking the cane juice to evaporate the water instead of firewood. EnDev has co-financed the improved evaporators, while the farmers contributed with local materials and labour for the construction of the kilns and a revolving fund for financing the evaporators was established by MAPANCE. With the improved technology firewood consumption during the processing was reduced by 88% and the time required for the production process was halved. As a consequence, farmers were able to improve the yield of brown sugar by 55% and the sales of brown sugar cakes were tripled.

Through this new financing line it is intended that FOCAEP will make available to selected recipients credits as well as grants for investments into more efficient technologies. Mixed financing, including grants for technical assistance and credit for hardware will also be a possible project set up. The fund will organize special calls for proposals and channel these through appropriate actors in the three countries in order to identify promising approaches and activities for increasing the efficiency or substituting the use of wood fuel in productive processes.

As the fund is intended to be open to any kind of productive use with high potential for carbon savings in the three countries, short (sub-)sector analyses with the most important socio-economic and other key data (such as target beneficiaries, consumption and reduction potential of wood fuel and associated costs and income opportunities, etc.) will have to be presented for each individual proposal as part of the identification and selection process prior to approval by the Coordination Committee of FOCAEP.

As a guiding principle, proposals by potential recipients to access credit and / or grants for technical assistance (TA) will have to present a clear interrelation between the proposed SME and either of the following actors:

- TA provider or nongovernmental organisation able to provide technical assistance and /or the management of grants.
- Micro finance institution (MFI) able to manage co-investments for credits.
- Associations or cooperatives as beneficiary or group of beneficiaries with the same traditional practices and potential for improvements.

According to the above mentioned specific sector analysis for the proposals submitted to FOCAEP, the individual selected projects will be required to contribute to the following impact indicators:

- Firewood reduction and associated fuel consumption cost reductions of at least 15 – 20% per SME,
- Reduction of emissions with pollutant materials (e.g. black carbon),
- Increase of the production of at least 10% per SME,
- Increase of the quality and added value of the products concerned,
- Strengthening of employment opportunities and technical and entrepreneurial skills of the SMEs,
- Reduced exposure to emissions for the employees of the SMEs.

The strategy to reach scale for climate change mitigation is:

- the selection of appropriate technologies and measures that can be applied across a number of SMEs with relatively low investment costs for improving the same traditional shortcomings or bottlenecks,
- and/or the reduction of firewood use for the individual SME is so pertinent, that the scale of production and impacts justify higher investments for the transfer of improved technologies.

The following are examples of possible measures to be implemented with the SMEs and also serve as project examples to be promoted by FOCAEP:

- Artisanal pottery, chalk, brick and tile production: increase combustion by the use of ventilators and/or improved kiln design in Nicaragua and Honduras.
- Production of brown sugar by fuelling with cane trash (bagasse): avoiding direct heating of sugar cane juice for the prevention of acrylamide contamination of the end product in Guatemala.
- Production of “Rosquillas” and other traditional bakeries: improved combustion with improved kiln isolation and/or design in Honduras and Nicaragua.
- Processing of agricultural cash crops: decreasing the use of wood fuel in drying or roasting of cashew nuts in Honduras, or substituting the use of wood fuel by solar drying of cardamom in Guatemala.
- Solar thermal applications for water heating: e.g. for hygienic sterilisation purposes in milk or other processing areas in the three countries.
- Preparation and sale of food products by women entrepreneurs: “tortilleras” using improved cookstoves for increasing production and product quality in the three countries.

2.3 Sustainability of the intervention

The sustainability strategy of this new line of financing of FOCAEP is based on the opportunity to attract market driven co-investors, thus contributing to overcome one of the most significant barriers for improving the technology innovation capacities of SMEs. Increased access to non-conventional debt or equity financing can mobilize investments in cleaner and more efficient technologies and ensure the realization of less intensive wood fuel use.

Combining "good management practices" with new partnerships between SMEs, MFIs, FOCAEP and bringing in the expertise from other programmes (such as the EELA Programme) contributes to sustainability by establishing local linkages and anchoring those within the respective sectors.

The savings generated by reduced firewood consumption can furthermore be utilized in several ways to be determined by the SMEs, including increased family income, improved working conditions and capital access to improve other components of the production chains. Hence, going beyond carbon emission reductions, with an appropriate mix of efficient technologies it is possible to promote a more decent standard of living in terms of income, safety, and job security in efficient, sustainable and equitable ways.

The **gender equality strategy** of EnDev Central America and FOCAEP incorporates the strengthening of gender awareness of partners and beneficiaries by:

- Applying gender sensitive selection criteria for the approval of proposals,
- Strengthening gender orientation through awareness raising in technology transfer and TA activities,
- Demanding at least 25% participation of women in training and TA activities.

The following set of parameters will be applied for verifying gender equality in the proposed project activities:

- Women are enabled to participate and negotiate in production processes, can take decisions about economic resources generated, and reduced labour loads allow leadership in the production units.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	• At least 5,000 tons of CO_2e/year avoided by firewood reduction and/or substitution in productive use activities.
Health	• Reduced exposure to emissions for the employees of the SMEs.
Poverty/livelihood	• Strengthen employment opportunities of SMEs. • Increase of production of at least 10% per SME. • Firewood reduction and associated fuel costs savings of 15 – 20% per SME. • Increase of the quality and added value of SME products.
Education	• Strengthen technical and entrepreneurial skills of SMEs.
Governance	• Exert the inclusion of industrial use of biomass resources in national strategies.
Climate change	• Reduction of emissions with pollutant materials (black carbon).
Gender	• At least 25% participation of women in training and TA activities. • Application of gender sensitive selection criteria for project approval by FOCAEP.
Market development	• Increased involvement of MFIs in financing energy efficiency technologies for the productive use of firewood.

4. Possible risks and potential ways to mitigate them

As this new financing line will be established within FOCAEP, it is uncertain if enough verifiable proposals covering the productive use of firewood energy will be submitted to the fund by the relevant actors of the three countries in due time. Therefore it is foreseen as a first step to identify the specific sectors and actors, as well as their institutional and technical experiences in order to be able to offer tailored services in project identification and formulation in the three countries.

5. Budget

		EUR
1	Human resources and travelling	100,000
2	Equipment and supplies	
3	Funding financing agreements/local subsidies	370,000
4	Other direct costs	30,000
5	Total direct costs (sub-total)	**500,000**
6	Mark up costs/administrative overheads/imputed profit	30,000
7	Cost price	530,000

Ethiopia

Promoted technologies		solar / stoves / hydropower			
Project period	old	01.2010 – 06.2017	**Budget (EUR)**	old	19,137,000
	new	01.2010 – 04.2019		new	29,393,000[27]
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		237,750	409,250		people
Cooking / thermal energy for households		1,375,000	1,710,000		people
Electricity and/or cooking / thermal energy for social infrastructure		925	2,160		institutions
Energy for productive use / income generation		2,900	4,900		SMEs
Lead political partner		Ministry of Water, Irrigation and Electricity (MoWIE)			
Implementing organisation		GIZ			
Implementing partner		Ministries of Energy, of Health, of Education, of Environment, Forestry and Climate Change; Regional Agencies/Bureaus of Energy, Education, Health, Women Affairs and Agriculture; Universities/Institutes of Technology/Technical Vocational Educational and Training (TVET) Institutes; Associations of Solar Energy Development and of Hydropower; Rural Electrification Fund (REF); Regional development and women associations; private companies; World Food Programme; various national and international NGOs such as World Vision Ethiopia, Horn of Africa Regional Environmental Centre; NABU; Solarkiosk			
Coordination with other programmes		GIZ Sustainable Land Management & Education Programme; Lighting Africa; National Biogas Programme including SNV activities; Mapping the EU + Engagement in the Green Sector			
Key interventions		**Improved Cookstoves (ICS)** Up-scaling the existing commercial stove approach through: • Capacity development and Promotion • Support of semi-industrial production of ICS • Extending the different financing mechanisms • Promotion of an integrated chimney for 'Mirt' stove • Improving quality of local ICS with substantial market shares • Improving biomass fuels value chain **Solar** Intensifying existing efforts through: • targeted capacity building on quality and warranty systems • addressing financing constraints at supply and demand end **Micro hydropower** Upgrading 30 existing traditional mechanical watermills into micro hydropower plants (MHPPs)			

[27] New funds to be made available from the following sources: EUR 9,000,000 by the EU, EUR 1,500,000 by EnDev global both for overall up-scaling of EnDev Ethiopia, and EUR 418,000 by NORAD for school electrification. In addition, the RBF component has been downscaled by EUR 662,000.

Main strategic changes introduced with up-scaling	The project will predominantly continue its strategies in the different components: Main changes and modifications of the approaches include the following aspects: • Stronger promotion of female owned solar enterprises • Use of the health extension infrastructure to promote clean cooking and lighting • Introduction of a new 'Mirt' Injera baking stove **with chimney** for smoke removal from kitchens and an improved version of the Tikikil stove • Supporting the market development of alternative biomass fuels • Establishment of functional warranty systems and awareness in cooperation with solar retailers & wholesalers • Facilitating MFIs' capital for energy access through market intelligence, technical support and capacity development • Promotion of energy access through enhanced cooperation with cooperatives and rural saving and credit associations • Up-scaling MHP development from pilots to replicable approaches through implementation of 30 MHP mini-grids
Project manager	Rainer Hakala Rainer.Hakala@giz.de

1. Situation Analysis

1.1 General energy situation in the country

a. Improved Cookstoves

Biomass is the main cooking fuel in Ethiopia. It is used by 99% of the rural and 80% of urban households and collected by women and girls. Unsustainable use of biomass results in deforestation and consequently land degradation. In addition to this, the incomplete combustion of biomass inside the home generates indoor air pollution which causes adverse health effects.

b. Solar

Only 5% of rural households in Ethiopia are connected to the national grid. More than 85% rely on fuel-based light sources, predominantly kerosene and/or on cheap Chinese lamps operated with dry cell batteries. On average rural households spend EUR 3.5 per month for kerosene, dry cell and mobile charging. As a result, they proportionally spend more of their income on power than on-grid households. Modern off-grid lighting systems, like small PV systems are often inaccessible or only available in low quality. Although cheaper products have lower investment costs, they often result in higher maintenance costs and shorter life. Unfortunately, market access to high-quality products in Ethiopia is still restricted. In addition, since access to financing for energy systems is limited in rural areas, potential customers are unable to afford PV systems, while retailers lack sufficient working capital. Off-grid regions in Ethiopia are often remote and difficult to access. Social institutions face challenges to secure their daily energy demands through diesel fuel, kerosene and dry-cell batteries. Local companies often lack the capacity to install solar systems and to offer adequate service and maintenance in remote areas.

c. Micro hydropower

In remote areas, where capital for investment is very limited, off-grid electricity supply becomes unaffordable for households, institutions and SMEs. A lack of capital may even lead to limitations in making productive use of electricity by the time it actually becomes available. Despite their great potential, MHP plants are not widely installed in Ethiopia yet and local companies that offer construction, service and maintenance of such are still few.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans

The rapid up-scaling of sustainable, clean and modern energy technologies is a key objective of the Ethiopian Government as reflected in their policy framework. The overall objective of the National Energy Policy is to provide all citizens with access to affordable, clean and modern energy and achieving middle-income status through carbon-neutral growth by 2025[28]. In the Growth and Transformation Plan (GTP) II of the government has the target to increase generation capacity to over 17 GW by 2020, with an overall potential of 35 GW by 2037, which would enable Ethiopia to become a regional renewable energy hub in East Africa. When it comes to the off-grid sector, GTP II's major objectives include the dissemination of 3.6 million solar lanterns, 400,000 additional solar home systems (SHS), 3,600 institutional PV systems and the construction of 105 micro hydropower sites. Additionally, this includes disseminating 11.45 million additional improved cookstoves and 250 new briquetting plants by 2020. The overall stated target is to reach 100% electrification by 2020. Energising Development Ethiopia is fully aligned with the GTP targets as well as with numerous other initiatives on the national[29] and international level[30].

1.3 Institutional set-up in the energy sector

At the federal government level, there exist a number of institutions involved in the energy sector in Ethiopia. The Ministry of Water, Irrigation and Energy (MoWIE) is the official implementing partner for EnDev and is responsible for the electricity sector, and overseeing, among others, the Rural Electrification Fund. The Regional Energy Bureaus of Amhara, Oromia, Tigray and Southern Nations Nationalities and Peoples Regional Governments of Ethiopia are co-implementers at ground level, and co-financing different components of the interventions. The mandate of promoting ICS has been shifted to a newly established Ministry of Environment, Forestry and Climate Change which is also in charge of coordinating Clean Development Mechanism (CDM) activities in the country. The World Bank, in addition to its overall support of the country's power sector, is also promoting the Lighting Africa initiative in cooperation with MoWIE. There is a National Improved Cookstove Programme (NICSP), with its secretariat within MoWIE maintaining regional offices in the different regions of the country. The NICSP has the role of national coordination to implement programme components such as Technology, Market, and Measurement, Reporting and Verification (MRV). The NICSP is expected to build the capacity of counterparts who eventually will take over the task. Currently, the NICSP is in the process of establishing its branches at regional level.

Furthermore, the government has initiated the development of a national biomass cookstove standard and regulation.

The government has included the dissemination of ICS as one component in its extensive public health programme.

1.4 State of market/sector development

a. Improved Cookstoves

The market for high quality ICS in Ethiopia is still in an early stage. Both, the supply and the demand side for these ICS, are relatively weak. There are only few production centres for high quality stoves with limited capacity and the demand is dominated by large orders of aid organisations and governmental programmes, such as the National Improved Cookstove Programme, which has disseminated 8 million stoves in the past five years according to estimates. Customer awareness about the benefits of ICS for instance the reduction of Indoor Air Pollution is low. Moreover, there are a limited number of marketing and promotional activities in the sector as small-scale producers lack the financial resources for marketing and promotion. Outside of the government and EnDev

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[28] Democratic Republic of Ethiopia (2011). *Ethiopia's Climate Resilient Green Economy Strategy*.

[29] E.g. Climate Resilient Green Economy (CRGE); National Improved Cook Stove Programme (NCISP); SE4ALL National Action Plan

[30] E.g. Energy+

Ethiopia, other stakeholders in the sector are not actively involved in awareness creation and promotion beyond their intervention areas.

Ethiopian markets and street shops are full of very low-quality stoves without any benefits except a bit of higher safety level (iron structure without any energy-saving). Various fuel-saving technologies were disseminated in the country by a set of actors in the sector, which do not fulfil today's energy efficiency standards. For instance, the Lakech charcoal stove has been promoted since 1992 by the then Ministry of Water, Irrigation and Energy. It is the most widely used improved charcoal stove in Ethiopia. In urban areas almost 100% of the households use this stove for cooking. In rural areas charcoal is used only exceptionally. Other stoves like the government-promoted Gonziye clay stove and the clay Upesi/Zewarit – which burn wood-fuel - have entered rural markets because of their relatively low price. The stoves are mainly disseminated to the rural households through stove producers trained by the government.

The Government has supported large scale manufacturing and marketing of Injera electric baking stoves (IEBS) or so-called "Mitads" at subsidized rates. As a result, the ownership of Mitad increased from 13% in 1984 to over 70% in 1997 of grid-connected households. Imported stoves such as Ethanol stoves, the wood-fuel EZY or the Berkeley Ethiopian stoves are available in some parts of the country. However, their market share is very low.

EnDev has been active in Ethiopia since 2005. The stoves promoted during the first phase were: The Mirt 'Injera' baking stove, the "Addis" Injera baking stove, and the household rocket stove (Tikikil). Interventions concentrated on the regions of Amhara, Oromia, Tigray and Addis Ababa. During the second phase of EnDev which started in 2009, activities were extended to Diredawa, Harari and SNNPR focusing on market development support through technical and business trainings, promotional materials and campaigns. However, the interventions in the emerging region were limited. Further emphasis was put on following-up on quality control, maintaining stove producers in existing regions and training of new producers in new intervention regions. Moreover, focus was also given for technology development and testing and piloting of new cookstove technologies for both household and institutions.

EnDev has trained over 490 small-scale producers of energy efficient cook stoves in 310 districts across seven regions. These producers have sold more than 1,000,000 improved cookstoves including Mirt for injera baking, Tikikil for cooking and the institutional rocket stoves for cooking at institutions. More than 700,000 persons are currently benefitting from these technologies amounting to a combined household fuel savings of more than 570,000 tons of biomass. Over the last two years an average of 50,000 ICS has been sold per semester.

Despite the above mentioned impact, a recent sustainability study conducted by EnDev (2014) has indicated that the overall penetration rate of EnDev promoted ICS remains low in the three major regions of Oromia, Amhara and Tigray. The highest ICS penetration rate registered is in urban Oromia with nearly 14%, whereas the lowest penetration rate was found in rural Tigray with 4%. The penetration rate in Amhara lies between 8 or 9% for rural and urban areas.

One major reason for low penetration rates is small scale production which results in low productivity and product quality. Factors such as transportation costs to remote areas, lack of suitable distribution infrastructures and the need to adapt improved cookstove designs to specific cooking needs and habits hamper the development of a rural market for ICS.

b. Solar

The Ethiopian (pico)PV market has been growing significantly in the last years. However, the market is complex and confusing with many small distributors using unclear channels and a lot of sub-standard products which pass through Merkato (N.B.: the largest market in SSA). The solar association assumes that currently around 2000 retailing businesses are active in the market, selling product distributed from around 35 wholesalers. Some of them provide training to their retailers. Many products are sold by unqualified traders which are not able to distinct between high and low quality goods and cannot provide technical advice to the customer.

When EnDev started interventions in the Ethiopian solar sector in 2006, PV systems were barely available and the technology was new to the country. Although national and international stakeholders identified solar technologies as reasonable solution to provide electric energy access to Ethiopia's off-grid population, implementation projects were sporadic and were suffering from poor sustainability - most of the previously installed PV systems were dysfunctional or not used properly. PicoPV systems were introduced in a test phase in Ethiopia in 2007 followed by EnDev's initial interventions in the picoPV market in 2010.

The baseline situation of the solar market in 2006 could be described as an "unwritten page" or even non-existent in regards to picoPV systems. Initial GIZ interventions focused on the installation of bigger PV systems for social institutions, followed by products for small household and individual systems being developed jointly with other national and international stakeholders. Key interventions were awareness creation amongst rural population and measures for improved reliability of PV systems. In 2011, the Ethiopian prime minister launched the "Climate Resilient Green Economy" (CRGE) Strategy which includes PV systems as key technology for electrification of the rural population. This changed the whole perception of solar technologies in the public sector and offered new opportunities for EnDev Ethiopia.

Since 2008, EnDev has electrified more than 160 social institutions with PV systems ranging between 1.5 to 2 kW_p and benefitting over three million people with improved health, education and other community services. Numerous capacity building measures for installation companies, service technicians and end users were conducted to ensure the sustainable operation of the solar systems. Additionally, the installation of larger PV technologies, with a direct benefit for the rural population, helped to promote smaller PV systems. Beginning in 2010, EnDev started promoting smaller PV systems like solar lanterns and solar home systems (SHS). Until end of 2015, more than 180,000 solar lanterns and 7,000 SHS have been disseminated by EnDev trained retailers during EnDev phase. Moreover, over 100 retailers have been trained in installation, servicing and maintenance of these systems. In total, more than 350,000 persons are currently benefiting from sustainable access to secure lighting and access to basic electrical appliances powered by small PV systems.

The solar sector still faces multiple barriers to a healthy sustainable growth. Despite the fact that more than 85% of Ethiopian rural households have to rely on fuel-based light sources, and that PV systems offer a competitive and sustainable alternative, the dissemination of solar technologies amongst this population is still limited. Modern off-grid lighting systems, like small PV systems, are often inaccessible or only available in substandard quality. Although cheaper products have lower investment costs, they often result in higher maintenance costs with a shorter lifespan. In addition, market access to high-quality products in Ethiopia is still restricted which is partly due to lack of consumer awareness or their ability to gauge quality. In addition, since credit for energy systems is limited in rural areas, some potential customers are unable to afford PV systems, while retailers lack sufficient working capital to provide them. With the increasing demand for solar powered systems, larger systems are increasingly being inquired about. Whenever the design shifts from a "plug and play" system (e.g. solar lantern) to a component based system, a trained technician is needed for the proper installation of the system. With a lack of trained technicians, even quality systems suffer from a reduced lifespan. PV powered social institutions are usually installed by trained technicians that also would offer proper service and maintenance. For these larger systems, the main challenge is the financial coverage of service and maintenance costs. The replacement of battery banks, for example, usually requires hard currency access and is expensive. Even with a conservative use of batteries and perfect service, battery replacement still needs to be considered after 5 years of service.

c. Micro hydropower

The mountainous topography of Ethiopia coupled with numerous rivers and streams makes MHP development highly suitable. About 15% of the overall hydropower potential is from unregulated river run-off, usually in the category of pico, micro and mini hydropower plants. The total potential for micro hydropower (of size less than 500 kW) is estimated to be 100 MW. By 2012, the baseline of EnDev's first intervention, the market was left largely untapped. In the past, productive use of water

has been mainly limited to traditional watermills for grain milling, which is widespread in the water rich regions in the western and south-western parts of the country. These existing water mills can be upgraded to serve for both milling and electricity generation. EnDev Ethiopia has more than 400 water mill sites identified and documented.

In its first intervention phase in 2009, EnDev trialled the feasibility of upgrading these water mills to construct MHP sites and mini-grids to provide electricity to the communities surrounding the mill site. In a pilot project, MHPs were installed at four different sites in the Oromia and SNNPR Regions. Apart from the feasibility of mill site upgrading to MHP, the operating model of community cooperatives was trialled in an Ethiopian context. As a result, close to 5,000 individuals, 40 social institutions and close to 100 SMEs gained access to electricity. The successful installation of these MHP plants can be regarded as a first proof-of-concept of the general feasibility and suitability of the community based approach of constructing and operating a MHP for off-grid, rural electrification in Ethiopia. The challenge is to find committed communities, able to self-organise as a cooperative, including the establishment of list of customers, collection of connection fees, connecting additional households at a later stage.

The increased attention to MHP by the Ethiopian government, which targets to construct 105 MHP sites in the coming five years, further exemplifies that MHP could develop into a strong off-grid electrification alternative in the coming years.

Current barriers or limitations of the sector are manifold. The lack of purchasing power in rural communities, the lack of uptake of productive use of electricity (PUE) activities, unclear regulations regarding grid extension procedures and lack of local industry and skilled manpower make the sector highly challenging for private investments. Mini-grids in Ethiopia are generally economically not feasible in the sense that investment cost are recovered. However, they can be operated in a way that the cooperatives cover the operation and maintenance costs of the scheme for its lifetime. In its current state, the development of MHP sites will largely depend on donor and government support. With households being unable or unwilling to pay tariffs for lighting of EUR 2/month, creating a positive business case that covers maintenance and repairs remains a key challenge. It will be important to find anchor customers, which guarantee a fixed income of the MHP.

1.5 Relevant activities of other donors and implementers.

The World Bank is financing several programmes under the Energy Access and Electricity Access (Rural) Expansion initiatives. A major project component includes the support of rural electrification through off-grid systems. Moreover, the Electricity Access Expansion Project aims to bring grid, mini-grid and off-grid electricity access to more than 250 towns and villages and provide such services as lighting for schools and clinics – benefiting a total population of about 1.8 million.

In the field of ICS, there are many organisations currently active; however, their involvement is mainly focused on financing the National Improved Cookstove Programme which supports the mass production of ICS. At the highest level, the most pertinent ones include SE4ALL, (Norwegian) Energy+, BARR foundation and UNDP. The regional development associations (e.g. ORDA, REST, Dinsho, WDA, SDA, ODA) are actively involved in the promotion and dissemination of ICS which complements EnDev activities throughout the country.

Despite ambitious goals set by the Ethiopian government to develop the solar market, activities from other donors and implementers remain limited. Especially the off-grid market for small PV systems is overlooked by most donors. The largest actor outside of EnDev is the International Finance Cooperation/World Bank Lighting Africa Ethiopia programme. Implemented since 2015, it aims at facilitating access to modern off-grid lighting options with a special focus on consumer and PV retailer education activities. The USAID Power Africa programme focuses more on larger systems rather than the smaller PV market. Many smaller programmes exist in the field of solar entrepreneurship or the electrification of social institutions, but the volume of these interventions is rather small. EnDev is in close contact with all other donors mentioned, and is currently regarded as the main player for picoPV dissemination and the electrification of social institutions because of the size of its activities and the experiences gained so far.

Like the technology itself, relevant activities of other donors and implementers in the field of MHP are in their infancy. With the support of the government and relevant agencies such as the Ethiopian Rural Energy Development and Promotion Centre (EREDPC) and funds like the Rural Electrification Fund, the development of MHP is gradually increasing along with the interest in the rehabilitation and modernisation of the old abandoned "Arab axis mills" and or new constructions. Larger donors such as USAID, via the (Beyond the Grid) project under the Power Africa initiative are active in off-grid activities such as MHP construction. These projects are still in the initial phase.

Ethiopia is one of the National Partner Countries of GACC but not the Alliance's Focus Country. The activity of the alliance is limited to supporting a number of studies. In 2012, the Alliance conducted a draft market assessment for ICS, as well as an assessment of biomass fuel resource potential and utilisation in Ethiopia.

2. Project Approach

2.1 Market development vision and EnDev conceptual approach

a. Improved Cookstoves

EnDev's vision for the sector is that the conditions for a pro-poor market development in the cooking sector improve significantly over the next year, by resolving some of the main barriers and by optimising the balance between the supply and demand sides of the ICS commercialisation. The existing ICS producers will be strengthened and new producers will be trained in areas where there is a supply constraint. Extensive promotional campaigns will be designed and implemented with and through partners and with enhanced involvement of the private sector to create favourable market conditions particularly in the rural areas. Linkages with local MFIs to design a financing mechanism for the end users who can only pay on instalment basis for a fixed period of time shall be facilitated.

In addition, to strengthen alternative supply of fuel, support for briquette (from agricultural waste) producers will be provided along the whole value chain - from the purchase of machines to their installation and through the provision of trainings on production, business, operation and maintenance. Furthermore, the briquette producers will be supported in accessing different markets and establishing market linkages. In the process, EnDev supported stove producers will be linked with briquette producers and retailers to come up with a package solution (stove, mainly the Multi-fuel Tikikil, and fuel). Moreover, some of the existing producers shall serve as a sales outlet for the briquettes and stove. Also linkages with local MFIs offering loans to end users shall be facilitated. Establishment of a revolving and/or guarantee fund in cooperation with MFIs is being considered.

Another new component is the inclusion of production trainings for the low-cost Mirt chimney stove as well as the recently-developed mud Chigr-Fechi stove and its introduction to the market.

b. Solar

Over the next five years, a more robust solar market shall be established through the introduction of a functional warranty system for picoPV products, access to finance through MFIs and further capacity building for retailers and technicians. Together, this will increase transparency in the market and provide added value for end consumers. This means that end-users of PV systems will have access to warranty services and will be advised to purchase the product that best suits his or her needs. Customers, who do not have the necessary capital at their disposal, will have access to corresponding financing solutions. Supporting the sustainability of this market will be the added capacity of technicians and retailers to properly install PV systems and support entrepreneurial activities in the sector.

c. Micro hydropower

Over the next five years, hydropower will prove itself a viable solution for off-grid electrification. Local technical and manufacturing capacities among the different stakeholders are enhanced and a refined model of community management and ownership is being used.

Through the involvement of numerous Ethiopian partners in the delivery of the planned 30 MHP sites, local capacity building in areas like site scouting and assessment, installations, civil works and manufacturing of mechanical parts like turbines, will lead to a technical self-sufficiency for development of projects in the future. The domestic demand of the sector will grow to a level that specialized players (e.g. turbine manufacturers) can run their businesses profitably. Sustainable operating models that address financial and technical needs of the communities will reduce the strong need for donors and governments involvement.

2.2 Specific intervention strategies per (sub)sector

a. Improved Cookstoves

ICS dissemination still faces several challenges such as market inefficiencies and limitations, high costs and low productivity as a result of small scale production, low product quality, high transportation costs to remote areas, lack of suitable distribution infrastructure and the need to adapt improved cookstove designs to specific cooking needs and habits. To address these challenges EnDev is implementing activities in six key intervention areas:

Key Intervention 1: Capacity Development and Promotion

Already active ICS producers will be strengthened through refreshment training and promotional support. In addition, new producers will be trained and supported in areas where there are supply constraints. Promotional campaigns will be implemented to expand the market especially in rural areas. Linkages with local MFIs will be established to design financing mechanisms for the end users who are unable to afford the up-front cost for ICS technologies.

Key Intervention 2: Support Semi-Industrial Production of ICS

The ICS production process of the selected small scale entrepreneurs and producers will be upgraded to reinforce a sustainable supply chain in the market. It is expected that the production of stoves in higher volumes reduces the unit cost and thus price to the end consumer. In addition, the quality of stoves is enhanced while at the same time reducing the cost of quality maintenance. Finally, specialised skills of the stove producers and manufacturers shall improve product features – leading to innovations for existing products and for the development of new ones. The selected producers will receive technical supported, technical training, basic production equipment, access to market linkages and support from the relevant public sector in accessing land and credits.

Key Intervention 3: Extending the different financing mechanisms

The results-based financing (RBF) approach uses private sector resources to finance inputs and service delivery and public resources to partially reimburse the service provider upon delivery of pre-defined results. EnDev has already started piloting the RBF approach in two regions. Based on this experience, EnDev is considering extending this initiative to other regions within this up-scaling proposal. Similarly, the experiences gained in registering Component Program of Activities (CPAs) in the ongoing implementation of the Clean Development Mechanism (CDM) under the Irish Aid cooperation shall advise the further extension of this financing mechanism within EnDev Ethiopia.

Key Intervention 4: Promotion of Integrating Chimney for 'Mirt' Injera Baking Stove

While the existing Mirt stove has significant smoke reduction potential due to its enhanced biomass combusting qualities, the installation of a chimney can be extremely effective in improving the air quality in kitchens further. The Federal Ministry of Health, with its policy focusing on disease prevention via the complete removal of smoke from the kitchens, is advocating for stoves with chimneys. Thus, to enhance the adoption of such improved cookstoves in collaboration with the ministry, piloting interventions which promote chimneys are crucial at this stage. As chimneys are expensive for low income groups, affordability challenges shall be resolved by the arrangement of proper financing mechanisms. Furthermore, solutions such as introducing chimneys made of local clay or mud as raw materials can be demonstrated as a pilot case. This project intends to implement both of these strategies.

Key Intervention 5: Improving existing ICS with substantial market shares

There are widely available ICS of lower price and quality which enjoy a substantial- or promising market share, but currently do not fulfil EnDev minimum quality criteria. EnDev's strategy is to overcome the challenge of competing with cheaper and lower quality ICS by improving existing models in terms of efficiency and/or reduction of IAP. Furthermore, increasing the range of utilisation of "EnDev-promoted" stoves, e.g. adapting Tikikil stove for coffee-brewing, to substitute less efficient and lower quality stoves shall also constitute part of the strategy. Already existing and well-known stoves (Tigray Mud stove, Upesi, Modular Mirt, etc.) can be further improved to meet both, local user habits and quality / efficiency standards of EnDev. Different types of stoves for different market segments will be availed.

Key Intervention 6: Improving biomass fuels value chain

The severe fuelwood scarcity in Ethiopia may be further exacerbated by the implementation or enforcement of land enclosure policy in the country in recent years. On the other hand, massive quantities of agricultural residue (cotton stalk, sesame straw, coffee husk, etc.) rot or are simply burnt in the field. To address this issue, EnDev has piloted one carbonised briquette plant (from sesame straw) in Adebay Humera, Tigray Region. Enhancing the household fuel supply through alternative fuel like briquettes will contribute to a significant reduction of GHG emissions through a lowered demand of non-renewable biomass. EnDev, through the promotion of briquette production and sale will further push the sales of high quality briquette stove such as multi-fuel Tikikil.

As an additional activity, EnDev will work on the improvement of the existing inefficient charcoal production system. For instance, there is a massive invasion weed tree (Prosopis) in the agricultural lands of the North-eastern and Eastern parts of the country which can be used for charcoal production.

In the key intervention areas EnDev will cooperate with several partners. The semi-industrial production of ICS will directly be supported by the NICSP. The RBF is implemented in cooperation with the Regional Energy Mines and Energy Agency, women development group, MFIs and Service providers to reach rural households. The Ministry of Health through its regional line bureaus is supporting the complete removal of smoke out of kitchens. Thus, health extension workers are working on clean kitchen awareness creation and ICS dissemination in coordination with EnDev. Organisations like World Vision Ethiopia, ZOA, WFP, SNV, Solarkiosk and HoAREC are supporting ICS dissemination through different mechanisms such as CDM implementation, dissemination in refugee camps, as well as establishing sales and retail outlets. EnDev Ethiopia has been cooperating with these organisations and continues to establish further cooperation with a number of NGOs and private sector companies.

b. Solar

The key interventions can be split into two fields of activities: those for bigger PV systems for social institutions and activities serving the market development for smaller PV systems. Due to limited financial resources, larger systems for public social institutions need significant donor involvement, whereas smaller systems for household could be affordable to the majority of Ethiopians provided that appropriate financial service-products exist. Electrifying social institutions has additional benefits in the area of health and education and plays a significant role in the public perception of PV technologies. They serve as a multiplier and demonstrate the benefits of solar technologies in a practical way. As sustainability is an important factor for any technology, interventions continues to be accompanied with focused technological capacity building and selected end user trainings.

Key Intervention 1: Creating Financing Options

As the solar market is currently driven by a scarcity of products, prices for PV systems suffer from erratic and no transparent pricing. This has a direct impact on the affordability of products and the access to financing as financial products are calculated according to price. As an initial step, the creation of transparent pricing through direct access to pricing information for customers and retailers and recommended retailer prices will be established. Initial discussion rounds with the

wholesaler community in regards to establishing a transparent pricing mechanism has shown a willingness to collaborate on their part. Once a general agreement has been reached, the topic of information distribution will be addressed. As key component of the initiative a comprehensive database for solar wholesalers and retailers will be established to enable a functional warranty system and allow market analysis. The primary stakeholders will be regional energy offices and retailers.

For end-users that do not have the financial resources to pay upfront for a PV system, respective financial products by MFIs will be developed. As funds for renewable energy products are generally available, EnDev's intervention will focus on practical implementation. This will require - aside from the general design of the financial products - quality assurance and process flow management. For example, currently for PV systems that require third party installation services, it is unclear who is held responsible if the system does not function properly. This will require an appropriate risk management and quality control mechanisms amongst all parties involved.

Key Intervention 2: Quality and Warranty

Aside from reasonable pricing and access to financial products, the main concern for end users is the long term functioning of products purchased. Both, the initial product quality and the warranty system determine the sustainability of the service provided by the product. An existing warranty system can compensate quality shortages from the end-user's perspective. The warranty provision also provides a secondary tool to improve the initial quality of products. A sustainable and healthy market requires the free flow of information to support 'educated' decisions in regards to the quality of products. Quality hereby is defined as value added in terms of product standard and services proportional to the price paid. Therefore, the key intervention in regards to quality focusses on awareness creation on the demand side, professional ethics on the supply side, and capacity for retailers to consult end-customers appropriately. It is not believed that a public ban of so called "poor quality products" will create the desired effect in the solar market. Rather, a collective rejection of these products by end-customers will, through demand pull, create a profitable situation for wholesalers to provide higher quality products.

The introduction of product warranties is currently being discussed with the majority of wholesalers, the solar association and relevant governmental bodies. The goal is to establish a functional and accessible warranty system for end-customers. This needs legal or voluntary agreements amongst stakeholders and solutions in regards to accountability and logistics. Within the first year of the project the general layout of the warranty system will be agreed on and practical implementation will start thereafter.

Key Intervention 3: Capacity Building

All the above mentioned interventions include a capacity building component to supply the market with practical technological and entrepreneurial capacity to strengthen retailers, service technicians and installation companies. EnDev aims to continue training solar technicians on installation, service and maintenance of solar systems. Retailers shall receive training on basic service repair and entrepreneurial skills while regional partners gain competencies in evaluating and steering public activities within the solar market.

Several of the activities mentioned in the key intervention will be carried out in cooperation with different stakeholders from the public and private sector. MoWIE has started a programme to engage TVET graduates to form energy cooperatives as village electricians in order to promote and improve the energy coverage in rural areas. EnDev will support those cooperatives that exhibit a sufficient level of organisation in establishing a viable business for solar products and reducing the challenges of after sale services. The government also supports MFIs to develop feasible financial products that address the needs of customers interested in PV products. However, the loan officers of the MFIs do not know yet how to utilize the given funds and will be supported by EnDev.

Lighting Africa is working with the Ethiopian Conformity Assessment Enterprise (ECAE) to set national standards for solar products and is having consumer awareness campaigns. Together with

international initiatives such as Lighting Africa, EnDev will work on the improvement of the quality framework of PV products. A close cooperation with the Ethiopian solar association and wholesalers of solar products already exists and will be strengthened throughout future interventions. The solar association will play the coordinating role to have a sustainable coordination structure

c. Micro hydropower

This up-scaling for three years will be used for a wider scale roll-out of MHP in Ethiopia. This will be the largest roll-out of the technology in the country to date. To deliver the project in the allotted time, strong partnerships will be formed that will enable capacity building and serve for a professionalization of the nascent sector.

Key Intervention 1: Upgrading 30 Existing Traditional Mechanical Watermills into MHPs

Out of a list of more than 400 potential water mill sites, 30 will be chosen for further development of MHP. The 30 mill upgrading projects are to be constructed in Oromia, Amhara and SNNPR region with an expected capacity in the range of 20 kW per site. The sites will be chosen out of a list of more than 200 potential sites, which increases the likelihood of finding highly suitable sites. The intervention will provide at least 3,000 households and several hundred social institutions and SMEs with electricity.

The business model used in the EnDev Ethiopia MHP watermill upgrading is closely aligned with the Ethiopian Government's cooperative establishment laws and regulations. Accordingly, the MHP cooperative committee shall own, run and manage the plant on behalf of the community. As a community-managed private limited company, the cooperative has its own capital, and specified number of shares to be sold to any member of the community who is over 14 years of age. Moreover, the former mill owner and his or her family members will also become members of the MHP cooperative and shareholders.

Tariff setting is done via a financial analysis, which will determine a price that is affordable for the community while covering operating costs including maintenance and repairs. This is done in consultation with the community, partners, and shareholders. The two main revenue sources are 1) electricity connections from households, social institutions, and SMEs; and 2) mechanically or electrically operated flourmills as the main productive use.

To deliver the challenging target of constructing 30 MHP sites in three years, strong partnerships and working relationships will be formed. EnDev will be in charge of developing the hydropower site up to the powerhouse, with expected financial contributions from University partners for civil work parts (50%). It is envisioned, that universities will be able to sponsor part of the budget as they have a dedicated community service budget provided by the government. The power generated is to be distributed through mini-grids, which will be built in cooperation with regional stakeholders, while the installation of the grid will be outsourced to private parties. It is anticipated that the hardware costs for the grid will be covered by the Ethiopian Government, which has a dedicated budget for the construction of MHP sites.

To test the commitment of potential university partners, socio-economic and technical pre-feasibility assessments are outsourced. Thirteen universities have shown willingness to perform the assessments and prepared work plans accordingly. Based on the performance of this first assignment, follow up working relationships will be formed with selected partners. Selected steel shop holders and trained turbine manufactures will be engaged and their capacity to deliver high quality turbines assessed. By giving order numbers of 15+ turbines to these manufacturers, planning safety for investments in necessary equipment and/or manpower will be safeguarded. This will benefit the MHP sector at large through increased professionalization of the sector and decreased prices for turbines.

2.3 Sustainability of the intervention

a. Improved Cookstoves

A sustainability study on ICS conducted in 2014 indicated that the introduction of the Tikikil stove was ineffective due to little marketing and promotion activities undertaken due to lack of funds. In

response, EnDev expects to build upon its recently established cooperation with BBC Action Media on a short documentary video in Oromia to promote clean cooking solutions. Advertisement materials have been printed (leaflet, bags and shirts) and a six-month educational TV programme has been initiated in Tigray and SNNPR. Furthermore, Public Renewable Energy Demonstration (PRED) displaying a range of technologies - amongst other places in health facilities - will be continued.

The study also identified a lack of cooperation and coordination among stakeholders in the market. Moreover, NGOs and other stakeholders have been flooding an already weak and uncompetitive market with free stoves. To facilitate further harmonisation amongst stakeholders, EnDev plans to increase engagements with NICSP, and using regional energy steering committees – of which EnDev is a key sponsor and actor – to support the coordination in ICS promotion. Furthermore, EnDev will regularly organise a gathering of stove producers at regional level to stimulate the formation of an industry association and thus strengthen the private sector approach.

The study also indicated some sustainability trends related to the design, quality, and specifications of stoves. It was found that, a major selling point of ICS is the reduction of health hazardous smoke. In response, a Mirt stove with chimney has been developed which will be promoted in collaboration with the Tigray Regional Energy and Health Bureau. Production moulds for clay chimneys and smoke outlets has been provided to trained stove producers. A radio campaign in SNNPR on indoor air pollution is set to commence. To tackle quality and maintenance issues, EnDev will use its active participation in CDM and RBF as a tracking instrument. CDM agreements with the regions and the implementing entities are soon to be finalised.

b. Solar

To support the creation of a self-sustainable market, special emphasis will be put on service and maintenance including repair as well as the introduction and enforcement of a warranty regime to foster the penetration of quality products and enhance consumer confidence. The organisation of the solar industry is to be supported (e.g. the solar association and regional branches or similar structures) to enforce the quality regime through peer pressure and other legal means. Additionally, since purchase and investment costs are often too high for the targeted low-income rural off-grid households and small businesses, EnDev Ethiopia will support MFIs in developing financial solutions to meet the needs of potential customers and retailers. This will include the setting-up of a revolving fund in cooperation with local MFIs for poor rural households.

Trainings and other capacity building measures will provide a number of local solar technicians the capacity to sell and install small PV systems in rural areas by providing participants with basic business and marketing knowledge. Where needed, EnDev will work to facilitate access to working capital for technicians and retailers in the market. Increasing promotions and demonstrations of high-quality solar products for rural households should provide for added dissemination of picoPV and SHS through sales to rural households.

c. Micro hydropower

Strengthening sustainability will require communities to decide on sustainable tariffs that are high enough to safeguard operation and maintenance while being affordable to beneficiaries. Without these tariffs agreed upon upfront, no infrastructure will be provided. The MHP system will be sustainable based on the number of household connections, productive use activities (business connected), and social institutions connected. Increasing system quality requires benefiting from pilot projects and experiences with local and international materials and components. 30 MHP sites is a preliminary step towards the government's ambition to build 105 MHP sites over the next five years throughout Ethiopia. This scale allows for building up of local capacity and industry. The goal is to support local steel shops to manufacture components (e.g. turbine and penstock) in the country. Finally, previous capacity building and training from EnDev Indonesia, close cooperation and quality control by EnDev Ethiopia, economies of scale and proof of concept for this large number of sites could kick off small-scale hydropower development in the country.

3. Expected Impacts of the Project Intervention

Impact	Possible indicators (indicators in bold will be actively monitored)
Environment	• **Reductions in CO_2 emissions** • Reduced pressure on the forest resources • More organic fertilizer usage • Decreased erosion of soil biodiversity
Health	• Reduction in respiratory and cardiovascular diseases due to indoor air pollution • **Improved access to medical services in connection with electrified health centres** • Reduced child / prenatal mortality • Reduction in low birth weight - reduced risk of a variety of children diseases • Reduction in number of fire related incidents with infants and toddlers • Reduced drudgery of fuel collection, cooking time, fuel collection frequency and better kitchen environment leading to following benefits: • More free time for prenatal and postnatal care and treatment • Reduced risk of assault, injury and polluted indoor air • More time to rest
Poverty/livelihood	• Number of people gaining access to modern energy technologies • Earnings from stove / PV system / turbine sales • Number of solar technicians actively employed • Jobs created through productive use of energy • Less fuel use and facilitation of more efficient food preparation • Saved fuel expenditure is tantamount to earned income • Production, dissemination and utilization of improved cookstoves provides opportunities for income generation and development of small enterprises
Education	• Number of students regularly attending school • Night time courses offered • Less time spent on fuel collection and improved health due to less indoor air pollution means: • Opportunity for improved school attendance • More time for students to finish homework
Governance	• Cooperation on Regional / District / Woreda level • Reduced consumption of biomass fuels means: • Opportunity to develop global partnership in carbon trading
Climate change	• CO_2 reduction • Reduction in air pollutant concentration
Gender	• Number of female solar technicians

Impact	Possible indicators (indicators in bold will be actively monitored)
Market development	• Number of ICS / PV systems disseminated • Number of stove producers / Solar technicians / Solar retailers trained • Number of active stove producers / turbine manufacturers in the market • Percentage of high quality PV systems sold • Functional warranty system for PV systems • Productive uses of energy established for micro hydropower mini-grid

4. Possible Risks and Potential Ways to Mitigate Them

a. Improved Cookstoves

A lack of user awareness for ICS represents a critical risk for the market sustainability of the technology. To mitigate this risk, EnDev will support awareness creation in close cooperation with relevant partners for the importance of energy saving stoves as well as provide end user training to ensure proper usage. Moreover, promotional activities will be implemented including: advertisements, TV and radio spots, brochures, leaflets, public renewable energy technology demonstrations and the creation of market linkages with NGOs and other mass purchasers.

Furthermore, a lack of financing options provided by MFIs may also hinder dissemination efforts. The project, together with select MFIs, will design appropriate and attractive mechanisms through, by example, covering the handling fees. This could also be facilitated through assisting MFIs to enter into contracts with village saving and credit associations instead of individual households.

A majority of the stove producers in the market are artisans with limited financial means to scale up their production capacity and maintain good product quality to meet growing demand. As a mitigation strategy, selected ICS producers will be supported in shifting from manual to semi-automatic production methods. Moreover, special trainings and the provision of small machinery and tools will be envisaged for selected producers to enhance their productivity and improve product quality. To mitigate the risk of low quality, regular quality checks and producer trainings will be conducted. Synergies with governmental programmes will be systemically identified and/or strengthened by, for example, the health extension network to ensure differentiated promotion of efficient and high quality ICS.

Additional chimney related cost may create hamper the commercialization of Mirt stoves with integrated chimneys. To mitigate chimney related costs, market introduction promotional purchase subsidies for chimney shall be considered for the first limited number of chimneys.

The level of end user awareness of briquette fuel is limited and can present a risk for the wider dissemination of the fuel. To avert this, EnDev will promote the fuel via various media channels. As the domestic capacity for the selection, installation and maintenance of briquetting machines is limited, EnDev will support capacity development in order to help sustain the briquetting market.

b. Solar

The main risk for the solar intervention strategies is the lack of coordination to establish product and service quality standards and enforce them. The main strategic stakeholders for establishing a warranty system are the political partners on regional and federal level and the wholesalers. The political partners might block decisions because they may not be politically opportune because of other colliding interests. For the solar wholesalers a limiting factor would be decreased profits or additional cost that do not pay back in increased market shares.

Addressing risks on the political level is basically aligning interventions with governmental development goals and helping the decision making persons to benefit politically from these interventions. As all interventions and strategies are fully in line with the GDP II of Ethiopia, the political risks are already minimized. Nevertheless, it might happen that interventions collide with

governmental procedures; in that case, appropriate alternative solutions need to be identified. All interventions have been checked on a legal level, so that it is not likely that legal problems will occur.

The wholesalers shall be made aware of the benefit of the respective intervention in order to ensure their participation. Especially the topics quality and warranty are connected to upfront cost for the wholesaler, which need to be covered with increased sales. EnDev will provide market intelligence to all participating wholesalers under the framework of the solar association. Additionally, they will gain access to relevant information from other stakeholders that will have effect on their sales figures.

c. Micro hydropower

Potential risks for the MHP development can be subdivided into in three categories: a) technical and infrastructure, b) institutional and c) community.

Technical and infrastructure risks refer to the hardware and system related components. Expected impacts due to the failure of preventative measures on this level include downtime of the scheme in the range of weeks or months, delay of the project implementation due to procurement problems, and substandard quality or functionality of the system components.

In order to mitigate these risks, EnDev is collaborating with local universities, which will collect data following a detailed questionnaire provided to avoid design errors. To overcome shortage of skilled labour capacity building for regional TVET graduates and electricians will be conducted. Cooperative members will receive technical and management trainings to ensure a good operational control of the system to minimize technical risks.

On the institutional level, the activities of all involved stakeholders outside of the community are considered. Risks on this level can be increased project costs and setbacks up to several months due to insourcing of certain activities, delays for repair works of weeks or months, and the underutilization or financial unsustainability of the MHP scheme.

EnDev will engage implementation partners such as universities and government entities carefully evaluating their willingness to collaborate and their capabilities in doing so. Once partners have been selected, roles and responsibilities will be clearly defined. This will be provided through a stakeholder map and the creation of a standardised reporting system.

To assure the sustainability of the MHP scheme care will be taken that suitable tariffs are chosen for the respective communities. Mitigation of this risk will involve first and foremost, a careful selection process of the communities based on socio-economic surveys of the sites followed by a mandatory tariff setting workshop for the community prior to implementation.

For the community level, the anticipated risks are project downtimes of weeks or months due to mandatory O&M, underutilization and or financial instability of the MHP scheme and presenting a general threat to the long term sustainability of the MHP site altogether.

Creating a general sense of ownership, willingness to pay tariffs and proper operation and maintenance (O&M) of the system are vital for the sustainability of the MHP scheme. Proactive measures will include a careful selection of communities based on a competitive process and a socioeconomic assessment, providing a general awareness of the benefits of the MHP system and technical skills capacity building. Moreover, a needs assessment for each individual household will be performed and a contractual intent to pay the tariff will be drawn up early on. An O&M manual will be drafted and the option to hire a qualified external operator will be considered throughout.

5. Budget

	EUR
1 Human resources and travelling	3,815,159
2 Equipment and supplies	3,123,260
3 Funding financing agreements/local subsidies	340,707
4 Other direct costs	2,523,348
5 Total direct costs (sub-total)	**9,802,474**
6 Mark up costs/administrative overheads/imputed profit	1,115,526
7 Cost price	10,918,000

RBF Ethiopia: Promotion of Improved Cookstoves

1. RBF project revision

In the annual RBF review meeting, it was recommended that the project will be:

- Extended time wise until: 06.2018
- Downscaled budget wise to: EUR 880,000

The RBF component started with significant delay caused by difficulties for MFIs/banks to understand the RBF mechanism and the banks' intended role in implementation while at the same time ICS are commercially little attractive for MFIs/banks. Both para-statal and (later) private MFIs in Tigray and in Oromia pilot regions had offered very high administration costs resulting in time intensive discussions and after one year the subsequent decision for the project to assume the role of the FI itself. In addition, considerable time has been spent to bring potential service providers on board to apply for RBF calls. Hence, actual market interventions commenced considerably later than anticipated. The project therefore anticipates an **extension of at least 1 year until 06/2018** to compensate the elapsed time. This will allow service providers (SP) to benefit from incentives for at least 2.5 years and give them the opportunity to build necessary distribution structures. While this is still less than the originally envisioned timeframe of four years, from SP have indicated higher absorption capacities than expected. While it still needs to be proven if SP will actually perform as indicated in their applications, it is already a promising indication and shows SP' confidence in the sector. Even though with significant delay, we therefore see latest development in terms of up-take through cooperatives promising.

A total of 14 cooperatives applied for the RBF project in the second half of 2015. With seven of them, financing agreements were signed (five in Tigray and two in Oromia) in December 2015. Contract with two more service providers are in the pipeline to be concluded. Procurement arrangements for more than 8,000 stoves have already been made by the cooperatives. The service providers have also started compiling lists of households that are ready to purchase the stoves and are concluding stove transportation arrangements to rural households.

At the same time, in order not to lock in budget in the facility, a **downscaling** of the RBF project is proposed. However, the project would like to keep the option open to re-apply for an up-scaling during next year depending on further developments and up-take of the incentives in the market. The KPIs have been revised and adjusted according to reduced budget available for incentives (previous mistakes made in the calculation of KPIs have been corrected).

2. Adjustment of KPIs

It is proposed to down-scale the total budget from EUR 1.54 million to EUR 880,000. Details can be found in the table below. In practice this will lead to a reduced number of stoves that can be incentivized through the project but within a more realistic time frame and will allow for a one time revision of incentives in early 2017 (and possibly one further revision in early 2018 depending on depletion rate). Taking into consideration the adjustment of the incentives in the next year will still allow deploying more than half of the stoves originally intended despite halving the total amount available for incentives. Beyond the reduction of budget for incentives by half as a result of the suggested downscaling, the budget has been adjusted shifting costs originally foreseen for FI fee to the management cost budget line as this role has now been assumed by the project. Overall management costs will nevertheless not be significantly lower and even increase in terms of share of overall budget due to the fact that intervention areas remain the same in number and geographic outreach as well as the number of service providers. Furthermore, in the process of contracting the

independent verification agent it became clear that costs for verification had been underestimated during proposal stage and accordingly needed to be increased.

Regarding the KPIs, the number of beneficiaries was corrected upward based on EnDev standard counting methodology for Ethiopia which counts half a household, i.e. 2.5 persons, per stove accordingly increasing cost efficiency of the project. The number of CO_2 emissions avoided was also increased despite a reduction of stoves based on values used for an official Programme of Activities under the CDM working with the stoves promoted by EnDev.

RBF Key Performance Indicators (KPI)	**Old targets**	**New targets**
People gaining access (EnDev counting method)	275,000	375,000
EUR per person gaining access	5.61	2.35
t CO_2e emissions avoided (over the lifetime of the products sold during project)	500,000	514,524
EUR per t CO_2e emissions avoided	3.08	1.71
Private sector leverage ratio	1.3	1.3
Jobs created	64	64
Enterprises created / improved	16	16
Technologies deployed	206,000	150,000

Madagascar

Promoted technologies		Improved cookstoves			
Project period	old	12.2012 – 12.2016	**Budget (EUR)**	old	EUR 300,000
	new	12.2012 – 06.2018		new	EUR 800,000
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		0	0		people
Cooking / thermal energy for households		47,500	130,000		people
Electricity and/or cooking / thermal energy for social infrastructure		Klicken Sie hier, um Text einzugeben.	Klicken Sie hier, um Text einzugeben.		institutions
Energy for productive use / income generation		Klicken Sie hier, um Text einzugeben.	Klicken Sie hier, um Text einzugeben.		SMEs
Lead political partner		The project cooperates with local leaders (e.g. chefs de region, chefs de cité, chefs de fokontany) and community structures.			
Implementing organisation		Association pour le Développement de l'Energie Solaire (ADES) (in cooperation with GIZ Madagascar)			
Implementing partner		Improved cookstove producers, private sector partners (BIONERR and BERMA) and a strongly growing network of independent retailers			
Coordination with other programmes		International and national NGOs as well as community based organisations such as Action Sud Développement Durable Genève (ASDDG), Aga Khan Foundation, HELVETAS Swiss Intercooperation Madagascar, Kiosques HERi, Madagascar National Parks MNP, Tany Meva Foundation, Vozama, WWF Madagascar, GIZ Programme Protection and Sustainable Use of Natural Resources Various regional and local authorities, such as schools, churches, cooperatives, women's groups, service clubs, SMEs etc.			
Key interventions		1. Establishment and operation of a mobile environmental awareness raising and cookstove promotion centre 2. Environmental awareness raising and promotion of improved cookstoves (firewood and charcoal) in new regions of Madagascar (North, East Coast). 3. Creation and strengthening of a network of independent cookstove resellers in the above area			
Main strategic changes introduced with up-scaling		To increase the geographical outreach of EnDev, a mobile environmental awareness raising and cookstove promotion centre will be set up. This mobile approach allows to reach more potential customers at lower costs compared to creating additional information and sales centres.			
Project manager		Regula Ochsner regulaochsner@adesolaire.org			

1. Situation analysis

1.1 General energy situation in the country

Only about 20 percent of the country's total population have access to electrical energy (about 60 percent in urban and 5 percent in rural areas). The per capita consumption of electricity is low. As

the generation and distribution infrastructure is large insufficient, the supply is unreliable. In rural areas, power plants usually only work for a few hours in the evening and prices per kWh are high.

The installed capacity of electricity production accounts for some 650 MW only. The currently utilised capacity is even less because of the poor efficiency due to lacking rehabilitation of some of the large hydropower plants. Six big hydropower plants (the biggest with an installed capacity of two times 30MW) provide the largest portion of the electricity production. Hydropower in general provides approximately 68 percent of the country's electricity; the rest is produced by about 100 diesel power plants. The rest of the electrified cities and villages rely on isolated small and mini-grids.[31]

1.2 Cooking energy

Madagascar as the fourth largest island on the planet has remarkable biodiversity: Over 12,000 plant species grow on the island, out of which 80 percent are endemic. Yet, this unique flora and fauna is threatened by the fast rate of forest cover loss and subsequent erosion, coral-reef degradation by high sediment loads, desertification and the impacts of climate change. Without major immediate interventions, most of this World Heritage will soon be irreversibly damaged. 200,000 hectares of forests disappear every year. An estimated 80 percent of deforestation goes back to high demand for fuelwood. But also agricultural expansion and exploitation of timber contribute to deforestation.

99.1 percent of the estimated 23.6 million people in Madagascar use solid biomass fuels for their daily cooking (81.7 percent use firewood and 17.4 percent use charcoal). Electricity, natural gas, ethanol and kerosene provide cooking fuel for only a very small minority. LPG accounts for 11 percent in the main cities, but has a negligible share elsewhere because people need to buy large quantities and do not have the means to transport the heavy cylinders. The household sector in Madagascar is expected to remain heavily dependent on wood-based fuels, with the FAO predicting an increase in household wood fuel consumption, and little substitution with electricity, kerosene or LPG due to the high costs of the fuels and appliances.[32]

Firewood and charcoal are getting increasingly scarce and expensive, adding a big cost burden to the poor population. Cooking with solid biomass fuels generates high levels of household air pollution, which is responsible for an estimated 16,375 premature deaths per year.[33] In most cases, charcoal is produced unsustainably from live trees. Most of the firewood is collected unsustainably as well, especially in the arid regions in the South and West of the island and in the mangroves on the West coast.

1.3 Policy ambitions for energy access in SE4All and other relevant country plans.

The **National Development Plan 2015 – 2019**[34] mentions the threats to the environment including the use of wood as the people's principal source of energy among the country's key problems and emphasises that this strong dependence on wood accentuates the social precarity. It stresses the need for technologies that are adapted to the local capacities and conditions.

The **Politique Nationale de lutte contre le changement climatique** (National climate change response policy)[35] stresses the importance of reinforcing adaptation actions by creating synergies and complementarity between different actors and interventions. ADES closely cooperates with organisations and authorities engaged in environmental protection, reforestation, sustainable agroforestry, education and social service delivery. The Policy also focuses on mitigation measures.

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31 https://energypedia.info/wiki/Madagascar_Energy_Situation#Introduction; http://cleancookstoves.org/country-profiles/24-madagascar.html

32 http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2012/06/21/000426104_20120621102923/Rendered/PDF/699820v10ESW0P0ry0Report0Eng0220911.pdf

33 Cf. http://hdr.undp.org/sites/default/files/2015_human_development_report_1.pdf; http://cleancookstoves.org/country-profiles/24-madagascar.html

34 https://drive.google.com/file/d/0B9-EuqDCVcacZ2JzeU9LSWJ3dFU/view

35 http://faolex.fao.org/docs/pdf/mad146465.pdf

EnDev both directly and indirectly contributes to carbon emission reduction by allowing cookstove users to reduce their CO_2 emissions and curbing their firewood consumption, which in turn results in a decrease of deforestation. ADES raises awareness for environmental and climate issues as well as for energy efficient cooking among authorities on all levels, the general population as well as students and teachers of primary and secondary schools.

Madagascar's **Intended Nationally Determined Contribution (INDC)**[36] by 2030 mainly consists in reducing the country's greenhouse gas emissions by at least 14 percent and increasing its greenhouse gas absorption by minimum 32 percent, compared to emission values of 2000 – 2010. The absorption goal is mainly based on a diversified reforestation programme, which is yet to be developed. Major mitigation actions include *improving energy efficiency, disseminating improved cookstoves,* large-scale reforestation, and a reduction of forest timber extraction. Given the precarious economic situation of the country, the implementation of its INDCs is conditioned by the availability of external financial support as well as transfer of technology and research. According to Madagascar's INDC, 50 percent of the Madagascan households will have adopted improved cookstoves by 2030. The project substantially contributes to this ambitious goal.

1.4 Institutional set-up in the energy sector

There is no public institution active in the field of cooking energy.

1.5 State of market/sector development

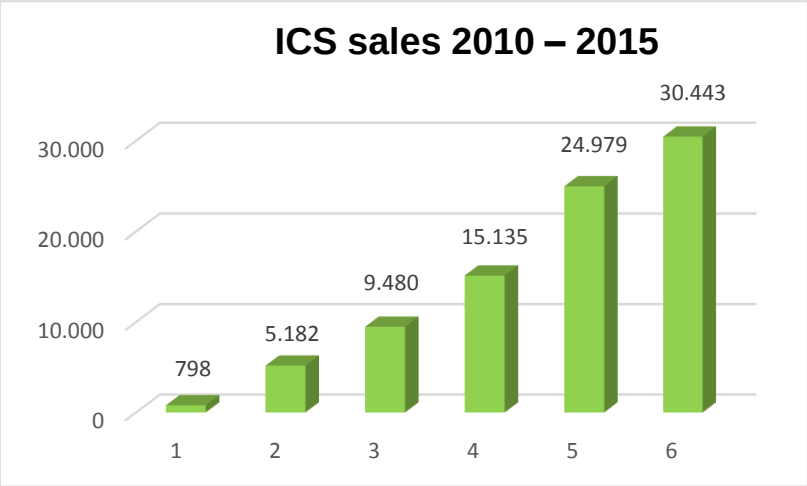
The demand for efficient cookstoves has been growing continuously because massive deforestation and droughts in the past decades have led to a situation in which the prices for firewood and charcoal and the time burden for collecting firewood have enormously increased. However, there are only very few organisations and microbusinesses producing ICS and very simple stoves at present. A foreign company tried to introduce ethanol stoves, but without success.

Implementation partner of EnDev is the Swiss NGO **Association pour le Développement De l'Energie Solaire (ADES),** which has been active in Madagascar for 15 years and is currently the biggest cookstove producer and distributor in the country.

Total penetration rate of ADES improved cookstove models in Madagascar:

Total population of Madagascar: approximately 23.6 million = approximately 4,291,000 households (with an average of 5.5 members). Since the introduction of its improved cookstove models in 2010 until the end of 2015, ADES has sold 86,286 ICS = approximately 2 per 100 households.

People mainly cook their food on open three-stone-fires or metal tripods. Therefore, there is a huge potential for efficient, convenient and affordable portable stoves for both firewood and charcoal. The demand for improved cookstoves is currently much higher than the supply, and it keeps increasing as the word spreads. In fact, ADES is approached by many NGOs, cooperatives, women's organizations, churches, schools, service clubs as well as regional and local authorities, even from areas where ADES has not yet conducted any awareness raising and promotion activities.



[36] http://www4.unfccc.int/submissions/INDC/Published%20Documents/Madagascar/1/Madagascar%20INDC%20Eng.pdf

The main growth barrier is the lack of production, awareness raising and distribution capacities. Further barriers are the weak purchasing power of the population (although the product price is heavily subsidised by carbon financing and donor contributions), a lack of awareness of environmental issues and last but not least the geographic remoteness of many communities.

1.6 Relevant activities of other donors and implementers

Due to Madagascar's outstanding biodiversity of and the country's exposure to climate change risks, most donor activities target the conservation aspects and climate change resilience of the island.

A natural resource protection project run by GIZ also supports the development of a local stove production, applying a different approach, where micro entrepreneurs individually manufacture and sell ICS. This project covers a different market range and operates at small scale, complementary to other EnDev activities. Both projects cooperate on an informal basis by exchanging experiences.

The private sector company BIONERR based near Antananarivo mainly manufactures ceramic tiles, but also produces improved cookstoves. Since it has no sales network, its sales are very low. BIONERR is a supplier and R&D partner of EnDev (see below: section 2.2, "Role of other development partners").

The Fianarantsoa based NGO *Tandavanala* plans to implement a cookstove project in rural areas of the Vatovavy Fitovinany Region in the Southeast. The organisation is a member of the Fair Climate Network South Africa and has teamed up with the Dutch NGO ICCO to run a climate offset project. *Tandavanala* is currently conducting a stakeholder analysis and is in the certification process of according to the Gold Standard. *Tandavanala* was originally started by the former co-owner of the Fianarantsoa based BERMA, one of ADES' combustion chamber suppliers. *Tandavanala* sells only cookstoves for firewood. The cookstove design is very similar to the design of ADES' cookstoves.[37] However, since *Tandavanala* only sun-dries the clay combustion chambers, the lifetime of their product is considerably shorter. ADES has asked *Tandavanala* for transparent information about its planned interventions in order to make sure there is no duplication of activities and to coordinate.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

ADES builds on 15 years' experience in promoting energy efficient cooking methods. To encourage environmentally sound and responsible behaviour ADES spreads knowledge via a variety of channels such as radio and television broadcasts, reports and advertisements in local print media, cooking demonstrations at public events, environmental education at primary and secondary schools. ADES is currently operating eight sales centres with outreach staff that raise awareness and sell cookstoves in the surrounding areas. In all areas covered by these centres, the demand for improved cookstoves has been growing constantly. An increasing number of households, schools, hospitals and cafeterias are using improved cookstoves. In order to further increase outreach at modest costs, ADES has established a steadily growing network of carefully selected and instructed freelance resellers, which includes individuals selling ICS at roadside or market stalls, shop owners incorporating ICS in their product range, farmers cooperatives, church based organisations etc.

[37] See http://tandavanala.org/pdf/serasera_tandavanala_14.pdf, page 3.

The resellers generate an income from the difference between the price at which they purchase the ICS and the official sales price. Moreover, HERi's solar kiosks sell cookstoves at a growing number of sales points in the country. ADES plans to sell 30 percent of the cookstoves directly via its centres and outreach teams and 70 percent indirectly via independent sales agents. ADES supports and supplies freelance vendors via the sales centres that are closest to them and is currently setting up a capacity building programme for them.

The demand in the areas that have been targeted by the ADES centres, extension staff and resellers so far is still higher than the supply. ADES is currently increasing the supply of cookstoves by both introducing a semi-industrialised production process in its own facilities and sourcing part of its combustion chamber requirements from two Madagascan SMEs specialising in potter ware/ceramics (see below: section 2.2, "Supply agreements"). Moreover, ADES plans to set up additional production facilities in about 2018.

By 2020, ADES will reach an annual output of 47,000 cookstoves (benefitting 258,500 people per year) and ensure they are correctly and consistently used. The general population as well as the primary and secondary school students targeted by the existing sales centres and the planned mobile awareness raising and promotion centre are aware of environmental issues such as deforestation, they know about the causes and effects of climate change and the health risks associated with household air pollution. They are familiar with energy efficient cooking methods and have realised the importance of a healthy, balanced diet.

Map showing ADES production and sales centres (2 centres in Toliara)

ADES contributes to EnDev Madagascar with own financial resources, including carbon financing. The scope of the present up-scaling project encompasses only the intervention described below, i.e. launch of a mobile promotion centre for improved cookstoves and operation during the first two years. The costs for the 9,000 cookstoves distributed during this period will be borne by ADES and the project beneficiaries[38]. As most Madagascans are very poor and unable to generate savings because they are expected to support their extended families, they are unable to purchase cookers at a price covering their full costs (including awareness raising, promotion, logistics, overhead, fair salaries and social benefits of all employees etc.). At the time being, the beneficiaries pay about 12 percent of the full costs and they make an additional contribution by ceding their carbon credits to ADES (which means that all together, they bear about one third of the full costs). The rest of the full costs is covered by contributions of non-profit foundations, churches, public and individual donors (mainly from Switzerland).

2.2 Specific intervention strategies per (sub)sector

a. Intervention

Since the beginning of 2013 until March 2015, EnDev supported ADES to develop expanded local production capacities for ICS, and hence to ensure a sustainable market for ICS in urban and peri-urban areas in Madagascar. The establishment of a new production centre in Fianarantsoa was co-financed by EnDev, and production started in the beginning of 2014. Since then further optimisation of work processes continued. Different types of so called OLI stoves are built both for wood and charcoal combustion, allowing a reduction of the amount of fuel by 50 to 65 percent per meal. Specifically the productivity and number of assembly lines for an OLI stove factory increased. In this context also the production of metal casings has been introduced locally in Madagascar, whereas

[38] Calculation example for smallest ICS for wood (approximate costs, base 2015): Material, production, logistics, awareness raising, promotion, after sales = CHF 43 per piece Sales price paid by customer CHF 5 per piece (approx. 12 percent of full costs) Costs minus sales revenue: CHF 38. ADES covers these costs via carbon financing and contributions of donors.

these casings had previously been imported from Italy. A key activity was the establishment of outlets and sustainable marketing structures in new areas of Madagascar, namely the capital Antananarivo. Even though the initial formal working agreement between ADES and EnDev expired in March 2015, informal cooperation continued, and ADES still reports outcome figures to EnDev, related to the jointly built production centre as well as to the sales outlet.

The aim of the present up-scaling is to increase the geographical outreach of EnDev by setting up a mobile awareness raising and promotion centre for improved cookstoves and establishing a network of independent resellers in the North and North East of the country, where there are a number of still quite intact forest surfaces but the pressure on the still existing forests, mangroves and coral reefs is continually rising. A huge potential for disseminating improved cookstoves is seen in these areas because there is already some awareness for the importance of protecting the biosphere and because a number of organisations as well as representatives of local and regional authorities have asked ADES to raise environment awareness and provide improved cookstoves also in these areas. Compared to permanent centres, a mobile awareness raising and sales centre offers a great deal of flexibility and allows reaching a high number of beneficiaries at relatively moderate costs.

The mobile centre consists of a truck, which serves as show/event/awareness raising location and at the same time as mobile home of the ADES outreach team (programme promotors, one truck driver/mechanic, one four-wheel drive vehicle driver and two security guards). The mobile centre sets an example of environment friendly behaviour by using a solar panel for its own power needs, consistently using energy efficient cooking methods etc. In the evenings, videos on the importance of forests, the biosphere of Madagascar, and the vision and activities of ADES are publicly screened.

The mobile centre stays in a defined area for about two months to raise awareness, recruit freelance resellers and take cookstove orders and then moves on to the next area. Since the mobile centre has only limited storage space for improved cookstoves, only a few stoves are sold on the spot. A forwarding partner company of ADES will pick up cookstoves at ADES' Fianarantsoa production site or the warehouse of another ADES centre and transport them to the villages that placed orders or to the independent cookstove agents who have already started their businesses.

While the mobile centre stays in a particular area, some members of the team moving about by the four-wheel drive vehicle go back to the areas that were previously covered to assist in the delivery of the cookstoves, instruct the users and train prospective resellers. They also travel to the future stations of the mobile centre to meet local stakeholders and make arrangements for public events as well as to find potential independent sales agents.

b. Role of other development partners

Research and development

In close cooperation with BIONEXX, a Fianarantsoa-based producer of medical plants, ADES has developed about one-meter long biomass briquettes consisting of Artemisia residues. These briquettes will be manufactured by BIONEXX and will be used for firing the clay inserts of the cookstoves. They cost about the same as firewood and allow ADES to annually save 200 metric tons of firewood. BIONEXX and ADES are also in the process of developing small Artemisia briquettes that are intended to replace charcoal for cooking meals.

With the technical support of BIONERR, a producer of ceramic tiles and improved cookstoves based near Antananarivo, ADES is currently building new kilns for its production site in Fianarantsoa. These kilns permit to use biomass briquettes (consisting of Artemisia residues) instead of wood for firing the clay combustion chambers of the cookstoves. At the same time, the new kilns drastically reduce the energy consumption and cycle time of the firing process, which results in energy cost savings and a higher throughput. Moreover, the kilns achieve higher operating temperatures, which means that the ceramic quality of the cookstoves is enhanced. A first kiln of this new generation is already fully operational. ADES and BIONERR are also developing a new cookstove design that cuts production materials costs, shows higher energy efficiency and can be used with biomass briquettes. In order to further increase the production capacity of its Fianarantsoa site and achieve a reproducibly high

product quality, ADES is currently equipping its workshop with a number of tools such as a clay mixing machine, extruder, piston press and moulds, thereby drawing on the experience of BIONERR.

Supply agreements

As the production capacity of ADES is too small to satisfy the demand for improved cookstoves, ADES has entered a first supply agreement for combustion chambers with the private sector partner BERMA in 2011. BERMA originally was a local ceramics arts workshop run by two local artists. With the support of ADES, they built a pottery workshop and hired 37 people. BERMA currently supplies ADES with 1600 combustion chambers per month. In 2015, ADES concluded a second agreement with the brick, ceramic tile and cookstove producer BIONERR, which allowed them to create 17 additional jobs. They currently manufacture 700 combustion chambers per month on behalf of ADES. The cooperation with BIONERR provides win-win because BIONERR has rich expertise in producing improved cookstoves and a high production capacity but no own sales operations.

Awareness raising and distribution of improved cookstoves

HERi's solar kiosks sell cookstoves at an increasing number of sales points in the country. A growing network of independent sales agents promotes and sells cookstoves in areas not covered by the ADES centres and outreach teams. Several international and national NGOs as well as local service clubs, church based groups etc. organise local public awareness raising and sales events. Some of them sponsor cookstoves for particularly vulnerable groups. The mobile cookstove promotion centre will screen films made available by GIZ and probably WWF.

Partnership for rural development

EnDev is joining forces with the Aga Khan Foundation (AKF). AKF has been active in the Sofia Region since 2005. Its integrated rural development project has a special focus on watershed protection, conservation agriculture, agroforestry and reforestation and is interested in using biomass energy. EnDev will enhance the conservation efforts of AKF by introducing ICS in the project area of AKF. AKF has also established a micro finance agency that provides financial services in the Sofia Region. AKF and ADES have signed a Memorandum of Understanding for a strategic partnership and will explore the feasibility of granting loans for improved cookstoves in the areas where AKF runs micro financing operations.

Reforestation

To compensate own wood consumption and CO_2 emissions, ADES has two trees planted per improved cookstove sold. Besides the reforestation project run by the ADES centre and local community in Ejeda, the Fianarantsoa based *Vozama,* the "Green Diocese" of Farafangana and the local association *Aro Ala Fihaonana* (AFA) benefit from ADES funding for saplings.

2.3 Sustainability of the intervention

Level of confidence of assessments: high

- CO_2 emissions, wood savings, cookstove performance, sustainable development (jobs created, expenses for firewood, environmental education at schools) are assessed in yearly intervals and are part of the Gold Standard verification process.[39]
- Cost efficiency assessments have been conducted by EnDev.[40]
- ADES plans to measure the indoor pollution reduction achieved by the new generation of improved cookstoves shortly to be introduced. This study will be conducted with the support of the *Amt für Abfall, Wasser, Energie und Luft* (Office of Waste, Water, Energy and Air of the Canton of Zurich, AWEL).[41]

[39] See https://mer.markit.com/br-reg/public/project.jsp?project_id=103000000002452

[40] See studies conducted by EnDev.

[41] http://www.awel.zh.ch/internet/baudirektion/awel/de/service/international.html

a. Sustainability on system level

Proper and consistent use of the cookstoves sold so far is ensured by training and follow-up of the users by either ADES centres or extension staff or a carefully selected and trained network of freelance resellers. This is verified by the ADES monitoring team as well as by annual audits. The improved cookstoves come with a three years guarantee. Within the guarantee period, they are repaired or replaced for free. Experience shows that people who are accustomed to the advantages of using improved cookstoves tend to replace them at the end of their lifespan, especially if they are readily available. ADES ensures availability by regularly revisiting the areas where cookstoves have been sold. ADES is currently developing a capacity building programme for freelance resellers in order to ensure they properly instruct and counsel their customers.

b. Quality assurance of products

All products undergo a rigid quality inspection. Since they carry a serial number and are registered in the Customer Relations Management System of ADES, they are fully traceable. ADES currently improves the quality of the cookstoves by firing the ceramic inserts at higher temperatures.

c. Sustainability of market/sector development

There is a huge potential for improved cookstoves in Madagascar, especially in the North and at the East Coast, where promotion has not started yet. At the same time, financial capacities of the buyers are limited (see above: section 2.1).

ADES does not actively pursue any micro financing or deferred payment systems because the administrative burden and default costs would simply be too high – especially in remote areas. Neither is it realistic for ADES to promote small savings associations for the sole purpose of buying improved cookstoves. Such associations usually are formed in order to foster income generation and require a high degree of organisation and continuous mentoring and training. However, ADES centres offer local customers the possibility of paying by instalments. Once the last instalment is paid, the customer receives the product. ADES currently investigates on options to cooperate with a Swiss NGO that also operates in the North-eastern region of Madagascar. This NGO plans to establish regional savings and credit groups. In case this plan is realised, a synergy could be created for the purchase of ICS. ADES normally charges the same price for a given product to everybody. Only in cases where NGOs, service clubs or church based groups sponsor the distribution of cookstoves to particularly vulnerable groups, the beneficiaries receive them for free or at a minuscule price.

d. Long term power to develop innovation in the local sector

ADES has been promoting energy efficient cooking methods in Madagascar since 2001. Its currently 160 employees have been carefully trained on their jobs. They rotate jobs, benefit from continuous capacity building and are encouraged to suggest improvements. Moreover, ADES offers internships to local students. A further 60 carefully trained people work as freelance cookstove sellers. Together with its local supply partners who operate on a highly professional level, ADES further develops its products and production processes and introduces innovations.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	Average annual reduction of firewood consumption (potentially 3 tons per stove): Mobile centre only: Year 1: 12,000 tons; year 2: 27,000 tons. ADES overall: Year 1: 97,650 tons; year 2: 111,105 tons (in addition to emissions avoided by all the cookstoves that are already in operation) Average annual forest conservation (potentially 0.3 hectares per cookstove): Mobile centre only: Year 1: 1200 hectares; year 2: 2,700 hectares. ADES overall: Year 1: 9,765 hectares; year 2: 11,110.5 hectares (in addition to emissions avoided by all the cookstoves that are already in operation).
Health	Reduction of smoke exposure as well as burn and fire hazard potential for all household members, particularly for women and small children (user survey).
Poverty/livelihood	• 9,000 additional households using efficient cookstoves reduce their biomass fuel costs by approx. 50 percent. This money is available for satisfying other basic needs of the household members such as food, medical care, school fees. • Incomes generated along the cookstove value chain: The mobile centre is expected to create 28 additional jobs. ADES currently has 160 permanent employees who receive fair salaries and social benefits and receive continuous further training on their jobs. Moreover, ADES continually trains a number of interns. Most employees of ADES are thus qualified to find good jobs in a number of Madagascan and international companies. A further 50 jobs have been created at local suppliers of ADES and 60 people generate incomes as freelance cookstove resellers.
Education	The team of the mobile centre will raise awareness for environmental issues (impacts of deforestation, resource efficient behaviour) and health (exposure to fire smoke, balanced diet) among the general population of the targeted areas. The environmental programme for primary and secondary schools. In 2015, this programme reached 90 schools and a total of 8,865 students (plus many of their parents) and 91 teachers. (The environmental programme is not within the scope of the mobile centre project.)
Climate change	Average annual reduction in CO_2 equivalents (CO_2e) emission (in t CO_2e): Mobile centre only: Year 1: 12,000 tons; year 2: 27,000 tons. ADES overall: Year 1: 97,650 tons; year 2: 111,105 tons (in addition to emissions avoided by all the cookstoves that are already in operation).
Gender	26.5 percent of the permanent employees and more than half of the staff on management level are female. (Manual and physically demanding work is carried out by male employees only.) The awareness raising team of the mobile centre is mixed; the drivers and security guards are male. Both women and men are eligible as sales agents. The cookstoves economically benefit all household members. Since women and small children spend more time indoors and are responsible for collecting firewood, attending the cooking fire and cooking, they will mainly benefit from a reduced risk of diseases and burns, firewood collection and cooking timesaving as well as from a reduction of potential risks related to wood collection.
Market development	During the project period, 9,000 improved cookstoves are sold in at least two new project areas, directly benefitting about 49,500 people. The inhabitants of these areas are aware of environmental, climate and health issues as well as of energy efficient cooking methods. During the project period, at least 15 new sales agents in two new project areas are recruited and carefully trained. The number of people interested in purchasing improved cookstoves is expected to increase once they are known in the area.

4. Possible risks and potential ways to mitigate them

4.1 Political situation

At the time being, no serious political crisis is expected. In the event of serious political unrest or civil disorder, ADES respects official curfews and continues operations as possible. In the last few months, a growing covetousness toward NGOs and companies was perceived (e.g. introduction of new duty fees, taxes, and other fees or claims for transfer of carbon credit proceeds). ADES adheres to a strict anti-corruption policy and takes concerted advocacy action with other NGOs as well as with embassies etc. whenever any charges are claimed without legal basis.

4.2 Cyclones

ADES has elaborated contingency plans for natural disasters such as cyclones and reckons that centres concerned can be reopened maximum one month after such an event.

4.3 Socio-economic developments

E.g. lower purchasing power of population, unforeseen general price hikes (especially salaries, transportation, fuel). ADES is able to reduce prices if necessary and to bear higher costs by intensifying its fundraising activities.

4.4 Inability to secure donor funding for the long term

Since its inception in 2001, ADES has been building and continuously expanding a diversified donor base. Even if donors would withdraw, long-term financial support is secured through the emission trading system: In 2008, ADES has entered a 21 years' agreement with the Swiss NGO myclimate. Carbon financing is thus secured until 2029.

5. Budget

	EUR
1 Human resources and travelling	**2,000**
2 Equipment and supplies	**000,000**
3 Funding financing agreements/local subsidies	465,000
4 Other direct costs	9,840
5 Total direct costs (sub-total)	**476,840**
6 Mark up costs/administrative overheads/imputed profit	**23,160**
7 Cost price	500,000

Mozambique

Promoted technologies		solar / stoves / hydro / grid			
Project period	old	10.2009 – 12.2016	**Budget (EUR)**	old	EUR 12,500,000
	new	10.2009 – 02.2018		new	EUR 14,500,000[42]
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		120,000	139,000		people
Cooking / thermal energy for households		300,000	410,000		people
Electricity and/or cooking / thermal energy for social infrastructure		26	15		institutions
Energy for productive use / income generation		203	75		SMEs
Lead political partner		Ministry of Mineral Resources and Energy			
Implementing organisation		GIZ			
Implementing partner		Electricidade de Moçambique (EdM), Fundo de Energia (FUNAE), NGOs (SNV, Associazione Volontari per il Servizio Internazionale (AVSI), Agência de Desenvolvimento Econômico Local (ADEL), Kulima, Magariro), universities, colleges and private sector			
Coordination with other programmes		GIZ: Education (ProEducação), Economic Development (ProEcon), Adaptation to Climate Change, Project Development Programme (PDP); DFID, Belgian Technical Cooperation, EU, World Bank			
Key interventions		• Support market development for household solar systems through public-private partnerships with larger picoPV importers/retailers • Support market development for industrial and artisanal ICS by advising actors along the value chain in cooperation with partners • Follow up on micro hydropower mini-grid sites developed in earlier phases by overseeing site rehabilitation and monitoring • Co-finance grid connections poor households with EdM			
Main strategic changes introduced with up-scaling		• Hydro: Closing of component (only follow-up / monitoring) and reduction of social institutions and SME targets which were related to the hydro component • Solar: focus on financially viable companies with new business models and solar as core business through PPP approaches. • Stoves: Scaling of successful intervention (outcomes have doubled in last semester after revision of partner approaches and division of labour). Additionally participate in the regional RBF "Access to modern cooking energy for poor and vulnerable groups". EnDev Mozambique will advise the UEM Foundation and organise verification and monitoring. (Results counted in regional project.)			

[42] Only EUR 1,800,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

	• Grid: Successful intervention to be scaled through the regional RBF "Grid Densification Challenge Fund" EnDev Mozambique is to advise the utility in preparing a proposal and organise verification and monitoring. (Results counted in regional project.)
Project manager	Véronique Stolz veronique.stolz@giz.de

1. Situation analysis

1.1 General energy situation in the country

Mozambique has a population of about 26.5 million with over 5 million households. Mozambique belongs to one of the poorest countries in the world. The Human Development Index (HDI) ranks Mozambique 180 of 188 countries. 60.7% of the population lives on less than USD 1.25 per day (2015). As a recently concluded household budget survey by the Mozambican government reveals the rural-urban gap and income disparity have considerably increased in the last 6 years.

The country is endowed with vast energy resources. More than 90% of the power generated in Cahora Bassa, the region's largest hydropower plant, is evacuated through the Southern African Power Pool (SAPP). With an untapped hydropower capacity of 12,000 MW as well as big coal and gas reserves, Mozambique has the potential of becoming the power house of the region.

Yet, the country faces an energy crisis when it comes to satisfying domestic demand, both on-grid and off-grid. The current installed generation capacity of 2,724 MW falls far short of meeting the demand. Mozambique has undertaken significant efforts in recent years in electrifying the country. The electrification rate has increased from 5% in 2001 to 26% today. However, access to electricity remains low and is mainly focused on urban areas. The vast majority (70%) of Mozambique's population lives in rural areas of which only 5.7% use electricity for lighting. Forest resources satisfy more than 85% of total domestic energy requirements, in rural areas even over 95%. Although also used for lighting, biomass is mainly used for cooking. The great majority of households uses inefficient cooking technologies such as three-stone fire and traditional stoves. The annual average consumption per capita, estimated based on direct measurements, amounts to approximately 0.6 and 0.9 tons of wood or equivalent in charcoal[43]. This leads to an annual figure of 14.8 million tons of woody biomass used for energy nationally. At the same time Mozambique faces an annual deforestation of 219,000 ha. The Liquefied Petroleum Gas (LPG) market in Mozambique is still at an incipient stage with an average per capita consumption of 0.73 kg per year, 90% of all LPG in Mozambique being used in the major cities.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans.

The legal framework relating to energy in Mozambique is composed of a variety of policies, strategies and regulations, the most important ones being the energy strategy (2009), the policy for the development of new and renewable energies 2011-2025 (2011), the strategy of the conversation and sustainable use of biomass energy (2013), the strategy of biofuels (2009), the regulation of biofuels and their mixture and the regulation that established the feed in tariff for new and renewable energies - REFIT (2014).

In the government's 5-year plan (2015-2019) increased access to electricity appears as one of the strategic objectives. Mozambique's target is to provide electricity access to 50% of the population by 2023. Rural electrification is planned to be increased using both the national grid and household solar systems. A special focus lies on the electrification of health centres through PV solutions. Also the construction of 12 mini hydropower plants is foreseen. Given the expanse of the country and low

[43] Sitoe, A., Mirira, R., Tchaúque, F. (2007): Avaliação dos níveis de consumo da energia de biomassa nas Provincias de Tete, Nampula, Zambézia, Sofala, Gaza e Maputo (Relatório Final). Ministério da Energia e Faculdade de Agronomia e Engenharia Florestal, Maputo, Moçambique.

population density, meeting the access target presents a major challenge, is highly dependent on donor financing and does not seem realistically achievable as confirmed by government officials. The 5-year plan does not make any mention of biomass related energy issues.

The government's energy access goals contribute to the achievement of the objectives of the SE4All initiative. Besides this, there are not many specific SE4All activities being initiated or followed-up upon by the government. The Forum for Energy and Sustainable Development of Mozambique (FEDESMO) had assumed the role to assure civil society's contribution towards national actions in the SE4All context in 2013. Since then FEDESMO organized a few workshops, however with few concrete results.

Late 2015 the government has approved an energy tariff increase of 27% which was long overdue since EdM's tariffs had in real terms decreased in the range of 20% with a real cost increase of 18% since 2010. The Government plans to regularly review the electricity tariff from now on which might also influence off-grid tariff setting which is so far not regulated.

The law on electricity is currently being revised since parts of it are now invalid because of the later adopted policy on private-public partnerships. Further the law on the regulatory authority is under development in order to create the new entity Autoridade Reguladora de Energia (ARENE) which should act as independent regulator as opposed to the current entity Conselho Nacional de Electricidade (CNELEC) which has only an advisory role. With regards to EnDev's activities ARENE might play a role regarding the regulation of energy service delivery, e.g. for new energy service companies (ESCOs) that are planning to introduce fee-for-service models for household solar systems. ARENE might also be in charge of tariff setting regulation for the off-grid sector. The REFIT's tariff structure is currently being revised and the necessary regulations for its operability developed. Even though not directly impacting EnDev's activities a working REFIT regulation might give a boost to the renewables sector and increase awareness about existing technologies. At the moment MIREME is being advised by the African Development Bank on the development of off-grid tariff regulations.

1.3 Institutional set-up in the energy sector

The Ministry of Mineral Resources and Energy (MIREME) was created in 2015 after elections by merging the former Ministry of Energy with the Ministry of Mineral Resources. The Ministry consists of four directorates: Mines and Geology, Hydrocarbons and Fuels, Energy and Planning and Cooperation. In the energy sector MIREME is responsible for national energy planning and policy formulation and for overseeing the operation and development of the energy sector. MIREME is represented in the provinces through the Provincial Directorates of Mineral Resources and Energy (DIPREME). Electricidade de Moçambique (EdM) is a vertically-integrated, government-owned electric utility responsible for generation, transmission and distribution of electricity in the national grid.

The public entity Fundo Nacional de Energia (FUNAE) is in charge of promoting rural electrification and rural access to modern energy services including the dissemination of ICS. EnDev has concluded a specific MoU with FUNAE defining the joint coordination role of the ICS sector by both entities. This includes amongst others a joint approach in developing commercial markets, coordinating donor projects and approaches, capacity building measures, exchange about monitoring data and the development of national standards. In the field of rural electrification FUNAE has implemented numerous projects using renewable energy technologies to electrify schools, clinics and communities. However, many of these projects have not proven to be sustainable due to non-payment of instalments and lacking maintenance of the systems. In late 2015, FUNAE's CEO has been replaced by the former Director of New and Renewable Energies of the former Ministry of Energy. Coordination between MIREME and FUNAE seems to have improved since then. The new CEO plans to review the organizational structure of FUNAE and possibly its mandate. FUNAE intends to increase private sector investment in rural electrification.

A micro finance sector with banks and NGOs is active throughout the country but often exclusively restricted to the province and / or district capitals. The NGO sector is characterized by relatively weak

institutional profiles and technical specialisation, as well as weak implementation structures and technical competences. Further information on relevant institutions and private sector players in the ICS and picoPV markets are being presented in the following chapter 1.3.

1.4 State of market/sector development

The relatively low population density in combination with the high levels of poverty and underdeveloped transport infrastructure represent a serious challenge for commercially deploying off-grid energy systems in Mozambique. This applies to solar lighting products as well as to other modern energy technologies such as ICS. This big potential market for both ICS and picoPV systems is formed by the lower income segments of the population – the Base of the Pyramid (BoP).

Mozambique's need for **ICS** can be estimated at more than four million households of which 1.2 million stoves in urban and 3.2 million in rural areas. 75% of urban households rely on wood and charcoal for their energy demands. In rural households, almost 98% use wood for cooking while 2% use charcoal. The penetration of ICS in Mozambique is still very low; the present dissemination rate is estimated at merely 2-3% based on EnDev monitoring data and data provided by other implementing partners. EnDev has a lead role in the sector promoting dissemination through various stakeholders and coordinating activities between donors and the national government for the implementation of ICS projects. EnDev proactively contributes to the design and implementation of biomass projects of other donors and the government. It further provides technical advice and supports actively the setting of new benchmarks for improved cookstove standards. The coordination with all donors and the government (see also 1.2) has proven to be crucial to avoid overlapping of activities in the same regions with different approaches. EnDev plans to further strengthen its leading role in coordinating the cooking sector stakeholders by creating a "Household Energy Platform" and to support the country action plan for clean cook stove.

During the first phase of implementation, the EnDev biomass component focused on identifying partner organizations and evaluating their capacities. Originally most of the partners worked all along the ICS value chain. Over time EnDev actively supported the specialization of the partners. Since then partners focus on their comparative advantages in specific areas along the value chain. This has also lead to an increased focus on commercial approaches and emphasis on private sector support. As a result of EnDev's efforts, several local artisans have improved the efficiency of locally produced ICS and standardised their production process. Companies like SOGEPAL and UNIMETAL as well as associations of youths have developed retail networks and sales approaches for the marketing of ICS. The Eduardo Mondlane University Foundation (UEM-F) acts as importer, assembly plant and wholesaler for industrially produced ICS, parts of the industrial stoves being imported and being assembled locally. The UEM-F biomass laboratory supports the ICS product improvement and the standardisation of local production. NGOs like SNV, AVSI, KULIMA and ADEL act as facilitators for the market development. They identify entrepreneurs and companies to be involved in the ICS business and support them in production, business management and marketing of ICS.

In urban and peri-urban areas where low-income households spend a considerable amount of their income on biomass fuels for cooking and where charcoal prices continue to increase sharply there is a great potential for a fully commercial ICS market. According to EnDev baseline studies, charcoal prices have recently increased at an annual rate of at least 15%. Currently, in these ICS markets availability of products is the main factor limiting market growth, rather than affordability.

With over 20 million Mozambicans not having access to the national electricity grid, rural low-income households represent a great potential for the distribution of **picoPV** systems. Currently the choice of small solar systems available on the Mozambican market is still limited, with most systems not having independent quality certification. Sales prices are high compared to neighbouring countries. Only two large importers of Lighting Africa (LA) certified picoPV systems exist to date. One of them is a retail outlet in southern Mozambique, marketing its products through Mozambican miners in South Africa, with solar devices being only one amongst many consumer goods on offer. The other one is the petroleum company TOTAL which has started to offer three different ranges of picoPV systems through its nation-wide filling station network in the 2nd half of 2015. During the first four months

900 solar systems have been sold to end-consumers by TOTAL. Recently a few companies with household solar as their core business – most with successful experience in neighbouring countries – have increasingly shown interest in establishing business in Mozambique and in introducing new business models such as instalment based payment mechanisms through mobile money and fee-based (PAYGo) electricity services.

The main barriers for market development of ICS and picoPV systems in Mozambique are:

- Low purchasing power of the target group, especially in rural areas (combined with low investment incentive for rural population regarding ICS when firewood is free of charge).
- Lack of access to finance. This applies to potential investors, importers, retailers as well as to consumers.
- Limited infrastructure. There is limited capacity for country-wide dissemination of off-grid products. Formal distribution networks are not widely available, while informal distribution channels are often not recognised by entrepreneurs or difficult for them to use. This adds to the high costs of distribution in areas where the geographical market is very scattered.
- Distortion of markets by non-commercially oriented practices by donors and government entities (e.g. FUNAE subsidy support to household solar and ICS dissemination).
- Limited capacity and skills as well as entrepreneurial spirit hampering further development of start-ups and first movers in the market.
- Lack of conducive policies. The introduction of clear and effective policies and regulations will help stimulate private sector energy investments (e.g. tax incentives, duty waivers, favourable foreign direct investment (FDI) regulations, quality certification etc.).

Apart from this, Mozambique's specific characteristics, compared to other countries in the region, makes it a less preferred target market for FDI. These include the post-conflict situation, the socialist history of the country, coupled with Portuguese as the official language and the legal system based on Portuguese law rather than Common Law.

1.5 Relevant activities of other donors and implementers.

Most donors support the on-grid energy sector in Mozambique and are therefore of limited importance as cooperation partners for EnDev. The following are the most relevant donors for EnDev Mozambique with whom EnDev closely coordinates activities and uses synergies.

DfID is currently designing a bilateral off-grid energy programme with a total budget of GBP 35,000,000 for a five year period. The components of the programme will be **(1)** household solar, **(2)** improved cookstoves and **(3)** productive use of energy. With start of implementation of the programme this will be the largest donor programme in this area with big overlaps with EnDev. EnDev Mozambique is in discussions with DfID, with the potential of GIZ implementing a key part of the programme together with SNV under the umbrella of EnDev. In preparation of the start of the programme DfID is currently planning some studies amongst which an organisational development advice for FUNAE, a scoping study for the PAYGo solar company M-KOPA which does not have a presence yet in Mozambique, and a study to assess the fiscal consequences of import duty and tax exemptions for solar and ICS technologies. The DfID country office closely coordinates with EnDev their cooperation with MIREME and FUNAE and regularly consults EnDev to inform the business case development process.

BTC's Rural Electrification Programme will be ending in December 2016. In parallel to its current programme BTC is designing a new one to start in 2017 with the following three components: **(1)** Investment projects through FUNAE, **(2)** Capacity Building of FUNAE and **(3)** of the MIREME. Currently GIZ is discussing with BTC to finance a study on available prepaid solutions for FUNAE's mini-grids (PV and hydro) and household solar systems. This is done through the Project Development Programme (PDP) financed by the German Federal Ministry for Economic Affairs and Energy (BMWi) and implemented by GIZ.

Under the 11th EDF National Indicative Programme (2015-2020) the **EU** will support Mozambique's energy sector with approximately EUR 80 million to EUR 100 million in the context of its rural development programme. The EU has recently enquired detailed information on EnDev's activities in the country since they are currently looking to support activities which would lead to quick results in the field of energy access.

EnDev actively participates in the **donor/implementer coordination**. Since 2016 the chair of the Energy Sector Working Group (ESWG) has been taken over by Norway and the UK. It has been specifically requested to put in future more attention to off-grid energy as well as renewable energies within the group. EnDev is a member of the ESWG. For 2016 it is planned to create a sub-group of the ESWG dealing in more depth with off-grid topics. Participants will be DfID, BTC and EnDev being represented by GIZ and SNV.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

In 2020, ICS and household solar products will be available in most towns and their benefits will be known by a majority of Mozambicans. The appetite of the population for modern energy services having been created, markets will gradually open up for higher tier technologies.

EnDev Mozambique has the following vision for the market development of ICS and household solar products in the country.

a. Improved cookstoves

- The annual sales of ICS in the Mozambican market have increased to 50,000 in 2020 as compared to 17,000 in 2014, representing an annual growth rate of ICS sales of 20%.
- Increasingly SMEs are producing and selling ICS with NGOs having rather assumed the role of rendering business services with adapted approaches for the Base of the Pyramid (BoP) market.
- The government focusses on ensuring conducive framework conditions for the private sector rather than being active in implementation.
- Capacity of local assembly facility for ICS which are being produced industrially abroad significantly increased and optimized flat pack solutions introduced (reduced import taxes and transport costs).
- Innovative retail and end-consumer financing mechanisms are introduced.
- Mozambique participates in the development of international standards for ICS and applies these to all donor and government funded programmes; ICS test centre certifying ICS in Mozambique and providing services region-wide.
- Local capacity for innovation and development in ICS is strengthened and leads to significantly improved efficiency and reduced emissions of promoted ICS.
- Impact financing mechanisms (such as Carbon Credits) to enhance the affordability of ICS in Mozambique is in place for the markets that cannot be reached by commercial approaches.

b. Solar

- The annual sales of picoPV systems in Mozambique have increased from 1,172 in 2015 to around 40,000 in 2020, representing yearly doubling of sales figures.
- picoPV systems are readily available in most larger villages.
- picoPV business in Mozambique is a viable and competitive market with different ranges of quality systems available; increased uptake of larger PV systems.
- End consumer finance solutions such as PAYGo have been introduced and a conducive regulatory framework for the introduction of Renewable Energy Service Companies (RESCOs) is in place.

- The majority of available systems fulfil Lighting Global or similar quality standards; an accredited solar test laboratory is in place and rendering services to companies, consumer organisations and the government.
- Access to credit for solar companies is available.
- Awareness among population about quality products and warranty schemes established.
- Expertise for installation, management and maintenance of PV systems available in the country.

2.2 Specific intervention strategies per (sub)sector

a. Improved cookstoves

After a slow start in 2013 and 2014, the component has gained significant speed. Since 2015, outcomes are growing exponentially, with figures increasing from 160,000 people to 275,000 people only within the last quarter.

At the same time, sustainability has been radically improved by advising partners to focus on fully commercial approaches. With this success in mind, the scaling will continue with the same intervention logic, bringing it to scale. The recent growth rate can, however, not be sustained, since substantial investments in market structures are required. This will slow down the growth rate but at the same time further improve the long term sustainability of interventions. Within the framework of the proposed budget, EnDev will focus its support on the three main implementing organizations (NGOs SNV, AVSI and the University Foundation FUEM) to scale up their implementation, building on recent significant increases of sales figures (2014: 17,246 ICS; 2015 35,025 ICS = > 200% increase). Experience shows that for success of a commercial approach, a minimum level of concentration of prospective clients is required. For successfully developing an emerging market, transaction costs need to be kept at a minimum. The project will therefore focus its efforts on the ICS market in Maputo and expand it further to the Pemba area in Northern Mozambique, areas with a comparatively high population density and high fuel costs which make the investment in ICS financially attractive to consumers.

The support will focus on the increased sustainability of commercial approaches by gradually reducing the support rendered by NGOs. This has already started in 2015 and will be continued, amongst others by identifying additional existing companies/entrepreneurs working with the base of the pyramid (BoP), supporting them with inclusive business approaches (e.g. using existing informal distribution channels) and respective trainings in entrepreneurial and business skills. EnDev will contribute to raising awareness of consumers through marketing campaigns, assisting existing partners with new and innovative ways of targeting prospective customers (e.g. innovative consumer behavioural change approaches such as sensing, mobile movies, product orchestrating). An important tool to attract private investments will be performance-based financial incentives offered to SMEs which have successfully been tested in 2015 with AVSI and SNV. EnDev will also further support the implementation of successfully introduced marketing and end-consumer finance mechanism. The Italian NGO AVSI supported youth groups in the biggest slums in Mozambique to sell ICS door-to-door based on instalment payments. Since the NGO as well as the young vendors have strong links to the local community this approach has proven successful. The approach was replicated by other implementing partners. Instalment-based payments, however, were less successful with other partners since they are less well established in local communities, a prerequisite for mitigating the risk of payment defaults.

The FUEM (Social Enterprise of the Eduardo Mondlane University) will be further strengthened to consolidate and scale up their import and local assembly facility for industrially produced stoves parts. They will introduce improved flat pack solutions and increasingly efficient and low emission ICS models which have been industrially produced abroad. Further emphasis will be given to the development of the carbon credit finance mechanism to support long-term sustainability in the low-margin markets and open up ways to reach less commercially viable market segments, e.g. vulnerable groups in rural areas. This will be linked to direct implementation within the regional RBF “Access to modern cooking energy for poor and vulnerable groups in Mozambique and Malawi”.

With the Mozambican Biomass Energy Strategy (BEST) as a reference, EnDev will continue advising the national government towards creating conducive policies and investment incentives. EnDev has been coordinating Mozambican stakeholders' ICS activities aiming at harmonized and market based approaches. Through successful advisory work by EnDev, the national renewable energy fund FUNAE has been convinced to link ICS promotion to EnDev quality standards and to sell stoves instead of giving them away for free. EnDev will support the government in participating in the development of international quality standards for ICS and their adoption. It will also support the UEM (University Eduardo Mondlane) biomass laboratory to become a fully functional entity offering designing, testing, standardisation and quality assurance services.

b. Solar

The solar component has in 2015 started to introduce a radically different approach, focussing on larger players with capacity to unlock import capacity constraints, rather than working with small retailers as in the past. This new PPP oriented approach has started to gain speed, but is yet to show large outcome numbers. With the aim of making the picoPV market sustainable in Mozambique, the solar activities will be further focused following a two-fold approach. This would, if successful, prepare the ground for massive scaling. Although the current cost-efficiency of interventions does not yet meet EnDev benchmarks, the solar component will continue to implement the new approach to prepare the ground for potential massive up-scaling , e.g. through bilateral DFID funds. If despite these efforts the market does not show improvement and co-funding does not materialise, a decision to phase out support to the solar sector would be taken in mid-2017.

On the one hand EnDev will further develop the rural end-mile retail networks in the context of its cooperation with TOTAL in 3 provinces and help TOTAL's most promising filling station agents in other provinces to successfully develop the solar business. So far a network of a total of 25 rural retailers is in place. In order to reach scale and sustainability, the future focus of activities will be on expanding successful business approaches so far implemented by already established retailers, extending the retail network as well as putting a stronger focus on marketing activities. Filling stations outside the targeted end-mile retail provinces will receive inputs as to how to successfully market the picoPV product range and be linked to potential clients.

On the other hand EnDev will support new promising solar companies in their venture to enter the Mozambican market with new business models. EnDev will help the companies to overcome market entrance barriers and establish business in the country. This will be done by providing market information, adapting sales models to local requirements, providing in-country b2b-linkages (e.g. between manufacturers, distributors and mobile money providers), paying performance-based financial incentives and assist in lobbying with the Mozambican government. A major focus of efforts will be the introduction of end-consumer finance mechanisms, the low purchasing power of the target population being one of the main impediments for market development. New companies already in advanced discussion for PPP-style arrangements include SolarWorks and Off-Grid Electric. Other interested market players are M-KOPA (currently receiving first support through DfID directly) and an Italian company scoping the market for solar PAYGo business.

Above efforts will be complemented by increasing awareness about benefits of solar products amongst the population as well as further supporting the solar test laboratory at the UEM to become fully functional and render product tests and providing feedback to distributors and manufacturers. FUNAE will receive advice in its efforts to increase private sector involvement in the renewable energy sector.

c. Both components

For market development of both ICS and picoPV products EnDev Mozambique started implementing a **gender strategy** in 2015. Activities are focussed around gender targeted marketing of the products and efforts to create jobs for women in the value chains, e.g. in ICS production as well as ICS and picoPV retail. These approaches are being further developed with help of the GIZ-Mozambique gender focal point and systematic gender-disaggregated monitoring data is being collected to measure impact with regards to gender equality.

Activities in both components will be supported by close cooperation with the MIREME (Ministry of Energy) and FUNAE to achieve a **conducive environment** for private investment, including the lobbying for financial incentives for investors such as tax and tariff exemptions. This is being done together with DfID which is financing a study in this context (see 1.4). The cooperation with FUNAE is crucial, as in the absence of close cooperation and advice from EnDev, there is a risk they will resort to interventionist approaches rather than supporting market development. Synergies between components are made use of wherever possible. These include the use of the same implementing partners and retailers, as well as combined awareness creation activities.

Supporting private sector's **access to finance** is out of EnDev's scope with given budget and time frame. However, EnDev will continue to promote relationships between private companies, investors and financiers to bridge this gap.

d. Cooperation with others

Besides the cooperation with DfID, the BTC and the EU (see 1.4), EnDev coordinates efforts in the sector with the World Bank, the International Organization for Migration and the Ministry of Environment MITADER (ICS promotion), as well as the German-financed bilateral programmes GIZ-ProEcon (promoting mobile money / introduction PAYGo) and GIZ-ProEducação (vocational training PV). EnDev also collaborates with the BMWi financed Project Development Programme (PDP) which contributes to the improvement of the investment climate. EnDev's coordinating role with all active donors and implementers has proven to be crucial to avoid overlapping of activities in the same regions with different approaches. It is planned to intensify cooperation with other donors to create a stakeholder platform on household energy and to support the country action plan for clean cookstoves and rural electrification.

e. Support for the implementation of regional RBF projects

EnDev Mozambique will support the implementation of two regional RBF projects, the "Access to modern cooking energy for poor and vulnerable groups in Mozambique and Malawi" and the "Sub-Saharan Africa Grid Densification Challenge Fund". The first will be implemented by the UEM Foundation with an outcome of 159,000 beneficiaries. The project aims to provide high quality wood stoves to low income and vulnerable population in rural areas. For the latter the national utility EdM has great chances to win parts of the challenge fund, since EnDev is currently implementing a grid densification project with the utility connecting 15,300 poor households across Mozambique with great potential to be scaled up. The implementation of the RBF projects will require significant resources for monitoring and extensive technical assistance, binding personnel and logistic resources (especially for the ICS project). These costs will not be covered by the regional DfID funds for RBF. This in turn, although contributing to global EnDev target achievement, negatively affects the cost efficiency of the up-scaling since the RBF outcome figures are accounted for separately.

2.3 Sustainability of the intervention

EnDev Mozambique has established an internet based **monitoring** platform to create, deploy and apply surveys which is also being used by other EnDev countries. Tablet-based customer satisfaction surveys as well as KPTs and WBTs are being applied and fed into this platform. A monitoring database with detailed information of all ICS users and lately most picoPV beneficiaries is the basis for the application of a sophisticated monitoring concept, tracing systems down to end-consumer level enabling the measurement of satisfaction, adoption, performance and use of the disseminated technologies. The information includes user name, address, GPS coordinates, type and serial number of device.

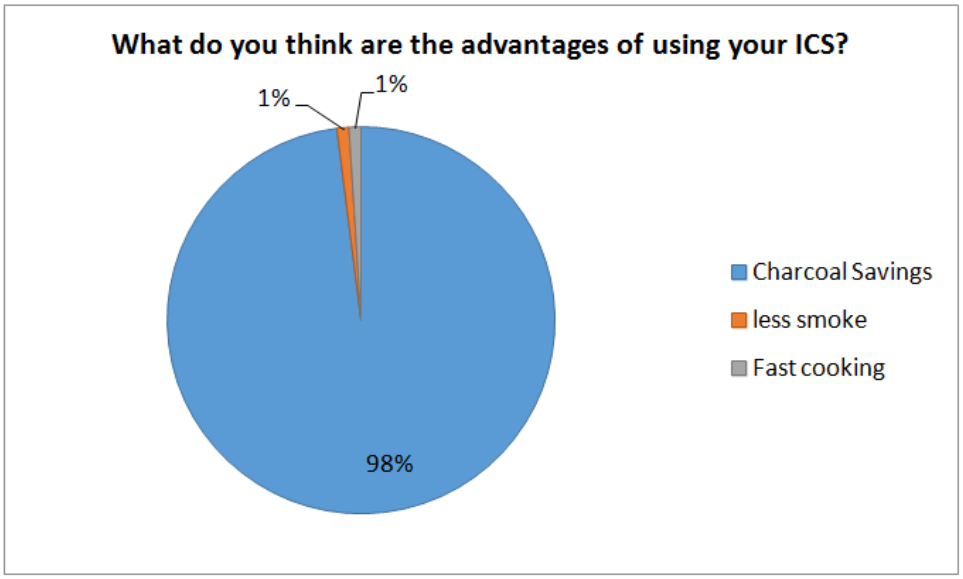
a. Improved cookstoves

In order to ensure that rural promotion of ICS is financially sustainable – considering the low purchasing power of households – EnDev has been supporting the development of a functional **voluntary carbon market mechanism** by training partners in the conduction of Kitchen Performance Tests (KPTs). In order to lower the production/importation costs of the industrial ICS and thus end-consumer prices, several initiatives and innovations regarding the design of fully locally produced

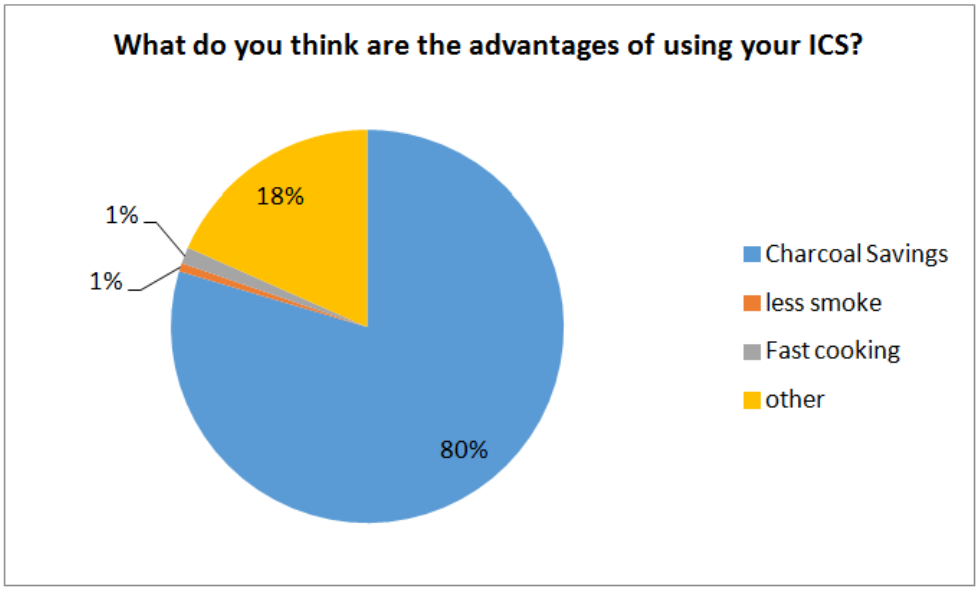
industrial ICS have been developed, which are currently in the process of being implemented with support of the Biomass Energy Certification and Testing Center at the UEM. The increasing promotion of high-quality, industrially produced stoves with 5-year life-span adds to the sustainability of access.

Below charts show the results obtained through **Customer Satisfaction Surveys** conducted for some of the disseminated ICS, advantages of the stoves being almost entirely attributed to fuel savings (80% - 98% of respondents). However, it is too early to assess replacement rates for the stoves, as the component started activities only recently and few stoves have actually reached the end of their lifespan.

Envirofit CH2200 (imported, industrially produced charcoal stove)



Mbaula (locally produced charcoal stove)



b. Solar

Currently the market is not self-sustained and therefore not sustainable. However, since 2015 new quality products are available and foreign solar companies want to invest in Mozambique. EnDev Mozambique's efforts to introduce **new business models** for end-consumer financing (e.g. PAYGo) will make products affordable to a large part of the population reaching a scale for sustainable business activities. This is to be achieved through support of companies who have

household solar as their core business. Evidence for this has been provided by other EnDev countries in the region, such as the success of companies like M-KOPA, Off Grid Electric and Mobisol in Eastern Africa. The continued creation of awareness about existing warranty systems will raise trust with consumers and contribute to increased uptake of products. The support to TOTAL is still in an initial phase. After take-off of the retailers, EnDev plans to **gradually withdraw its support for the rural retail network** to function sustainably.

In order to support the establishment of a **sustainable quality assurance** of PV products available on the Mozambican market, EnDev is supporting the set-up of a quality-testing laboratory at the Eduardo Mondlane University (UEM) in Maputo. In 2015 the following achievements towards sustainability of the laboratory were achieved: Three well-trained staff members have been fully employed by the UEM; the establishment of an Energy Research Center (ERC) at the UEM has been approved, which guarantees further and sustained finance by the UEM for the laboratory.

First customer surveys indicate a great **satisfaction with the promoted technologies** (refer to impact chapter), one important aspect being the reduction of household expenditures for energy. When the introduction of instalment payments via mobile money as well as PAYGo models will be introduced by the solar firms, it is believed that this will speed up the development of the market and thus its sustainability.

c. Both components

DfID is in advanced discussions with EnDev to partly implement its new off-grid programme in Mozambique. Close cooperation with DfID will ensure synergies, avoid diverging approaches and therefore further support the sustainability of EnDev's efforts. The same applies to coordination with FUNAE, where EnDev convinced them to disseminate ICS on a more sustainable basis (see further above).

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	• Increased use of solar power generation for lighting and small appliances and use of more efficient ICS lead to reduced use of dry-cell batteries, kerosene and/or woody biomass (less polluting waste and emissions, less deforestation) **Measurement / Baseline:** • to be measured by user surveys & KPT • Current main energy sources for lighting: 39.7% disposable batteries, 24.8% electricity, 14.2% firewood, 13.2% kerosene as from Family Budget Survey of the National Institute of Statistics published in January 2016, http://www.ine.gov.mz/operacoes-estatisticas/inqueritos/inquerito-sobre-orcamento-familiar • Current measurements of fuel savings through ICS in real household conditions: 43% - 80% (laboratory results: 32% - 72%) (Source: (EnDev monitoring)
Health	• Decrease in occurrence of emission-related (respiratory) diseases and consequential higher average productivity • Less fire incidents due to reduced use of kerosene lamps, candles and firewood for lighting **Measurement / Baseline:** • cannot be measured within project, health aspects will be assessed through proxies defined in EnDev cooking energy system approach

Impact	Possible indicators
Poverty/livelihood	• Savings on energy spending increase household income – to be measured by user surveys **Measurement / Baseline:** • To be measured by user survey and KPT (see also environment indicator) • ICS EnDev baseline survey (2013/2014): monthly spending for firewood/charcoal range from MZN 144 to 800 depending on fuel and province • First picoPV user surveys indicate monthly average savings of EUR 5.- • Improved access to information (cell phone/radio/TV) increase the sense of inclusion and enables access to market and price information necessary for strategic planning and sales – to be measured by user surveys. • Time used for collecting firewood, covering distances to charge cell phones is available for productive use – to be measured by user surveys and KPTs.
Education	• Increased knowledge on PV technology for students and private sector through training at educational institutions • Improved business management skills through business trainings for companies and entrepreneurs • Increased capacity of implementing partners regarding market development for RE technologies and financial management of projects • Increased time for evening studies for students – first picoPV user surveys in 2016 resulted in 10% of respondents stating evening study time as advantage of lighting systems
Governance	• Increased support of commercial approaches to promote RE technologies (rather than fully subsidizing) by MIREME and FUNAE and improvement of monitoring of projects • Introduction of financial incentives for RE technologies • Improved coordination between MIREME and FUNAE activities • Increased coordination and management role of the delegated office DIPREME (Ministry of Energy) resulting in documented transparent planning and priority settings
Climate change	• Annual reduction in CO_2 equivalents (CO_2e) emission: 6,100 t
Gender	• Job creation and income generation for women along ICS and PV value chains – to be measured by standard EnDev outcome monitoring • Health benefits especially for women (less exposure to emissions) – cannot be measured within project, health aspects will be assessed through proxies defined in EnDev cooking energy system approach.
Market development	• Increased awareness about benefits of RE technologies and quality issues • Increased sales figures of quality RE technologies – to be measured by standard EnDev outcome monitoring • Increased in-country production and importation of ICS / solar technologies • Increased jobs along the ICS and PV product value chains – to be measured by standard EnDev outcome monitoring • Carbon credits for ICS market on sale • Introduction and of new business models for household solar products

4. Possible risks and potential ways to mitigate them

The armed conflicts between government forces and the military arm of the opposition RENAMO recently flared up in the central zone of Mozambique leading to the closing of parts of the main South-North commercial route. This might hamper the development of distribution systems in affected areas in Manica and Sofala provinces where EnDev is active. It also negatively influences foreign companies' investment decisions. Generally the business environment in the country is not very favourable, being one of the most costly countries in the region in terms of costs of doing business. The strong devaluation of the Metical against the US dollar experienced in 2015 as well as the recent drought impact negatively on the purchasing power of consumers. By supporting the introduction of new end consumer financing mechanisms the project is addressing this issue.

If FUNAE would continue to provide PV systems to private households at subsidised rates, this could endanger nascent markets of companies selling household solar products. However, it appears that with the new leadership at FUNAE approaches might be changed. EnDev coordinates its activities with FUNAE and advises it regarding commercial approaches in promoting energy technologies.

5. Budget

		EUR
1	Human resources and travelling	1,243,000
2	Equipment and supplies	50,000
3	Funding financing agreements/local subsidies	375,000
4	Other direct costs	85,000
5	**Total direct costs (sub-total)**	**1,753,000**
6	Mark up costs/administrative overheads/imputed profit	247,000
7	**Cost price**	**2,000,000**

Peru

Promoted technologies		grid / solar / biogas / stoves / other			
Project period	old	06.2009 – 06.2018	**Budget (EUR)**	old	16,390,000
	new	06.2009 – 06.2018		new	16,920,000
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		325,000	325,000		people
Cooking / thermal energy for households		881,500	906,500		people
Electricity and/or cooking / thermal energy for social infrastructure		6,800	6,808		institutions
Energy for productive use / income generation		9,160	9,168		SMEs
Lead political partner		Ministry of Energy and Mines (MINEM)			
Implementing organisation		GIZ; IICA; Practical Action; MFI Caja Arequipa			
Implementing partner		Ministry of Energy and Mines (MINEM); Ministry of Development and Social Inclusion (MIDIS); Ministry of Housing, Construction and Sanitation (MVCS); Ministry of Education (MINEDU); regional and local governments, private companies (especially mining, utilities and technology suppliers); micro finance institutions			
Coordination with other programmes		GACC (UN foundation); FONER (World Bank & MINEM); Chakipi (Clinton Foundation); Green Energy for All (ADA); Cocinas Mejoradas (UNDP); Energía y Acceso (OLADE); Qori Q'oncha (Microsol); ProAmbiente (GIZ Peru); FONCODES (MIDIS); FISE (OSINERGMIN)			
Key interventions		• technical assistance to scaling-up projects of the Peruvian Government concerning improved cookstoves (ICS) and solar home systems (SHS) • development of last mile distribution channels for ICS, picoPV, improved baking ovens, domestic connections to the grid and solar water heaters • technological innovation, standardization and validation in cooperation with academia and regulatory authorities • capacity development for entrepreneurs and partner institutions • development of information, education and communication strategies for energy access projects among public and private partners			
Main strategic changes introduced with up-scaling		• This up-scaling concerns only FASERT (energy access fund as part of EnDev, managed by IICA). FASERT's main focus is market development for thermal renewable energy technologies (mainly ICS and improved ovens; abbreviated TERTs). There will be no major change to FASERT's strategy.			
Project manager		Dr. Ana Isabel Moreno Morales, ana.moreno@giz.de			

1. Situation analysis

1.1 General energy situation in the country

According to IDB, MEM and GACC 2.5 million households use traditional fuel types. Firewood is the fuel used for cooking by most of these households (National Statistics Institute, 2011).

Improved cookstoves have received growing attention over the past 10 years. Almost 340,000 cookstoves were installed from 2009-2015 through a public campaign with participation of many public and private institutions. Implementation continued even after the campaign's formal end date. At present, public and private actors which were involved in this campaign discuss how to improve sustainability of the access achieved. These mechanisms will focus on development of markets that provide after-sales services for maintenance, repair and/or replacement of improved cookstoves. In addition, since 2013 the government (MINEM and MIDIS) has been developing the "Peru Cookstove Program" by providing kits for LPG cookstoves and constructing improved firewood cookstoves.

The rural population that uses biomass for cooking in most cases also uses firewood to heat water. Market development of solar water heaters has, so far, been limited to urban areas due to logistical difficulties, limited access to financing (for both end customers and last mile businesses), and low awareness about the technology.

Despite the generally favourable political framework conditions and the different public programmes created by the Peruvian government to achieve universal access, there are no nationally valid goals on access to modern biomass for cooking and there is no monitoring. (There are goals at the level of individual ministries: MIDIS, for example, has fixed an objective of promoting 200,000 ICS through its programme FONCODES.) In addition, there is a need for greater coordination among the various ministries involved in energy access, such as the Ministry of Development and Social Inclusion and the Ministry of Energy and Mines.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans.

Peru had subscribed to the Millennium Development Goals. The Peruvian government considers that universal access to energy is essential not only to eradicate poverty and improve the health of population, but to increase productivity, strengthen industry competitiveness and promote economic growth. Peru's vision is focused on creating an energy system that meets national demand in a safe, timely, sustainable and efficient manner, based on planning and continuous research and innovation. Peru aspires to increase access of rural households to 92%, and that each Peruvian citizen reaches universal access to energy in 2021.[44] For this reason, Peru supports the initiative of "Sustainable Energy for All" and its three principal objectives.

Energy sector in general: The **Universal Energy Access Plan 2013-2022** formulates the goal to achieve universal access. In order to reach this goal, the plan suggests the following: (1) to promote electricity access for lighting, communication and community services, (2) to promote access to clean technologies and fuels for cooking and space heating (improved cookstoves, gas, LPG, bio-digesters) and (3) to foster productive use of energy. The plan is based on a holistic vision: it links availability of energy with the improvement of education, health, security and agricultural production. The plan mentions four general mechanisms: (a) programmes for massive use of natural gas; (b) promotion of and subsidies for LPG access; c) programmes for development of rural electrification; and d) programmes for improvement of rural energy use / energy efficiency, including improved cookstoves. In these initiatives, the private sector is invited to participate in tenders and in operation of the technologies. The main resources that the Peruvian government established for implementation of the plan are the FISE (Fondo de Inclusión Social Energético, or: Fund for Energetic

[44] In 2021 Peru will celebrate the 200th anniversary of its independence.

Social Inclusion) and FOSE (Fondo de Compensación Social Eléctrica, or: Fund for social electricity compensation), assigned to the National Plan for Rural Electrification 2013-2022.

The **National Energy Policy of Peru 2010-2040** launched at the end of 2010 includes the objective of developing an energy sector with a low environmental impact and low carbon emissions.

The Ministry of Energy promotes off-grid technologies such as **solar home systems** in order to increase the electrification rate in areas that will not be covered by the national grid. A specialised fee-for-service tariff is available. Guarantees by the state and cross subsidies from urban customers reduce risks from non-payment by rural customers. Tariffs and cross subsidies are determined in relation to the services delivered by the SHS. Today, regional electricity utilities use this setup for the nearly 20,000 SHS already installed in Peru over the last five years, when the SHS tariff was launched. At the end of 2014, the ministry launched an **auction** for 150,000 SHS. Investors were invited to install, operate and maintain the SHS under a fee-for-service concept over a period of 15 years. The investor with the lowest cost was awarded the contract in 2015. EnDev has provided technical assistance to this programme with i) comments on the technical specifications for the required technologies, ii) the development of a mapping software application to identify end users (combining information from various sources) and iii) the elaboration of the communication and awareness-raising strategy. Currently, the Company Ergon, which is implementing this programme, has slow progress, therefore it is unknown if implementation will continue due to sanctions in the contract.

There will be presidential elections in April 2016. It is expected that the new government remains committed to universal access to energy.

Social inclusion and poverty reduction: The objective of the social inclusion policy of Peru is to close the gap of poverty and lack of access to services. Within this policy, MIDIS has been given two functions: supervise the actions of the different sectors and levels of the government that are related to poverty reduction; and provide direct services through five social programmes: FONCODES, Quliwarma, Juntos, Pensión 65 and Cuna Más.

In April 2015, MINEM transferred some of its functions and budget, coming from FISE, to MIDIS in order to implement improved cookstoves subsidized by the government. Currently FONCODES is responsible for implementing the improved cookstove intervention.

EnDev and FASERT coordinate with MIDIS and its programmes to ensure complementarity in their interventions.

Health: The Ministry of Health implements the “Healthy Houses and Families” programme. The goals of this programme are to improve housing infrastructure, to improve basic sanitation and hygiene and to promote improved cookstoves. There are about 2,000 health posts; each health of them has received a budget to target five households.

Environment: Peru has considered measures related to the energy sector within its national mitigation contributions. 23 priority measures were identified, geared mainly towards renewable energy and energy efficiency in both domestic and industrial demand. The following priority measures directly relate to EnDev actions in Peru: rural electrification with solar panels, solar water heaters in households, energy efficiency in artisanal brickworks and installation of improved cookstoves in rural areas.

1.3 Institutional set-up in the energy sector

The **Ministry of Energy and Mines** (MINEM) is the central institution of the energy sector. It is one of EnDev’s main partners, specifically the Vice ministry of Energy through two directorates: (1) Directorate of Rural Electrification and (2) Directorate of Energy Efficiency. The regulatory authority, which is also in charge of regulating rural electrification, is called Osinergmin. In addition Osinergmin is in charge of the administration of FISE (see above).

However, other **national ministries** such as the Ministries of Health, the Environment, Social Inclusion or Housing are also aware of the connection between energy, poverty and economic development and are therefore important partners for EnDev as well. Foncodes, for example, is a

social programme of MIDIS that also implements ICS. Furthermore, there are **regional and local governments** who focus on access to basic services.

Beyond these public bodies, there are also **academic institutions** who have been working for years on topics related to energy access in rural areas. The oldest is the Center for Renewable Energies (CER), hosted at the most recognized engineering university in Peru. Likewise, UNSA in Arequipa has equipment and proper climate conditions for testing solar water heaters. EnDev works with these institutes on development and testing of appropriate technology, such as improved ovens, improved cookstoves, solar water heaters and basic lighting systems.

1.4 State of market/sector development

a. General considerations

The energy access market promoted by EnDev Peru focuses on four main technologies (estimates on market volume by EnDev):

- household grid connections: potential market estimated at 0.5 million households[45]
- improved cookstoves: potential market estimated at 2.5 million households [46]
- solar water heaters: potential market estimated at 0.5. million households[47]
- picoPV: potential market estimated at 0.5 million households[48]

Each technology has distinctive features in their markets, and face distinctive barriers. The last three access technologies correspond to goods markets whereas the first access technology corresponds to a service market.

b. Household grid connections

In household grid connections, local electrical service markets are established around public rural electrification projects. These markets (for technical service but also for electrical components) allow closing the electrical circuit within a household, thus reaching the "electrical last mile". (Grid extension projects do not include household connections and internal wiring.) Stakeholders in these markets are the importers and/or manufacturers of electrical components, electricity utilities and local electricians. The greatest challenges are funding of local training and working capital for electricians.

c. Improved cookstoves

The supply, demand and supporting functions of the improved cookstove market have greatly evolved since 2009. In the first two years, EnDev's market development was on fostering supply of quality ICS and on awareness raising. Supported by EnDev lobbying, the Peruvian government decided to launch its campaign "500,000 ICS for a Peru without smoke". During this time, the regulatory framework was strengthened (quality standards, administrative rules allowing public funding to be used for ICS, etc.) and large-scale awareness raising activities were conducted. The campaign also contributed to the fact that today more than 20 suppliers are active in the market. These suppliers target both the institutional demand created by poverty alleviation programmes of the government and the individual retail demand. Companies generally have access to financing. However, sustainability is not yet a given and market functions such as supply of maintenance, repair and replacement services must still be promoted, innovation be fostered, and end-user financing be further developed.

d. Solar water heaters

The market for SWH is the oldest of all renewable energy product markets in Peru and has started to develop more than 40 years ago. During this period of time, many private firms were established.

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[45] source INEI: Encuesta Nacional de Hogares 2014, Dirección General de Electrificación Rural

[46] source INEI: Censos Nacionales 2007: XI de Población y VI de Vivienda

[47] source: EnDev estimation

[48] source: Dirección General de Electrificación Rural, MINEM

The industry is mostly centred in and around Arequipa where it started and from where it has been expanding to other regions. However, between 90% and 95% of all SWHs in the country are still marketed in Arequipa.

Overall, the demand in Peru is more pronounced in certain regions, especially in the South (cities of Arequipa, Tacna, and Moquegua), in the central zone (Cusco, Puno, Huancayo, and Ica) and in the North (Piura, Chiclayo, Trujillo, and Cajamarca). According to the Peruvian solar atlas the highest radiation in Peru is measured in the departments of Junín and Arequipa and, for these regions alone, the current market size for SWH is estimated at around 80,000 households.

Peru has a population of almost 30 million people of which approximately 1% has access to SWHs. This figure indicates a huge latent demand which could be transformed into actual uptake of SWHs if certain barriers can be overcome. On the supply side, stakeholders expect an increasing market for SWHs as the demand, mostly in cities outside Lima, has been growing recently. However, these markets are often only served by one sole supplier of SWH, effectively creating small regional monopolies. Retailers are struggling to establish new bases and sales structures outside their home market given the high risk and the little experience with market expansion. On the demand side, the main barrier is that many households prefer traditional boilers because they are unaware of the monetary advantages that a SWH provides: The investment in one SWH is estimated to be recovered by grid-connected households in a maximum of three years, only through the savings in electricity costs.

EnDev is currently developing a RBF project to stimulate and expand the SWH market in Peru in alliance with one local MFI (Caja Arequipa). In this line EnDev provided further technical assistance to MFIs. The aim was to develop a financial services portfolio for energy access technologies. Currently some IMFs are planning to expand not only their portfolio of financing services for different green technology projects.

e. picoPV and SHS

In the last years the price reductions of solar panels and components of SHS have stimulated the market worldwide. Peru has not been an exception and many solar products have entered the market. A sizeable black market for panels and batteries has developed offering low quality solutions without after sales service in response to the high demand for low-priced products. This development puts the trust in solar technology at high risk.

However, there are some importers/providers of quality picoPV systems (two small companies, each less than 10 employees) with about four years of existence, who are importing, integrating and selling renewable energy solutions as their core business. They have a focus on high-quality products and high-quality technical service in order to create the customer confidence that is needed. Both companies pursue a strategy of developing and expanding a regional commercial retail network.

The potential market for retail sales is huge: At least 500,000 households will not be attended by governmental fee-for-service models or grid extension and will remain without access to electricity in the next 10 years.

The energy access businesses also include SHS importers. These focus their efforts mainly on large public and private projects and on offering sophisticated engineering services, leaving the SHS retail market in the hands of the black market. Three solar firms share among them 90% of the Peruvian SHS market. All three have a strong experience in public tenders. These companies have installed almost 15,000 SHS in the last four years. Another 5,000 systems were already installed before the SHS tariff was approved.

1.5 Relevant activities of other donors and implementers

There have been no major interventions from other donors concerning neither improved cookstoves nor solar water heaters. The Inter-American Development Bank and the World Bank are advisors to the Ministry of Energy and Mines concerning regulation, promotion and implementation of the National Rural Electrification Plan, as well as on productive use of energy.

JICA and the KfW have given a loan to COFIDE to promote renewable energy and energy efficiency in all its dimensions.

2. Project approach[49]

2.1 Market development vision and EnDev conceptual approach

EnDev's vision is that, in five years from now, a much more **dynamic market** for TERTs has been created. Energy access will have been established as a profitable business line. The market will (1) have a greater outreach: more customers will have been reached and new areas will have been covered, especially by targeting customers on the last mile; (2) be more mature: market actors will have gained more experience working with different customer groups, different financing agreements and different products and the market will also (3) be more diverse: more products and more services will be available.

This concerns the supply, demand and enabling environment:

- **Supply:** Products (such as stoves and SWH) and services (such as maintenance, repair, spare parts and replacement of systems) are readily available in rural areas throughout the country. Suppliers offer a range of products and services for different circumstances and customers can choose the product, service or financing arrangement that provides the best fit to their preferences and circumstances.
- **Demand:** Customers are aware of the technologies and are willing to spend money, both for the initial investment and for services, spare parts and accessories. Customers know how and where to obtain products and services. Customers are able to distinguish quality products from non-quality products.
- **Enabling framework:** There is a functioning quality certification system for improved cookstoves and SWH. Public funding from various sources is available to subsidise part of the initial investment for certain customer groups (for example, households eligible to receive welfare). Micro finance institutions offer end-user credits for access technologies as part of their green portfolio. Business finance will be available to last-mile entrepreneurs, retailers and distributers.

EnDev's market development vision applies equally to customers in the household, social infrastructure and productive use sector.

In this vision, **sustainability** of access has two dimensions. On the one hand, the **durability** of the access technology is high (high quality product & installation, maintenance, spare parts), thus ensuring that the service is provided over a long time-span. On the other hand, the **resilience** of the market system is high (profitability of access business will attract private sector, competition between businesses will decrease cost and foster innovation), thus ensuring that the products and services will be available in the future even as framework conditions change.

There are two markets for energy access: a **public sector market** and a **private retail market**. (1) Peru has strong investment programmes for energy access. These are based on public tenders, providing systems at a highly subsidised rate for customers. Many private sector players are interested in these

[49] This up-scaling concerns the FASERT fund only. (FASERT is part of EnDev Peru's stove activities.) The description in the following therefore leaves out stove activities outside FASERT, and leaves out rural electrification entirely.

because of the high volumes. (2) On the other hand, there is a growing retail market servicing individual customers. These two markets coexist; for example, there are a number of retailers who used public programmes to establish themselves in the retail market.

The **general strategy** of EnDev Peru is focused on these two different types of markets:

- public sector market: EnDev provides technical assistance to public-sector projects which aim at low-income populations through tenders, thus developing and strengthening companies engaged in the manufacture and/or importation of technologies.
- private retail market: EnDev develops and boosts the retail distribution chains of companies interested in the retail market.

The ratio of the approaches in EnDev Peru's outcome has been 5:1 for the period 2007-2015 and 3:1 in 2015. The target for 2018 is a ratio of 1:1.

2.2 Specific intervention strategies per (sub)sector

This up-scaling proposal concerns the FASERT[50] component of EnDev Peru. FASERT is an energy access fund that is an integral part of EnDev Peru's stove component. It has been created in 2014 with the objective to promote the commercial value chain for renewable thermal energy technologies[51]. The fund is hosted by IICA, a long-time partner of GIZ.

This proposal will scale up and consolidate the initiatives already implemented under the fund and to contribute to their sustainability.

FASERT has three components:

- a competitive grant component
- an innovation and quality improvement component
- a promotion and dissemination component

In its **competitive grant component**, FASERT co-finances TERT projects of private companies or CSOs. These projects can target households, social infrastructure and productive uses. There is **no end-user price subsidy**. EnDev's co-financing is used to strengthen supply (for example, through training, support for branding, set-up of rural distribution points, and organisation of meetings with micro finance institutions) and to strengthen the demand (for example, awareness raising, development of marketing materials, co-financing of marketing activities). Projects eligible under the grant fund component must fulfil a number of criteria: market development focus (i.e., no end-user price subsidy), demonstrating additionality, working with validated technologies, and being ready to be scaled-up.

In the **innovation and quality improvement** component, FASERT tries to build institutional capacities on testing and certification. FASERT trains staff of SENCICO (the Peruvian institution in charge of stove certification) in various aspects, such as design and implementation of stove user surveys or the use of stove usage monitors and personal exposure monitoring devices. FASERT's support was a key contribution to SENCICO's publication (in December 2015) of a protocol for field testing of stoves. This will help to speed up product innovation cycles. FASERT is currently also developing a strategy to position itself as a promoter of technologies at the energy-agriculture nexus, such as biodigesters and solar dryers.

[50] "Fondo de Acceso Sostenible a Energías Renovables Térmicas", in English: fund for sustainable access to renewable thermal energy technologies

[51] abbreviated as TERT, these include a number of technologies such as improved cookstoves, improved ovens, biogas digesters, solar water heaters and solar dryers

An improved brick oven, one of the productive use technologies promoted under the competitive grant component of FASERT

The goal of the **promotion and dissemination component** is increased visibility and political lobbying. FASERT tries to position TERTs in the public discourse (for example, as a technology option in climate change mitigation) through various measures, such as participation in public forums and large-scale advertising in public events (for example, before football games). One specific goal is to have TERTs included in government programmes and public initiatives. This is especially important given the virtual absence of political goals related to access to modern biomass. Another activity in this component is to identify projects at the agriculture/energy nexus as this may open up possibilities to mobilise agriculture-related funding for energy access.

Both the second and the third component of FASERT do not directly generate outcome. They contribute, however, to market development by strengthening **market support functions**.

In this **up-scaling**, FASERT will continue to work in all three components. The up-scaling, however, is directed mainly at the first and second component.

FASERT will scale-up the competitive grant component in two ways: **(1)** A new call for project proposals will be launched. It is assumed that more than 10,000 households can be reached through this tender. In the selection of projects, FASERT's focus on increasing entrepreneurship of energy access companies and on increasing TERT sales through consumer access to microcredits. **(2)** The two most successful projects from the competitive grant component will be scaled up. FASERT will also continue to support actors from the first tender in order to help them maintain and consolidate their approach, as well as to strengthen sustainability.

The innovation and quality improvement component will also be scaled up in two ways: **(1)** FASERT wants to develop the market for portable cookstoves with chimneys. 1500 of these will be imported by FASERT and sold to retail customers in two regions of Peru by private companies. Under this arrangement, companies have the obligation to import stoves from the revenue generated by the first wave of sales. EnDev/FASERT thus hopes to link national private companies directly to foreign technology suppliers. **(2)** FASERT will also conduct a pilot project on maintenance. In a first step, a baseline survey will gather information on (1) the current condition of stoves installed by non-EnDev actors in the framework of the national cookstove campaign (2) the current usage and maintenance patterns (3) the current commercial network around stove products and services. This baseline will be conducted in three regions. In a second step, concrete offers will be developed for maintenance, repair and replacement and will be positioned in the market. (These offers may contain a subsidy component in areas where municipal governments are willing to contribute.) In a third step, an end line survey will be conducted.

2.3 Sustainability of the intervention

FASERT's focus is on **market development**. The underlying hypothesis is that a profitable retail market will generate continuous interest of private companies in providing energy access products and services. In Peru, there has been a rather developmentalist / paternalistic approach to energy access in the past. EnDev has been on the forefront of developing a market-driven approach, for example in improved cookstove distribution. Interestingly, many of the participants of FASERT are beginning to change their approach toward more market-driven and less assitentialist approaches.

This main driver behind this is that more market-driven projects tend to create larger dynamic and higher outcomes at lower cost – clearly and advantage in FASERT's competitive grant component.

Public-sector projects create a high demand and, therefore, a high interest of the private sector initially. Not all of the companies which participate in tenders are interested in the retail market for peri-urban and rural customers. However, from EnDev's general experience, about 50% of the companies establish retail outlets and continue to service retail customers in peri-urban and rural areas. Therefore, even though the energy access market is highly influenced by subsidised government programmes this does create businesses with a long-term interest in peri-urban and rural retail customers.

In EnDev's experience, energy access businesses may even coexist with public sector programmes. The key is to create a distinctive product identity which allows the customers to distinguish between free giveaway products and retail products: premium branding, different colours, better initial customer training, and the offer of follow-up services allow the private retail market to set itself apart from public programmes.

One of the keys to sustainable access is **durability** of the technology; the other is **resilience** of the market system. Durability of the products promoted by FASERT is ensured through quality certification by SENCICO, the authority in charge of certifying cookstoves in Peru. EnDev is currently working with SENCICO on a protocol for certification of portable cookstoves with chimneys, taking into account their special characteristics such as metallic surfaces that may become hotter than surfaces of masonry stoves. Resilience of the market system is fostered by FASERT's activities on promotion of maintenance, spare part and replacement, as well as by the creation of direct business links between foreign stove producers and Peruvian retailers.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	Reduced firewood consumption due to use of more energy-efficient cookstoves and ovens, and use of solar water heaters for hot water
Health	Reduced health problems due to reduction of indoor air pollution
Poverty/livelihood	-
Education	-
Governance	-
Climate change	Reduced CO_2 emissions due to use of more energy-efficient cookstoves and ovens, and use of solar water heaters for hot water
Gender	Reduced exposure to indoor air pollution for women using ICS
Market development	job creation in the distribution chains for ICS and SWH (distributors and installers & retailers)

4. Possible risks and potential ways to mitigate them

4.1 Risk: Drop-out of businesses

There is a certain risk that companies turn away from the energy access business to other, more promising businesses, if they are not successful fast enough. On the other hand, many of the companies are still immature. They will need more experience to establish themselves in the market. FASERT will therefore provide intensive support especially in the beginning to ensure, for example, that entrepreneurs know how to access to finance. In addition, drop-outs will be studied.

4.2 Risk: Natural disasters, linked to climate change

EnDev works in rural areas. The impact of adverse climate events (drought, floods or other related problems) may very seriously affect the economy in rural areas. People's revenues and their capacity to access the technologies promoted by the project may be reduced.

4.3 Risk: regional economies

Most of the people in rural areas depend on one main economic activity such as animal husbandry and agriculture. Price fluctuations or a decrease of demand might negatively impact the families' economy.

FASERT will try to work in localities that do not entirely depend on a single economic activity. This may help to minimize impact on the economy. In addition, FASERT's interventions are distributed over the entire territory, making it unlikely that the whole portfolio will be equally affected and making it possible to shift the regional focus.

5. Budget

		EUR
1	Human resources and travelling	250,000
2	Equipment and supplies	0
3	Funding financing agreements/local subsidies	230,000
4	Other direct costs	20,000
5	**Total direct costs (sub-total)**	**500,000**
6	Mark up costs/administrative overheads/imputed profit	30,000
7	**Cost price**	**530,000**

Rwanda

Promoted technologies		solar / biogas / hydro			
Project period	old	10.2009 – 06.2018	**Budget (EUR)**	old	EUR 15,490,000
	new	10.2009 – 06.2019		new	EUR 15,140,000
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		1,008,090	681,340		people
Cooking / thermal energy for households		20,544	20,544		people
Electricity and/or cooking / thermal energy for social infrastructure		0	40		institutions
Energy for productive use / income generation		0	40		SMEs
Lead political partner		Rwanda Energy Group (REG) / Ministry of Infrastructure (MININFRA)			
Implementing organisation		GIZ			
Implementing partner		REG / MININFRA, Urwego Opportunity Bank (UOB), private sector			
Coordination with other programmes		Belgian Technical Cooperation (BTC), EU, AfDB, World Bank (ESME, SREP, Lighting Africa), SNV, Rwandan Climate Fund (FONERWA), GVEP			
Key interventions		• Technical, financial, business management and institutional support for private investments in hydro-power • Promote access to electricity by picoPV systems disseminated through an RBF mechanism • Promote access to electricity by renewable energy village mini-grids disseminated through an RBF mechanism			
Main strategic changes introduced with up-scaling		• Scaling down the picoPV RBF • Extending the village grid RBF			
Project manager		Miriam Schröder (miriam.schroeder@giz.de)			

Sustainable Market Creation for Solar Lighting, Rwanda

1. RBF project revision

In the annual RBF review meeting, it was recommended that the project will be:

- Downscaled budget wise to: **EUR 3,050,000**

The recommendation sees a slight downscaling in the total budget, with a shift from the budget of the financial institution and part of the incentives towards Independent Verification, Management and TA. This is due to several reasons, including the fact that phone verification proved to be difficult in rural Rwanda, and more field verification is needed. This increases the budgetary requirements of the Independent Verification. Such increase is in line with lessons learnt from other picoPV RBFs under EnDev. Additionally, some of the roles assigned to the financial institution had to be carried out by EnDev staff. The FI, although the best available in the country after competitive selection, had much lower capacity than originally expected. While GIZ will invest in capacity development for the FI from a German-financed programme, this is not a quick solution and heavy involvement of EnDev staff in RBF processes will be required for the time being.

2. Adjustment of KPIs

Since incentive levels cannot be reduced as planned, it means that fewer systems can be supported and thus target numbers should be reduced. Starting from status quo of maintaining incentive levels of 4 EUR per person, the outcome targets have been reduced in the table below.

While the plan was to reduce incentive levels gradually throughout the project period, the delay in uptake and the feedback received during the review process made it clear that reducing the relatively low incentives further was unfeasible. Maintaining incentive levels will result in a lower cost-efficiency and therefore a lower number of target beneficiaries.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	880,000	550,000
EUR per person gaining access	3.86	5.54
t CO_2e emissions avoided (over the lifetime of the products sold during project)	64,800	40,500[52]
EUR per t CO_2e emissions avoided	52.47	75.30
Private sector leverage ratio	3.0	3.0
Jobs created	50	50
Enterprises created / improved	10	10
Technologies deployed	352,000 picoPV	220,000 picoPV

[52] Calcuation based on EnDev standard assumption of lifetime of picoPV products of 2 years.

Sustainable Market Creation for Renewable Energy Village Grids, Rwanda

1. RBF project revision

In the annual RBF review meeting, it was recommended that the project will be:

- Extended time wise until: **06.2019**

Companies require less financing to make their projects a valid business case, which has improved the overall cost-efficiency of the project. They adapted their business cases according to the purchasing power of their customers, offering mostly Tier 2 access to households. This has driven project costs down, while making the tariffs attractive for rural customers. RBF rewards only performing companies. However, if only foreign companies benefit from the RBF, the RBF results in market distortion rather than market development, driving out potential local actors. Therefore EnDev RW supports local companies in accessing the RBF through consultants. Eight companies have applied, proposing 67 mini-grids in total, covering over 70 villages. If all proposals were to be accepted and all results were to be delivered, the outcome target would be exceeded. The extension of the project would to tap into the potential for more projects from Rwandan and international investors. In addition, it would open the possibility to test out more innovative approaches, such as Small Power Distributors (SPD). This would reach productive use and social infrastructure customers, as these are more likely to connect to pico-hydro or distribution mini-grids than the DC solar mini-grids that dominate the current RBF project portfolio. The time extension would also ensure a smooth handover from RBF to larger financing schemes coming up for the mini-grid sector.

2. Adjustment of KPIs

Targets can increase within the existing budget, with additional targets for social institutions and productive use. As the costs of pre-financing in Rwanda are considerable, aiming for a private sector leverage ratio of 2.0 proved to be unrealistic, with 1.0 being a more realistic target. EnDev further proposes the targets to follow the technology-neutral approach of the Rwandan regulation.

RBF Key Performance Indicators (KPI)	**Old targets**	**New targets**
People gaining access (EnDev counting method)	18,750 people	22,000 people 40 SI, 40 PU
EUR per person gaining access	100.85	85.94
t CO_2e emissions avoided (over the lifetime of the products sold during project)	11,105	11,534
EUR per t CO_2e emissions avoided	170.28	163.95
Private sector leverage ratio	2.0	1.0
Jobs created	90	90
Enterprises created / improved	16	16
Technologies deployed	25 pico hydro 10 micro hydro	4 solar AC 80 solar DC 6 pico hydro 4 distribution

Tanzania

Promoted technologies		stoves / solar			
Project period	old	12.2012 – 12.2017	**Budget (EUR)**	old	EUR 2,571,000
	new	12.2012 – 06.2018		new	EUR 5,660,000[53]
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		181,970	360,000		people
Cooking / thermal energy for households		63,030	200,000		people
Electricity and/or cooking / thermal energy for social infrastructure		0	0		institutions
Energy for productive use / income generation		1000	0		SMEs
Lead political partner		Ministry of Energy and Minerals			
Implementing organisation		SNV in cooperation with GIZ			
Implementing partner		Tanzania Investment Bank (TIB), stove producers and retailers, solar companies, TAREA (Tanzania Renewable Energy Association)			
Coordination with other programmes		GIZ Renewable Energy and Energy Efficiency Programme; WB Lighting Global; SNV youth employment programme (OYE)			
Key interventions		• Development of a supply chain for wood burning ceramic stoves ("Matawi") by enhancing ceramics production, metal work and local retailing. • Promote access to electricity by PicoPV systems disseminated through a RBF mechanism			
Main strategic changes introduced with up-scaling		• Scaling of the successful entrepreneurship based cookstove activities, focussing on the most successful producers and expanding to further geographic areas. Phasing out specific support for productive use due to dominant domestic uptake of that specific stove. • scaling the successful RBF approach by adding another geographic zone (see RBF review document)			
Project manager		Josh Sebastian jsebastian@snvworld.org			

1. Situation analysis

1.1 General energy situation in the country[54]

Rural energy service delivery continues to be one of the most significant development challenges for Tanzania. 80% of the national energy consumption is directed to domestic use, such as cooking and lighting that largely relies on inefficient stoves or the traditional 3-stone method for cooking and

[53] Contains EUR 1,998,030 additional funds for the RBF plus EUR 59,970 additional GIZ budget for RBF as well as EUR 1,031,000 additional funds for general EnDev activities. Only EUR 831,000 of the additional general funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

[54] https://energypedia.info/wiki/Tanzania_Energy_Situation#Situation_Analysis_and_Framework_Conditions

kerosene lamps for lighting, consuming upwards of 33% of a typical families' monthly income (SNV, 2012).

Modern fuels (electricity, gaseous and liquid fuels) are costly, and it is estimated that only 3% of population use these fuels. Greater than 95% of citizens (WHO, 2007) rely on less efficient solid fuel energy sources, which impede local economic development (UNDP). The burning of biomass fuels, mostly fuelwood, represents over 92% of the total energy use of the country.

Accessing conventional energy such as LPG or electricity is cost prohibitive and unable to reach the majority of Tanzanians. The GDP (PPP) is USD 3,000 per capita and 67% of the population lives below the poverty line (CIA, 2015). Despite this context, most attention (and investments) in energy in Tanzania continue to be directed to recently discovered oil and gas reserves, grid extension, and to a lesser extent, hydropower. Even in the most positive of scenarios the largest part of the rural population will not have access to modern energy in the coming 30-40 years.

Tanzania's energy supply therefore depends mainly on biomass, with the overwhelming majority of households using wood and charcoal for cooking. Almost 95% of the population in Tanzania used biomass based fuel for domestic cooking in 2012 – the two primary sources being firewood (68.6%) and charcoal (25.6%)[55].

In rural areas, firewood is mostly used for cooking. The wood is either collected by household members, or bought at local markets. In urban areas, many households use charcoal (sometimes in combination with other fuels) for cooking. Charcoal demand has nearly doubled over the past 10 years, due to high urbanisation and high (perceived) prices of other cooking fuels like LPG or electricity.

Out of Tanzania's 51 million inhabitants (CIA, 2015), so far 36 percent of the total population and 20 percent of rural areas live within the reach of the electric grid (REA, 2016). Actual national electricity connectivity is about 20.7%; though, it is expected that electricity demand will double by 2020. In the current setting demand will therefore even further outpace supply.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans

Tanzania was one of the 14 early movers for Africa to join the SE4All initiative in 2012. Tanzania's SE4ALL Action Agenda (2015) seeks to integrate the multi-tier efforts that the country is implementing towards providing universal access to energy, increased energy efficiency and an increase in the use of renewable energy. Towards 2030, Tanzania aims to have at least 75% of the population with access to modern energy services in both electricity and cooking solutions. Proposed SE4All activities include the development of a concrete policy, strategy and targets to regulate the clean cooking sector, and renewable energy projects with particular emphasis on clean cooking and off-grid energy.

Further scaling of ICS market development in Tanzania is fully in line with national policies to promote the use of renewable energy, as provided for under the Rural Energy Act. The Tanzanian government has recognized the challenges in the ICS sector and concluded in 2014 a Biomass Energy Strategy for Tanzania (BEST) through the Ministry of Energy and Minerals, including an Action Plan recommending biomass energy policy, supply-side and demand-side actions to be initiated. BEST suggests a "major, commercially-oriented, mainstream improved cookstove programme" to be launched, which so far has not materialized though.

In early 2015, the Tanzanian national government (through the office of the president) announced its One Million Solar Homes initiative aimed at providing a million Tanzanian homes with access to reliable solar electricity by the end of 2017. The project is expected to work closely with the commercial players, investors and development partners to provide solar electricity for 10% of the nation's population and generate more than 15,000 solar industry jobs.

[55] GVEP, Tanzania Market Assessment, 2012.

Increasing attention to domestic cooking energy has been expressed in the Rural Energy Agency (REA, an autonomous entity under the Ministry of Energy and Minerals). The major focus of REA has been electrification and the development of recently discovered gas fields. REA has further taken active collaboration into renewables with strong recognition of potential contributions for solar energy as part of the national energy mix as off-grid components to rural electrification. However, the development of the Biomass Energy Strategy (BEST) for Tanzania in 2014, followed by REA's collaboration with SNV to support the Tanzania Domestic Biogas Programme are indicative of first shifts to support cooking energy under more market driven approaches utilizing the abilities of a semi-formalized local private sector.

The Government of Tanzania (GoT) priority following the 2015 October general elections has further expanded its focus more broadly to realize a transformation of the country to a middle income economy by 2025 through improved industrialization and development of the local private sector with high attention to stimulating local (youth) employment creation and quality assurance.

1.3 Institutional set-up in the energy sector

Four line ministries share responsibility to address household energy issues, including the Ministry of Energy and Minerals (MEM), Ministry of Natural Resources and Tourism (MNRT), Vice President's Office -Division of Environment (VPO-DoE), and President's Office – Regional Administration and Local Government (PO-RALG). MEM is responsible for policy matters relating to the household energy. It has a Renewable Energy Department, which is mandated to support policy implementation. The Rural Energy Agency is an autonomous entity under MEM tasked to improve access to energy for rural Tanzanians through the development of rural energy sources, technologies and projects.

1.4 State of market/sector development

Improved Cookstoves: Contrary to commonly held beliefs, improved cookstoves (ICS) play a significant role in Tanzanian market places and account for an average of 75% of all current retail cook stove sales. While a further 40% of Tanzanian households indicate improved cookstove ownership, less than one out of every ten ICS users have fully abandoned traditional and inefficient forms of cooking such as open air three stone fires (SNV, 2012.)

The improved cookstove sector at present is highly informal and urban oriented with limited design innovation, quality control and promotion-marketing. Improving cost saving arguments (due to increasing wood fuel scarcity) have begun to demonstrate potential for greater rural diffusion of ICS. Development of a profitable business case for stove producers to reach this expanding market remains a persistent challenge given the current status of the private sector.

Market available improved cookstoves at present are almost exclusively manufactured locally by largely informal and micro small enterprises in aggregations in (peri)-urban centres and sporadic rural localities (generally within proximity to high volume clay sites). At the present time, virtually all ICS available to consumers via these channels are intended exclusively for the use of charcoal in urban markets. However, more than three quarters of Tanzanians, particularly rural families, depend also on the use of firewood for daily cooking. As such, while improved charcoal stoves are presently accessible to consumers, these products are oriented towards urban based cooking needs and are not suitable to the actual firewood based cooking energy needs of the majority of rural families in Tanzania.

picoPV / solar lighting: The Tanzanian solar energy sector has been fast growing in recent years and solar products are now a common sight in urban shops and markets throughout the country. Past awareness raising campaigns by government and NGOs has helped raise knowledge and understanding of solar products among consumers. Low rural electrical connectivity coupled with high frequency power outages and high costs for connections to the grid have made Tanzanians consider solar an increasingly attractive and viable modern energy option. The decision by the Government of Tanzania to drop VAT and duties on all solar products while dually reducing subsidies on kerosene has made the solar market very interesting to both supply and demand side actors in

Tanzania. However, reliable solar technology options capable of affordably reaching the majority of the rural off-grid market in a sustained manner continues to be a persistent challenge.

In the past 3-4 years, there have been tremendous advancements in the development of small scale or entry level solar products that provide solutions to the typically low wattage energy needs of rural households (1-2 rooms, small radio, and cell phone). These 'pico-solar' applications allow for pre-electrification of 1-15 W and can be part of the solution for the many people that will remain without electricity in the near future. The recent wider inclusion of Pay as You Go (PAYGo) technology to solar devices that enables consumer purchasing via monthly instalments with mobile money as further seen rapid growth within the sector during the past 2 years.

Import-suppliers for these products in Tanzania have increasingly come to recognize a significant market opportunity in pico-solar solutions to reach previously untapped low-income, off-grid markets. However, suppliers have experienced a consistent bottleneck at the end of the rural distribution chains that has been slowing the overall dissemination of a technology universally agreed as possessing the potential to transform the domestic rural energy context. Attempting to overcome this hurdle has come with high investments by suppliers as cultivating the retailer via dealership development typically incurs a 1-2 year profit loss to the supplier. Additionally, the same circumstances of limited stock/working capital for the retailer remain in play with the end result that the supplier is unable to achieve reasonable economies of scale via larger import orders from pico-solar manufacturers with better wholesale discounts. These scenarios are further exacerbated amongst firms integrating PAYGo modalities given that upfront costs are tremendous when considered that solar products and services are being advanced to consumers as essentially credit.

1.5 Relevant activities of other donors and implementers

Tanzania is already a partner country of the Global Alliance for Clean Cookstoves (GACC), a platform in which EnDev and SNV are active as well. Facilitated by SNV, an ICS Taskforce was created in 2011, with the Ministry of Energy and Minerals (MEM) as the Chair and the Tanzania Renewable Energy Association (TAREA) elected as the secretariat, with the aim to increase coordination between ICS stakeholders across the country. TICS will be able to build on the sector relations established and knowledge base as achieved under the ICS Taskforce, including organisations like TAREA (multi-stakeholder coordination, advocacy), the University of Dar es salaam (ICS testing), Tanzania Bureau of Standards (ICS quality assurance); all organisations with a considerable track-record in ICS.

In the up-scaling of the EnDev country programme, SNV intends to maintain a close coordination with Tanzania's Rural Energy Agency (REA), building on an existing collaboration between REA and SNV in the Tanzania Domestic Biogas Programme (TDBP), which is co-funded by REA with support from the Norwegian Embassy. EnDev is already involved in the TDBP as well, through results-based incentives to biogas enterprises (to stimulate quality assurance and after-sales services) and MFIs (to stimulate biogas loans), as part of the Hivos-managed 4B-F programme for Kenya, Uganda and Tanzania (3rd round RBF). As REA's engagement in RBF-minded programmes (funded by SIDA and DFID) is expected to increase from 2016 onwards, building on existing RBF experience in the pico-solar component under EnDev Tanzania, amongst others, coordination with REA is expected to increase for EnDev Tanzania overall.

The IFC Lighting Global programme has been preparing to enter Tanzania for the past few years, but was however constrained by financing to start up larger scale activities. EnDev has been coordinating with Lighting Global on the RBF activities in general and on qualification of different products for the scheme specifically. EnDev and Lighting Global keep in regular contact through the RBF advisory group since 2013.

Recognizing the priority of the Tanzania government to boost youth employment, EnDev TICS will build on a partnership with the Opportunities for Youth Employment (OYE) programme as managed by SNV (2013-2018), in which youth receive technical training and life skills training and are subsequently linked to enterprises for mentorship, internship and job opportunities. Collaboration already started during current implementation of both the EnDev TICS and RBF programmes and is expected to be further scaled in in the up-scaling of the EnDev programme.

2. Project approach

2.1 Market development vision and EnDev conceptual approach

The overarching Theory of Change in the EnDev Tanzania Programme is that successful change in the domestic renewable energy sector is market driven and realizable in connecting existing dynamics (local drivers & engagements in networks/ chains, local 'energy', local demand and supply). SNV's contribution is to be based on tailoring our capacity development services in business development and impact investment, relation brokering and relevant technical advisory support to stimulate positive and under-utilized sector actors that maximize sustained and commercially viable access to appropriate improved cooking and pico-solar technology options.

The approach of the programme is to encourage performance based supports to the private sector (non-monetary based in TICS and financial based in RBF) that stimulate and accelerate modern energy service delivery amongst entrepreneurs. The intent of the approach is to place the means for market development more directly and flexibly into the hands of the private sector. This is intended to unlock their abilities for sustained development of the market with relevance and responsiveness to specific local dynamics and ultimately enable viable and sustained access to energy services for consumers in the longer term. Throughout engagement with all levels of the private sector (from informal micro entrepreneurs to multinational corporations), the programme cultivates relationships predicated on trust while striving to develop, foster and disseminate knowledge based on evidence and enhance improved product and service delivery that is reflective of consumer demands.

The programme envisions the continued radial expansion of energy services from the traditional urban centres of the northern crescent of Tanzania to increasingly rural and interior markets of the country. Consumers will be able to access these services affordably and with confidence from local and profitable MSMEs. As the sector continues to scale sustainably, the abilities of all walks of the local private sector (both formal and informal) are increasingly recognized and understood amongst commercial and public sector interests as essential investment worthy contributors to realizing modern energy access goals for Tanzanians.

As a vision for the solar sector, EnDev five years from now expects commercial dissemination of picoPV products in all regions of Tanzania, offering a wide range of product sizes (from lanterns to solar home system) and business models (from agent based cash sales to utility-style PAYG solutions). For ICS, EnDev envisions a number of local producers in the higher population density areas to grow to industrial scale, achieving production volumes beyond 1,000 systems per month and offering a diverse range of stoves for different income strata of the population. More expensive imported stoves are expected to enter the market, once dissemination of these gets to scale in neighbouring countries, especially in Kenya.

2.2 Specific intervention strategies per (sub)sector

The **EnDev-Tanzania Improved Cook Stoves (TICS)** project works to build upon the positive dynamics of existing local ICS supply chains to initiate the production, distribution and sales of clean and marketable ICS options capable of meeting (rural) household cooking needs. SNV works with an array of local service providers to tailor specific development services that advance the technical and business acumen of stove artisans throughout Tanzania.

The programme steps hand in hand with existing cook stove entrepreneurs to realize improved performance, quality and marketability of cook stove options for introduction to local markets. In the first phase of the project this has been realized through development with women lead stove enterprises of the 'Jiko Matawi' – a multi-purpose stove capable of using both firewood and charcoal depending on the preference of the user at the time of cooking. The stove is available in entry cost levels via a stand-alone ceramic model (also capable of installation as a fixed stove) ranging in consumer price from EUR 2-3. During the programme lifespan a metal clad version of the Matawi stove has also been developed at a consumer pricing point of EUR 8-10.

TICS is well on pace to achieving present goals of 65,000 persons, realizing access to improved cooking energy services by close 2016. Fuller programmatic support and continued monitoring within broader markets is thus far indicative of strong market pull now emerging from adjacent markets in the southern and interior portions of the country.

After successfully developing a commercial market for the “Matawi” cookstove in several districts of the Lake Zone, the medium-term vision of the project is now to support Tanzanian entrepreneurs to achieve nationwide availability of the “Matawi” firewood stoves through a competitive local private sector.

Further scaling of EnDev-TICS will consolidate, refine and deliver the performance driven approach in widening extents of the Lake Zone (Central - Western regions), Central-Eastern Zones and Northern Zones of Tanzania. The programme will further initiate the full roll out to cultivate new cook stove champions in the Highland and Southern Regions (Iringa, Mbeya, Njombe, Songea) of Tanzania.

Throughout the implementation of the first phase of the programme in in 2013-16, a significant degree of learning and approach refinement has been realized to ensure sustainable programmatic delivery in the long term. The parallel delivery of the pico-solar component of the EnDev programme employing a results-based financing (RBF) approach has played a central role influencing work within ICS.

A key success factor has been the adoption and tailoring of ‘performance driven’ programming approaches suitable to the context of more informal sector oriented ICS artisans that stimulate entrepreneurship and instil fair competition. These shifts have realized very positive responses both in terms of results delivery and in uptake by artisans leading to the identification, cultivation and emergence of ‘ICS Champions’ operating with increasing independence.

In the delivery of TICS through its first phases in 2013-16, successive programmatic steps have been identified for facilitating the successful entry of Matawi stoves to new markets and cultivating ICS Champions. These can be articulated as:

(i) Identification: The programme undertakes a mapping of market context via the use of Market Intelligence (MI) to gauge supply and demand side dynamics in local renewable energy markets. The MI further serves to articulate specific considerations to users (cooking and fuel practices) while identifying existing and active ICS producers and technologies available in the market, identifying opportunities and barriers in bringing ICS markets to further scale .

(ii) Initiation: Identified artisans are engaged in the first stages of technical training to the programme in the form of a stove camp. In addition to practical work on stove making, the session focuses on how a cook stove actually works, the confirmation of locally appropriate production standards (materials and methods), proper costing (to ensure profitability), and a customer sales recording (for programme and artisan profit monitoring). At the conclusion of these session(s), all artisans are provided the necessary basic production tools (mould, templates), starter materials, and fundamental marketing tools.

(iii) Incubation: Post-training support is availed to trained artisans and ICS entrepreneurs via the first stages of monitoring paired with monthly onsite coaching to provide direct technical-quality control and business development services (BDS) on an entrepreneur by entrepreneur basis. Inter-artisan relation building is strongly encouraged throughout this stage and relevant linkages to local players-networks are facilitated along with support to mentoring and exchanges with particular attention to gender and youth employment considerations. During seminars to advance common entrepreneurship needs, arrangements for non-monetized performance incentives are presented that can be earned by (i) production and sales increments (points earned towards production tools, phones, bicycles) and (ii) sustained production and sales volume achievements towards access of a Champions Fund.

(iv) Investment: The programme continues onsite monitoring and coaching with ICS producers along with consumer spot checks. Achievement is measured consistently and transparently with incremental performance incentives awarded on an enterprise by enterprise basis. For those

achieving production and sales oriented benchmarks, paring is made with a local business consultancy to enable the preparation of an Investment Request to the TICS Champions Fund. BDS is provided via individualized sessions and culminates in the identification of a larger ticket capital item (ultimately acquired-installed by the program) necessary to scale production. At the conclusion of the TICS Champion cycle, ICS entrepreneurs are matched also with a graphic designer to develop a customized branding and marketing tool package.

(v) Independence: As ICS entrepreneurs mature through the investment stages of the programme, responsive market development supports are availed under the leadership of the entrepreneurs. At stages when local level markets demonstrate stable and consistent sales returns, the programme will work dually with the ICS entrepreneurs and local aggregate market players to develop and deliver 'Triggering' events. These can take the form of paired promotions with health service outreach centres; demonstrations to agri-business networks (contract farmer groups, cooperatives, etc.); micro finance institutes and/or SACCOs networks, amongst others. To meet increased demand potentials, graduated TICS Champions are further presented with a second round of access to the Champions Fund (upon evidence of surpassing initial fund access benchmarks), during which stage BDS and technical refreshers are provided.

So far, 11 enterprises are in process of champion level support and entering independence stage. As ICS entrepreneurs continue to graduate through the cycle, TICS will concurrently support diversification and increased company independence. Where relevant, this will include support to mainstream marketing (radio, TV, billboards, etc.) and business to business brokering amongst players capable of wider investments in production, distribution and sales in clean cooking technologies (such as solar firms in the pico-solar RBF component now making first movements into the cooking energy space). The programme will further evaluate diversification strategies for the inclusion of other stove models pending the testing of their performance in the field, and evaluating the suitability and additionality of these stoves according to EnDev criteria. TICS will work to support players operating in the EnDev picoPV RBF to realize distribution and sales of **high efficiency industrially produced imported cook stoves** targeted to benefit 10,000 persons.

The EnDev **RBF for Pico-Solar** component of the programme aims to sustainably increase the use of solar light and energy products by rural households by shifting the market equilibrium in remote rural areas away from kerosene towards solar. A results-based financing (RBF) is employed to realize this by providing reward payments for import-suppliers and free bonus products for retailers who succeed in expanding the volume of solar products they sell to rural households; the incentive amount is determined by the energy service provided by the product.

The RBF works to address market failures so realize benefits from solar product use in areas where incomes are low, and logistics are expensive (in part due to poor quality roads / high transport costs, and in part due to low density of customers reducing economies of scale).

The programme is so far designed to focus on one Zone in Tanzania (which is composed of 6 regions and accounts for 10-12 million persons), to concentrate resources and allow firms to demonstrate success, which could then be replicated elsewhere in Tanzania without subsidy. As the present RBF in the Lake Zone continues to expand, it is clearly noted that firms are moving to markets immediately surrounding the urban hubs in the regions and into more remote corners of the Lake Zone. These include the Eastern, Western and Southern peripheries. Firms are beginning to naturally push towards these boundaries, where they are encountering good levels of demand and/or potential in markets that have been traditionally overlooked. However, these markets occupy a more or less barren corridor of regions that are typically removed by 500-800km from supply hubs in the Dar es Salaam/Coastal, Northern or (now) Lake Zone.

Delivery to these new markets in interior regions outside Coastal, Northern and Lake Zone under current financing and programming available in Tanzania is generally cost-prohibitive for firms. Taking into consideration low past investments to these markets, it can be recognised that they act as a hurdle to the private sector in establishing broader base operations conducive to product flow

between more mature (but dispersed) markets and/or launch pads to the largely untapped interior and southern solar markets of Tanzania.

Up-scaling of the current RBF would build upon the geographic parameters of the present Lake Zone boundaries. The programme would look to expand eligible sales areas to establish a Central Market Corridor composed of regions bordering the present Lake Zone RBF (wherein firms have established new operations) and traditional operational centres in Dar es Salaam and Arusha. This will enable natural expansion to bordering markets and facilitate more consistent supply chain expansion across Zonal operational hubs of supplier operations (linking Coast, North and Lake Zones).

The Central Market Corridor in practice would include the Regions of Singida, Dodoma, Tabora, Manyara and Morogoro. However, specific districts within these boundaries would need to be selected to account for infrastructure limitations (i.e. road conditions in southern portions of Tabora, Singida and Dodoma) and current market activity (i.e. main off urban markets hubs in Mayara and Morogoro). In this context, before announcement of an expanded RBF Fund it would be necessary to deploy Market Intelligence surveys (mainly at consumer level) to ascertain more specifics on demand and awareness levels v. base market conditions so as to adjust and refine the market parameters and/or incentive modalities accordingly.

2.3 Sustainability of the intervention

The **ICS component** works amongst a smaller range of enterprises already engaged in ICS production at point of intake. This is to ensure base technical skills are present, but more importantly to identify entrepreneurs committed to ICS as a business from the outset of engagement. This assists to ensure longer term sustainability from day one in the programme, while enabling more rigorous sales and quality assurance monitoring. Monitoring occurs on a monthly basis inclusive of both phone and onsite visitations directly at points of stove production and sales localities. All information received is further vetted before entry into the project database with discounting factors applied for both QC and double counting risks before provision to EnDev.

In a recent project review of the TICS component, clear indications have emerged that the most entrepreneurial oriented producers have strongly taken to the performance based and Champion driven approach, as it responsively frees players to innovate and develop markets independently. This was clearly demonstrated during most of 2015 that saw greatly reduced levels of programme support. The ongoing results of performance based delivery in this period demonstrated that enterprises are indeed capable of not only sustaining delivery, but of independently pushing to realize even further growth as evidenced by 50% increases to total annual sales between the 2014 and 2015. By the closing of 2015, producer groups entering Champion level activity are now accounting for a third of active stove makers and are responsible for close to three quarters of total sales realized in the program. As such, gains of the programme are proving to be sustainable and scalable in the medium to longer term as actual benefits realized per producer are actually increasing while market development supports and expansion are led by entrepreneurs.

Sustainable, and socially beneficial, market supply of **picoPV** products to rural areas requires firms to find innovative, low-cost distribution mechanisms which allow solar sales at affordable prices in remote rural areas whilst still turning a profit. This innovation is higher risk to the firms than expanding supply in urban peri-urban areas. The RBF is a way to compensate the firms for this higher risk, without picking winners or pre-prescribing successful product/distribution method combinations.

In the proposed up-scaling of the EnDev Tanzania programme, both the **stove and pico-solar components** will work to expand knowledge outreach of the programme more broadly in the sector. EnDev Tanzania will work in this space by continuing to refine the MI tool set to enable the capture of greater details relative to cooking energy systems (in consultation with EnDev-GIZ), employment and income assessment (as informed by studies with RWI-HERA) and broader market development indicators (in consultation with EnDev-RVO) necessary for pinpointing key aspects in enabling environment spheres necessary to accelerate energy access. The MI tool set will further be integrated to use in mobile device applications employing the EnDev app platform for intended scaled MI roll out in both new and former markets, lending greater perceptions of professionalization amongst sector players who regard ICS and last mile entrepreneurs as overly 'localized', and to ultimately contribute towards a means of developing a consistent platform for a national energy access tracking framework.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	• Reduced use of solid biomass fuels for cooking (reduced deforestation-emissions) • Reduced use of kerosene/candles/dry cell batteries for lighting and small appliance operations (reduced emissions) **Baseline:** Tanzania Household Budget Survey (2012) • Main sources for lighting in Tanzania are kerosene/paraffin by 61 percent of households. Use of kerosene/paraffin in Rural Areas is highest at 70% compared to Other Urban Areas at 55%. • Approx. 89 percent of households in rural areas rely on firewood as their main source of energy for cooking compared to 30% in urban areas. Balances of main cooking energy amongst households are assumed to be predominantly charcoal (11% rural HH, 70% Urban HH). MI studies by SNV in the same period were indicative that biomass usage is mostly commonly a combination of firewood and charcoal (74% rural HH, 61% Urban HH) **Measurement:** Current measurements of fuel savings through ICS in field with HH conditions via CCT-WBT: 43% - 51%. To be further measured by standard EnDev outcome monitoring and MI Consumer tool set (see 2.3 above). For picoPV monitored via onsite verification procedures.
Health	• Decrease in chronic health risks such as respiratory illness caused by exposure to harmful emissions (IAP) • Decrease in acute health risks and incidences such as burns caused by unsafe stoves/open fires and kerosene-candle lighting **Measurement:** Most measures by proxy defined within EnDev – cannot be measured directly by project. Indicators can include ISO emissions and safety test on ICS. Counterbalance with MI including CES relative to exposure events (attentive time cooking, ventilation).

Impact	Possible indicators
Poverty/livelihood	• Savings on energy spending v. household income • Time used for collecting firewood relative to available HH labour. **Baseline:** MI baseline carried out by project (2012) • monthly average spending for solid fuels (firewood or charcoal) is typically EUR 7-8 EUR per month • Pico solar users surveyed indicate monthly average savings due to kerosene reductions of EUR 6. Cost savings non-indicative for PAYGO based customers. Measurement of previous kerosene/battery expend v. monthly PAYGO v. improved service level accessed **Measurement:** • Income and employment gains in renewable energy enterprises – to be measure by MI Enterprise survey. Indicators now expanded to include fuller income generation and asset base measurement and in alignment to regular monitoring system. • Measurement at intake and biannually through programme engagement. Comparison to avg. HH income can be made via comparison to parallel MI consumer surveys. For picoPV monitored via onsite verification procedures
Education	• Improved business knowledge through business training and coaching for entrepreneurs
Governance	• Introduction by public sector of performance based approach methods (non-monetary and financial incentives) supporting ICS and pico-solar. • Improved energy access monitoring of domestic renewable energy technologies by public sector • Increased engagement and inclusion of ICS enterprises by sector actors (TaREA, REA)
Climate change	• Annual reduction in CO_2 equivalents (CO_2e) emission according to standard EnDev outcome monitoring
Gender	• Job creation and income generation for women along ICS and PV value chains – to be measured by standard EnDev outcome monitoring and MI Enterprise tool set (gender disaggregation). 40% female enterprise participation is foreseen. • Health benefits for women – particularly in relation to cooking (less exposure to IAP). Most measures by proxy defined within EnDev – cannot be measured directly by project. Counterbalance with MI including CES relative to exposure events (attentive time cooking, ventilation).
Market development	• Increased production capacity and sales stability by ICS companies • Increased rural availability of industrially produced ICS options • Increased jobs along the ICS and PV product value -(see poverty/livelihood above) • Increased access to financing for RE enterprises. In pico-solar, to be further assessed as leverage as part of regular EnDev monitoring. **Measurement:** To be measured by MI Enterprise tool set (see 2.3 above). For picoPV monitored via onsite verification procedures.

4. Possible risks and potential ways to mitigate them

Risk Type	Description	Mitigation
Strategic Effectiveness	Demand for products-services does not correspond to supply side capacity	Market outreach is placed to direct engagement of the private sector (i.e. supply side manages level of demand side engagement). Products supported are vetted to ensure consistent quality and relevance (usage and affordability) to consumer needs
Stakeholder Support	Implementing partners, particularly the private sector, dissolve their working relationship with the program	High vigilance to consistent monitoring and response time on all reports received – particularly those related to any incentive claims. Terms and conditions to working relations are clearly articulated – including programme response times and confidentiality. Dedicated MERVA unit is established to facilitate in house monitoring. Counter balanced with local service provider oversight. Programme coordinates multiple parties' simultaneously to ensure integrity of monitoring and pace of delivery.
Sustainability	The market for appears unattractive to entrepreneurs and/or is artificially distorted by the program.	Programme works with existing enterprises with focus to increase their growth and outreach. Emphasis is to increase output amongst supply side players as opposed to increase the number of supply side players. Outreach to markets is led by entrepreneurs to ensure continued outreach. Programme provides advisory coaching on further synergies. All incentives are designed to stimulate first-movers and decline in value over time
Financial Soundness	Incentives are improperly and/or over/under claimed	Incentives in any form are not provided as 'pre-financing'. They are earned as based on performance and provided only upon verified delivery Monitoring-verification combines multiple parties via paper, phone and onsite checks before incentives are provided. Triangulates oversight and limits collusion. Tolerances and thresholds on compliance and support levels available are defined. Low, medium and high usage rate along with reallocation scenarios are forecasted on budget
Operational Efficiency	Unforeseen market and/or product dynamics undermine viability of cost effective delivery	Seasonal market conditions (such as adverse weather, low season dynamic) are clearly discussed amongst partners well before onset.- Programme maintains relations in public sector space to keep implementing partners informed of any upcoming developments (standards, tax regime changes, etc.). Lends influence to public sector dialogue through sector mechanisms (such as TaREA, REA, etc.). Quality assurance is upheld through defined standards (ICS internal with onsite quality control, picoPV via Lighting Global). Monitoring is inclusive of onsite visitations to users to confirm technical performance of products and warranties (when applicable). Team composition is embedded throughout offices in existing country setup (Lake, North, Central, South, Dar es Salaam) immediate proximity to all markets and partners.

5. Budget

	EUR
1 Human resources and travelling	0
2 Equipment and supplies	0
3 Funding financing agreements/local subsidies	1,000,000
4 Other direct costs	0
5 Total direct costs (sub-total)	**1,000,000**
6 Mark up costs/administrative overheads/imputed profit	31,000
7 Cost price	**1,031,000**

RBF for solar picoPV, Tanzania

1. RBF project revision

In the annual RBF review meeting, it was recommended that the project will be:

- Extended time wise until: **08.2018**
- Up-scaled budget wise to: **EUR 3,400,000 (SNV Budget only)**[56]

Initial market uptake has proven to be slower in its first phases and hence returns on private sector investment to these new markets take longer than anticipated to return. This does cause a natural implication to additional scaling as firms (particularly those more locally oriented) are to some extent fully leveraged in the current Lake Zone RBF and the overall level and terms of pre-financing available are not attractive to take on additional debt financing. The theory of change would best be revised to reflect that sustained operations can be continued in the markets where RBF has been availed, but additional incentives to accelerate markets in further zones of the country are necessary.

Up-scaling of the current RBF would build upon the geographic parameters of the present Lake Zone boundaries. This will enable natural expansion to bordering markets and facilitate more consistent supply chain expansion across Zonal operational hubs of supplier operations (linking Coast, North and Lake Zones).

2. Adjustment of KPIs

Apart from incorporating new targets related to the scaling of the fund, KPIs have been adjusted to account for the market tendency towards larger system categories and to align CO_2e savings calculation with standard EnDev methodologies.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	181,970	360,000
EUR per person gaining access	8.47	9.44
t CO_2e emissions avoided (over the lifetime of the products sold during project)	57,000	29,000
EUR per t CO_2e emissions avoided	27.04	117.24
Private sector leverage ratio	2.7	2.2
Jobs created	90	800
Enterprises created / improved	56	400
Technologies deployed	115,000 picoPV	105,000 picoPV

[56] The total new budget for the RBF including GIZ costs amounts to EUR 3,599,000.

Uganda

Promoted technologies		SHS, picoPV, stoves, grid, (MHP only until 06.2016)			
Project period	old	04.2009 – 12.2016	**Budget (EUR)**	old	9,250,000
	new	04.2009 – 08.2018		new	12,250,000[57]
		old targets	**new targets**		
Energy for lighting / electrical appliances in households		34,000	157,800		people
Cooking / thermal energy for households		500,000	550,000		people
Electricity and/or cooking / thermal energy for social infrastructure		275	1,100		institutions
Energy for productive use / income generation		445	1,600		SMEs
Lead political partner		Ministry of Energy and Mineral Development (MEMD)			
Implementing organisation		GIZ			
Implementing partner		Solar: Rural Electrification Agency (REA) and private sector; Stoves: private sector and NGOs. Grid: REA and private sector			
Coordination with other programmes		Promotion of Renewable Energy and Energy Efficiency Programme – PREEEP (BMZ); Energy for Rural Transformation – ERT III Programme (World Bank); SE4ALL; Global Alliance for Clean Cookstoves (GACC)			
Key interventions		• Market-based support of access to finance and distribution of quality solar systems. • Market-based support of production and distribution of improved cookstoves. • Grid activities continue with no-pole connections until regional RBF challenge fund starts			
Main strategic changes introduced with up-scaling		• Solar: Activities will focus on up-scaling successful approaches: Rural service outlets, Pay-As-You-Go (PAYG) financing model, and picoPV last mile distribution (rural agent network) • Stoves: Building on strengths of the current approaches (successful cooperation with NGO partners to scale up rural stove promotion as well as cooperation with Ugandan stove companies to increase quality product availability in the urban and rural markets) with a stronger focus on distribution systems, technical innovation and health aspects.			
Project manager		Daniel Johannes Schütt daniel.schuett@giz.de			

[57] Only EUR 2,500,000 of additional funds are guaranteed, the remaining funding is subject to availability of EnDev Global funds.

1. Situation analysis

1.1 General energy situation in the country

Though Uganda is endowed with abundant energy resources, including hydropower, biomass, solar, geothermal, and fossil fuels, the diversification of the energy mix is insufficient. The national energy balance is comprised as follows: firewood (78.6%), charcoal (5.6%), crop residues (4.7%), petroleum products (9.7%) and electricity (1.4%). This heavy dependence on biomass and the low level of access to electricity are major bottlenecks to socio-economic growth. Thus, the development of the energy sector is key to economic growth in Uganda.

a. Electricity

Approximately 14% of Ugandans have access to grid electricity (54% in urban and 7% in rural areas)[58]. Taking into account users of solar home systems (SHS) and generators, the electricity access rate in Uganda has been calculated to reach 26% at national level.[59] Rural households in particular strongly rely on traditional lighting technologies (e.g. candles or kerosene lamps) that give poor quality lighting, emit noxious fumes and present a hazard in terms of fires or burns, especially for children. Many social institutions in rural areas do not have access to electricity, significantly lowering their ability to deliver good quality services. Lack of access to electricity is also a key factor obstructing local economic development; it hampers the establishment of businesses and job creation and forces enterprises to buy diesel or petrol generators that are costly to operate. Although the Government of Uganda acknowledges this challenge, it has prioritised the extension of the national grid and large scale generation, especially hydro sites. Governmental grid extension plans focus on connecting larger towns and industrial clusters to the grid. The scattered nature of rural households makes it very expensive to extend the grid to these households. Even rural communities located along main roads and power lines often do not have access to electricity because low voltage power lines are mainly constructed in densely populated and economically vibrant urban areas.

b. Biomass

For more than 90% of the population, biomass is the primary energy source, especially for cooking and water heating.[60] This heavy dependence on biomass energy, in combination with a high population growth, contributes to the increasing forest degradation in Uganda. Over a period of 15 years, Uganda's forest area reduced from 20% in 1998 to only 11% of land being forested in 2013.[61] The continuous forest degradation has led to fuelwood scarcity in many rural areas. Further, since 2005, Uganda is experiencing a dramatic rise of charcoal prices of between 6% and 14% per year[62]. Fuelwood scarcity, increasing charcoal prices and environmental degradation clearly highlight the urgent need to reduce biomass energy consumption and increase biomass energy efficiency, so as to contribute to the management of the resources in a sustainable manner.

1.2 Policy ambitions for energy access in SE4All and other relevant country plans

Uganda's SE4ALL Initiative Action Agenda (2015) aims to achieve 98% access to electricity and 99% access to modern cooking solutions by 2030. The Action Agenda suggests an increased implementation of off-grid solutions to support the electricity access goal and plans an additional 2.9 million households having access through solar systems until 2030. EnDev is contributing to achieve this target.

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58 Uganda Bureau of Statistics (UBOS) Energy Survey (2012)
59 Uganda's SE4All Initiative Action Agenda (2015)
60 Uganda's SE4All Initiative Action Agenda (2015)
61 World Bank data - http://data.worldbank.org/indicator/AG.LND.FRST.ZS
62 Ministry of Energy and Mineral Development, Biomass Energy Strategy (2014)

Besides the SE4All targets, Uganda's energy vision and plans are documented in a) the Energy Policy, b) the Renewable Energy Policy, c) the Rural Electrification Strategy and Plan and d) in the Biomass Energy Strategy.

a) Energy Policy for Uganda (2002, currently under revision) aims to meet the energy needs of the Ugandan population for social and economic development in an environmentally sustainable manner. Policy objectives include increasing access to modern, affordable and reliable energy services and managing energy-related environmental impacts.

b) Renewable Energy Policy for Uganda (2007, currently under revision) aims to promote research and development, international cooperation, technology transfer and adoption of standards in renewable energy technologies for the efficient utilisation of biomass energy among others.

c) Rural Electrification Strategy and Plan 2013-2022 targets to reach 22% rural electrification and to disseminate 140,000 solar systems in rural areas until 2022.

d) The National Biomass Energy Strategy (2014) aims at ensuring sustainable use of biomass energy resources such as firewood and charcoal which are the biggest and cheapest source of energy for most Ugandans are better planned for. It promotes raising awareness, developing a biomass information system and promoting the use of efficient technologies.

1.3 Institutional set-up in the energy sector

The Ministry of Energy and Mineral Development (MEMD) is the lead agency in the energy sector. The Ministry is responsible for policy formulation, promotion, coordination, monitoring and evaluation. MEMD is also responsible for initiating legislation in the energy sector. Uganda's National Energy Policy is so far centralised, i.e. there are no regional/district energy offices at the local level. The BMZ funded and GIZ implemented Energy Programme (PREEEP) is, among other activities, supporting MEMD to integrate energy focal points into the local government of pilot districts to enable better information exchange and cooperation between the ministry and the local governments. Part of MEMD is the Energy Resources Department, which comprises the divisions 'Energy Efficiency', 'Electric Power' and 'New and Renewable Sources of Energy', the latter one co-ordinating the dissemination of improved cookstoves and other biomass technologies.

The Electricity Regulatory Authority (ERA) is responsible for regulating the electricity industry in accordance with applicable laws, policies, standards and international best practice. ERA therefore is in charge of issuing licenses for generation, transmission, distribution or sales of electricity as well as establishing tariff structures. ERA has the regulatory responsibility for on-grid as well as off-grid electrification (off-grid focus is on micro and mini-grids (0.5 MW and above)).

The Rural Electrification Agency (REA) serves to facilitate provision of electricity in rural areas. It functions as the secretariat to the Rural Electrification Board, which realises MEMD's rural electrification plans as stipulated in the Indicative Rural Electrification Master Plan. REA controls public funds meant for the subsidisation of rural electrification projects. Since REA's mandate is also off-grid electrification, REA is supporting the regulation of smaller off-grid-systems (especially SHS).

The Ugandan National Alliance on Clean Cooking (UNACC) implements GACC activities in Uganda and serves as a platform for private and public actors to support the development of policies and regulations as well as enhance coordination and synergy among the stakeholders of the clean cooking sector. Smaller improved biomass stove businesses are organised under the private sector association "Biomass Energy Efficient Technologies Association (BEETA)".

1.4 State of market/sector development

As this up-scaling proposal is addressing the solar and cookstove component, the following market/ sector development description is focussing on these two technologies.

a. Solar based access to electricity

Ten years ago, there were only a handful of solar companies mainly engaged in institutional solar PV installations and battery back-up systems in Kampala. Within the last five years, the Ugandan solar market has expanded significantly with larger product diversity and larger private sector players

entering the market. The fast growth of the solar industry in Uganda was facilitated through conducive regulatory policies (e.g. tax exemptions and favourable renewable energy policies), government projects that promote the use of solar in rural electrification (especially the Photovoltaic Targeted Market Approach (PVTMA) through the World Bank funded Energy for Rural Transformation (ERT) II programme), the growth in the telecom sector (demand for mobile phone charging) and various national awareness programmes facilitated with donor support. In 2009, Uganda had an estimated total installed PV capacity of 1.1 MW. Estimates indicate that the installed capacity has increased by more than five times since. The involvement of larger players in the sector has triggered private sector innovation regarding sustainable distribution and financing models to reach the high-potential rural market. Though the sector involves a couple of donor and development cooperation programmes, the private sector still remains the major implementer of most energy access projects. The government is also starting to adopt more of a facilitating role (e.g. putting more focus on regulation) and is slowly moving away from spearheading rural access projects.

However, the Ugandan solar market still faces a number of strongly interconnected key bottlenecks:

- Inadequate distribution and after-sales infrastructure: The majority of high-quality solar shops are based in Kampala and some larger regional towns. This makes it challenging for these companies to offer timely after-sales services to customers.
- Limited access to finance: Especially most rural consumers cannot afford high-quality solar systems while private companies have limited working capital to provide reliable and affordable solar systems and services.
- Lack of awareness: In the Ugandan market, especially in rural areas, high volumes of substandard quality products are sold. Most households are not aware of good quality solar products brands or where to buy them.

EnDev Uganda, in partnership with its private sector partners is working to reduce these barriers through its focus on distribution and financing activities elaborated in the later part of this proposal. To reduce the barrier of poor quality systems, EnDev Uganda only partners with companies which promote Lighting Africa certified picoPV products and/or the Uganda National Bureau of Standards certified SHS components.

b. Improved cookstoves for access to cooking energy

Until recent years, the stove sector was largely informal, uncoordinated and unregulated with an estimated 75% market portion of individual small-scale artisans. Production of standardised local factory-made improved cookstoves (ICS) started in 2008, promoted mainly by EnDev. Today, there are seven local middle-to-large-scale companies[63] active in the production of standardised ICS in Uganda. During the past years, international stove manufacturers like BURN, Envirofit or African Clean Energy (ACE) are observing the Ugandan stove market and approach EnDev to identify opportunities for market entrance support. The vision of WB and GACC is to support especially those large-scale manufacturers (local and international), which are able to mass-produce quality-stoves, still focussing on international companies. In this context EnDev plays a crucial role to identify market niches for artisanal production, e.g. to reach the very remote rural areas, as well as to enable local manufacturers to compete and/or cooperate in the market with international companies.

However the market is huge and demand is still high. As the latest MEMD national-wide estimation of penetration rate from 2014 demonstrates, only 10% of Ugandan households are using efficient charcoal and/or fuelwood stoves. Programmes like EnDev in partnership with the Ugandan Government as well as private sector initiatives supported factory-made ICS as well as standardised mud stoves built by rural artisans and thus contributed to this penetration rate. Nevertheless

[63] The seven companies are: Ugastove, BM, SESSA, ILF, GBE, AES and Banadda. Middle-to-large-scale means a monthly production of more than 500 ICS (middle-scale) respectively 1,000 ICS (large-scale).

traditional three-stone fires and traditional or, only slightly improved, metal charcoal stoves, showing very limited performance in fuel savings and causing high exposure to smoke, remain the most commonly used cooking methods in Uganda. Main market development barriers for ICS include:

- Production of ICS in Uganda is highly concentrated in Kampala.
- Distribution of ICS is also concentrated in a few major towns mostly in the Central Region, leaving most of the 80% rural population using woodfuels without access to ICS.
- Lack of low-cost firewood ICS for the rural poor in particular.
- Lack of end-users' awareness for the benefits of ICS in conjunction with a lack of product standardisation and lack of consumers' ability to identify quality stoves in the market.
- Missing access commercial finance in the sector and low profit margins for stove producers due to high logistical costs to distribute stoves beyond the Kampala region.

EnDev, being the key actor in the ICS sector, started reducing these barriers. In 2014, EnDev, in cooperation with MEMD, launched the nation-wide unique quality brand 'Good Stove – Better Cooking' that serves as a quality seal for stove buyers to identify quality-tested ICS in the market. EnDev Uganda also successfully revised its strategy in 2014 so that through EnDev's support private sector ICS manufacturers were able to start improving their production infrastructure, distribution networks and stove marketing. In rural areas, EnDev was able to increase access to and adoption of improved mud stoves even in remote communities by cooperating with other development partners. These approaches so far had an effect on the Ugandan stove market, with regards to e.g. quality brand, awareness, market entrance or production and sales systems, and have a high potential for up-scaling .

Other actors important for the development of the stove market are the above mentioned private-public stakeholder platform UNACC and the private sector association BEETA that both enhance sector coordination and exchange of experiences among the various stakeholders in the sector.

1.5 Relevant activities of other donors and implementers

The community of international development partners in the Ugandan energy sector coordinates activities through the Energy and Mineral Development Partners Group (EMDPG). Most development partners focus on power generation, electricity transmission and distribution (like programmes by Japan, Norway, France, USA, EU and Germany (KfW and GIZ)). German Development Cooperation and EnDev are the key partners of the Ugandan Government in the field of access to modern energy services (off-grid electricity and biomass energy).

- The Government of Uganda is implementing the World Bank funded Energy for Rural Transformation (ERT) programme in three phases, with the objective to increase access to access in rural areas. The second phase (ERT II) is under implementation up to June 2016 and the third phase (ERT III) started in 2015 and runs up to 2020. ERT III is implemented by REA (managing the Rural Electrification Fund; subsidy and contracting), Uganda Energy Credit Capitalisation Company - UECCC (refinancing working capital debt), selected private sector companies and financing institutions. The fund entails a solar as well as a clean cooking component. EnDev is observing the developments as it might affect the sectors, and it might involve some EnDev partner companies, but that remains unclear until ERT III really starts.
- The EU Energy Facility (EF) is funding various solar PV distribution and access projects in the Western and Northern regions of Uganda through selected private sector companies and larger not-for-profit organisations. EnDev is supporting one of the not-for-profit organisations (the Lutheran World Federation (LWF)) in the Northern region with technical support regarding solar as well as stoves.
- Since 2016 UNCDF CleanStart programme started activities in Uganda and supports low-income consumers to transition to cleaner and more efficient energy through micro finance. Five private sector companies were already selected to implement the programme, focusing on distribution of solar systems and stoves through micro financing

and PAYG financing approaches over a two-year period. UNCDF also assesses the impacts of micro financing on rural customers moving from small picoPV to larger solar systems. EnDev is involved in this study and shares experiences & lessons learnt regarding PAYG and micro financing with UNCDF.

- The GACC started a clean cooking awareness campaign in 2016 in Uganda, based on experiences and ideas of EnDev and the MEMD. While GACC supports UNACC with capacity building funds, EnDev is supporting UNACC with technical support. In 2015, RVO was assigned by the Dutch government to provide strategic support to the clean cooking sector in Uganda, focussing on strengthening UNACC and academic and testing institutions. This RVO project is implemented in alignment with EnDev and in discussion with SNV.
- SNV implements a last-mile access campaign called "SWITCH to Clean Energy", which aims at generating demand for clean energy products, like improved cookstoves in some districts of Eastern Uganda (funded by the Dutch government). EnDev is in communication with SNV to identify cooperation potential.
- In cooperation with EnDev, the development partners USAID, CARITAS, and LWF also started to implement ICS projects in terms of awareness-raising and marketing of factory stoves through their networks to rural communities and refugee camps.

2. Project approach

This proposal focuses on up-scaling the activities for stoves and solar market development. Grid activities shall continue with "no pole" connections, therefore grid interventions are not subject of this proposal. The RBF "Grid Densification Challenge Fund" is expected to start later in 2016. However, respective preparation and staff costs for advising the utility and support RBF implementation are included in the budget.

2.1 Market development vision and EnDev conceptual approach

For both, the solar and the stove market, EnDev envisages a considerable reduction of the above described barriers (availability, awareness and finance) over the next three to five years. This is coupled with a nationwide increase in the supply of and demand for quality stoves and solar products. For solar, the private sector is relatively well established and will be increasingly able to drive development processes. For the ICS sector, this progress is expected to be largely driven through the, rapidly increasing interest of international development partners in Uganda's ICS market. Many of their interventions could build on EnDev's past work. EnDev Uganda intends to continue taking a leadership role in strengthening markets and facilitating access to quality products in the Ugandan ICS sector. In the meantime, EnDev has become a lead development player in the two sectors in Uganda and brings together a number of private sector stakeholders, local NGOs, GOs as well as international organisations in their cooperation network.

EnDev activities in the solar component shall contribute to improve the solar market to show the following features in five years time:

- A strengthened and reliable picoPV last-mile agent distribution network (of more than 500 active agents) owned and managed by picoPV private sector partners, enabling easier accessibility of good quality picoPV products and services in most parts of Uganda.
- A strengthened and operational network of more than 100 rural service outlets owned by private sector companies and available in most peri-urban and rural districts of the country, focusing on distribution and after-sales services for good quality solar systems.
- Increased innovation in financing models especially focusing on the larger multiple lights picoPV systems and SHS. On one hand side end-user financing through e.g. PAYG should be supported, as PAYG systems contribute to at least 30% of the sold systems annually. On the other hand access to capital finance from financial institutions and investors is

supposed to result in improved liquidity of solar companies and also leading to sustainable market structures.

- A much better regulated solar industry in terms of the quality of products and services that the private sector offers to the customers. The share of Lighting Africa certified products in the market has doubled, more plug & play small SHS that meet Lighting Africa standards have started entering the market, a functional association for private sector companies is in place and a clear certification process for solar PV technicians is in place and operational.
- Lower price ranges for Lighting Africa certified picoPV and plug & play small SHSs, by supporting major distributor companies to develop stronger rural distribution infrastructure (through establishment of rural outlets and agent distribution networks owned by distribution companies), improved price transparency and awareness about distributors' recommended end-user prices. This shall avoid selling through small electronics retail shops, which currently put large price margins on the products.

EnDev activities in the stove component shall contribute to improve the stove market to show the following features in five years time:

- Sustainable distribution structures for ICS are established in urban and rural areas nationwide, including ICS distribution through supermarket chains, several stove distribution hubs throughout the country and small stove vending structures in rural areas in Northern Uganda.
- Increased production capacity for factory-made ICS including new production sites established in the Northern, Eastern and Western regions as well as increased supply of low-cost firewood ICS for remote areas, including several hundred rural stove artisans in Northern Uganda active in the production of improved mud stoves.
- Increased access to cooking energy systems, which meet the EnDev access level 2 (including stoves with chimney and/or increased cooking with good ventilation).
- Well-trained technical and sales personnel active in the distribution of ICS including the establishment of after-sales services.
- Increased demand for ICS due to increased awareness for the benefits of ICS among the public.
- Local stove companies are strengthened to such extent that they qualify for bigger grants from other programmes (e.g. WB programme) resulting in an even further improvement of local production and distribution structures.

2.2 Specific intervention strategies per (sub)sector

Based on the successes achieved since 2014 through EnDev's current approaches in the solar and stove sectors, EnDev intends to scale up its successful interventions, thereby supporting the sustainable growth of the solar and stove markets. In addition, all partnerships that involve financing agreements or local subsidy contracts will be implemented on a cost-sharing basis; EnDev thereby effectively leverages investments from the private sector and development partners.

For both solar and stoves, EnDev's strategy is in line with the above described targets of the Ugandan Government, REA and especially Uganda's SE4ALL Initiative Action Agenda. EnDev will continue to cooperate with the Ugandan government, private sector companies, international and local NGOs and other development partners to align activities and jointly promote market development in the stove and solar sectors.

a. Solar

EnDev will scale up the private sector approach activities that proved to sustainably reduce the above-mentioned market development barriers in the solar sector. In addition, the increasing number of innovative larger private sector players focusing on the rural market offers great opportunities for EnDev Uganda to further strengthen its private sector approach. Solar activities will focus on up-scaling and further strengthening successful distribution and financing models.

Up-scaling successful distribution models: new rural outlets as well as last-mile agent distribution network:

Rural outlets: Since 2013, EnDev facilitated the establishment of ten new rural outlets, leading to a 90% over-achievement of EnDev Uganda's electrification targets. While maintaining the current outlets, activities will focus on establishing ten additional outlets in the districts where EnDev is not yet active. For sustainability reasons, all outlets are established in cooperation with EnDev's private sector partners (like Greenlight Planet, UltraTech, etc.) who fully own the outlets and are responsible for equipping outlets with marketing personnel, technicians, solar systems stock and spare parts. During the establishment of the outlets with the private sector, EnDev provides technical as well as marketing and promotional support. Technical support is provided through co-development of concepts (based on EnDev's experience and lessons learnt from past activities), technical trainings and, in some cases, selection of good quality products. Marketing and promotional support is provided through branding of the outlets (painting and outlet signage), product brochures, media advertisement (through local radio stations) and mobile sales/marketing tools (e.g. products display kits, branded mobile vans and mobile public address systems). The established outlets act as smaller sales and service centres in the rural communities. Technicians are able to provide timely and cost-efficient after-sales services to the end-users. Marketing personnel enable easier accessibility for good quality products as well as provide training to the customers on the benefits of the products. In the end, the customers' confidence in the solar systems greatly increases and customers can easily purchase suitable solar systems from the established outlets.

Last-mile agent distribution network: The portability and plug & play nature of picoPV systems has made the last-mile agent distribution model very successful and allowed for a sustainable and fast increase of access. Up-scaling activities will focus on strengthening the distribution network in cooperation with EnDev's picoPV partners. In the next two years, the EnDev partners' network will comprise at least 150 agents providing after-sales services, product education and awareness for rural customers. The agent serves as the middleman between the customers and the distributing private company, providing sales and warranty services to the clients. For sustainability reasons, the network and all its agents are fully owned by EnDev's private sector partners, who are responsible for recruiting, training and equipping the agents with stock items to be sold to customers. The agents are mostly paid on commission basis by the companies. EnDev provides technical as well as marketing and promotional support, as already mentioned above for the establishment of rural outlets.

For both distribution models, there is a need to ensure proper management and monitoring of the performance of the outlets and sales agents. EnDev Uganda will continue to support and train its partners to choose and apply proper IT software (Customer Relations Management system), which tracks leads and supports companies and their sales agents to effectively follow-up with interested customers and close on sales. In some cases, EnDev might co-finance this IT software jointly with its partner company.

Up-scaling successful financing models: PAYG, end-user credit, rent-to-own and loans:

To reduce the affordability barrier and bridge the financial gap between the low income of particularly rural customers and the high costs for good quality solar systems, EnDev Uganda has piloted four financing models on both the supply and demand side, in partnership with its private sector solar companies. These models include; a) PAYG model, which allows end-users to pay for a system in instalments of 3–12 months through mobile-money service providers, b) End-user credit through micro finance institutions and commercial banks, c) The Rent-to-own programme, where end-users organized in small village saving groups pay for their systems in small daily instalments (about $ 0.2 /day) for a period of 6 – 12 months, and d) loans in form of vouchers from financial institutions to entrepreneurs for acquiring solar systems stock from a distributor. The voucher system ensures that the loan will be used for stocking solar systems, instead of cash which can easily be diverted to other purposes. EnDev will continue to further strengthen these financing models. Especially the PAYG model shall be scaled up in the next two years. EnDev just concluded a 12

months pilot for the PAYG model together with one of its private sector companies. Annual partner sales have already almost doubled with more than 50% of the company's sales being PAYG enabled.

For all the end-user financing models, the private sector solar companies fully own and manage these models. Private solar companies are also responsible for providing the needed capital financing for these systems either through using their own investments or partnering with financing institutions. Limited working capital is envisaged as a major hindrance in the future when the number of sold systems starts to increase beyond what the companies can supply in terms of their financial capability. Since EnDev Uganda has only a limited mandate to provide financial support to its partners, EnDev creates linkages with other programmes that provide working capital financing. The World Bank ERT III programme will have a component of providing working capital credits to solar companies. EnDev Uganda supports its private partners to apply for such programmes through co-development of concepts with the companies and recommending the companies to these programmes.

b. Stoves

EnDev will scale up both, its private sector development approach and its rural partner synergy approach to further promote ICS production, innovation, distribution and awareness, with a focus on distribution models in peri-urban and rural Uganda, technical innovation and health aspects.

Expanding existing distribution structures:

In partnership with private sector companies, EnDev further establishes a nationwide distribution and sales hubs system (for direct sales as well as distribution to smaller existing outlets) for ICS. The hubs are run by our private sector partner companies (e.g. GBE or UpEnergy) and will offer storage for a high number of stoves, serve as direct sales points, offer after-sales services and allow for the affordable distribution of stoves to smaller sales points in the area. Within these distribution partnerships with the private sector, EnDev will provide technical advice and financial support to the implementation of the hubs. The partner company itself will be responsible for the establishment and needs to pay for at least 50% of the costs. Joint activities include selection of hub location, hub construction/renovation, training of hub managers or sales teams, market activation, creating business linkages with retailers in the area and if appropriate, procurement of a small vehicle for stove transport to retailers or promotion events. The hubs will be fully owned and managed by the companies themselves or private small-scale entrepreneurs selected by the companies. EnDev will conduct visits to these hubs on a regular basis for evaluation purposes and the provision of targeted advice if necessary. This distribution strategy will build on the success and lessons learnt from the two pilot hubs that were established on the premises of GIZ regional offices in 2015 and are owned by EnDev. EnDev plans to keep these pilot hubs for the purpose of testing new approaches and being able to extract further lessons learnt for the future hubs.

In addition, EnDev will scale up its rural partner synergy approach, establishing a network of Energy Service Providers (ESPs). These increase access to rural firewood stoves through harnessing synergies with other development programmes or local organisations active in rural Uganda. By tapping into established structures, EnDev trains members or beneficiaries of the partner organisations to produce and sell improved firewood stoves from locally available material. Thereby low-cost ICS become available for local communities attached to the partners' networks. Within these partnerships, EnDev provides technical expertise (i.e. concept development, stove manuals) to ensure standardisation and quality control, caters for trainer fees and mould procurement and also provides marketing support. The partner organisation takes care of logistics, selection of trainees and assists with monitoring and on-ground support. This cooperation with other development partners is highly cost-efficient (yet respecting that EnDev only counts the share of outcomes related to its financial input in the partnership). Thus, EnDev plans to scale up its current partnerships with CARITAS and the Lutheran World Federation (LWF) and to establish at least two more partnership within the partner synergy approach.

Further technical stove development and promotion of healthy cooking practices:

EnDev is very attentive regarding product performance with a focus on promoting cooking with qualified and tested stoves, with good ventilation and/or cooking with a chimney. Using the recently established EnDev mini-lab, EnDev plans to support the development of a more portable rural firewood stove which can easily be moved inside and outside depending on weather conditions. EnDev also plans to support its partner International Lifeline Fund (ILF) in modifying their rural wood stove design to reduce stove weight for better mobility and to make it more appealing to the end-user. Market introduction of these lighter stove models will be coupled with raising end-user awareness to promote cooking outdoor or in well ventilated kitchens. In addition, EnDev will also look into new rural firewood stove options with chimneys especially for the artisanal ESP stove. Stove design modifications and improvements shall be informed by a study on consumer preferences, allowing for targeted technical development of stoves.

Enhance quality and capacity of production infrastructure:

EnDev will also continue to support local ICS manufacturers in improving their production infrastructure. This is done through both technical advice and financial support. The manufacturers can apply for this support, but for sustainability reasons EnDev assesses the production sites and business practices of interested companies before entering into such a partnership. Items co-financed through EnDev comprise, for example, modern machines to improve metal work and to enhance clay work, or advanced kilns for a higher temperature when firing ceramic stove parts. By promoting advanced production infrastructure, EnDev enables a standardised production process for improved product quality and increased production capacity to reach scale in the ICS production.

Conduct marketing activities and increase demand:

In order to increase demand for ICS and create awareness for the benefits of using an ICS, EnDev plans to co-finance the private companies' promotion and marketing activities for ICS (e.g. paying for exhibition fees, tent hiring, radio ads and talk shows, marketing material, sensitisation sessions etc.). In addition, Endev will also provide in-kind support by helping the companies to develop marketing concepts, find good marketing spots, set up an attractive sales booth etc. Increased awareness among the public will increase the sustainability of EnDev's stove approaches.

2.3 Sustainability of the intervention

EnDev's private sector and partner synergy approaches are designed to be self-sustaining and to deliver lasting impacts for both the stove and solar sectors.

- On system level for products disseminated so far, EnDev will continue to support its partners in the introduction or improvement of after-sales and repair services (business advice and capacity building). The rural outlets play an important role in this context since they increase the coverage of after-sales services outside the big cities. Further, by strengthening the partners production and/or distribution structures and marketing skills, supply of the promoted products is continuously increasing which ensures that end-users can replace their systems if necessary.
- Regarding the quality assurance of products, EnDev puts strict emphasis on Lighting Africa certification of the promoted picoPV products, including a 24-month warranty as well as Uganda National Bureau of Standards (UNBS) and REA certification of the promoted SHS. For stoves, EnDev conducts regular tests of the promoted stoves in its mini-lab parallel to commissioning an independent testing agency (CREEC) to ensure quality as well as transparency. It is also planned to start conduct more field tests. Depending on the test results, EnDev will provide suitable capacity development measures to improve stove quality. Through capacity trainings in technical and business skills, local stove producers/distributors as well as solar distributors are empowered to deliver quality services and products in the long term.
- Sustainability of market/sector development: The production and distribution structures strengthened through EnDev's support are independently managed by local stove and

solar companies. Thereby production and distribution capacities are sustainably increased. Promotion activities and raising awareness increase demand for ICS and quality solar systems. With the majority of the population still using traditional cooking methods and lacking any form of electricity access, market potential for ICS and solar systems is very high. Furthermore, EnDev's partner synergy approach in the stove sector triggers other development partners to become active in the promotion of clean cooking technologies, expanding ICS coverage. In addition, a recently conducted Lighting Africa Market Assessment study for Uganda identified several sustainability factors of the solar products promoted by EnDev: 90% of households were satisfied and find solar products reliable, rural households were willing to pay more than the average retail price of the solar systems and phone charging is a key reason why rural clients purchase a solar system (more than 50% of rural households spend on average USD 0.40 per week to charge their phones away from their homes).

- Long term power to develop innovation in the local sector: Through the close partnership with EnDev, solar and stove companies continuously receive advice and support for capacity building and for piloting of different approaches, thereby significantly increasing the companies' capacity for innovation. Moreover, through capacity development measures within UNACC and BEETA, Public-Private Stakeholder Platforms and Associations are enabled to independently strengthen the stove sector and promote innovation.

3. Expected impacts of the project intervention

Impact	Possible indicators
Environment	The per capita demand for firewood and charcoal for cooking decreases by 10% in the EnDev project areas between 06/2016 and 06/2018. (EnDev Uganda shall conduct two stove impact studies, i.e. one at the beginning and one at the end of the up-scaling phase)
Health	• The awareness regarding the negative health effects of traditional cooking has increased in the target area (health impact study; 50% of randomly chosen households are aware). • A health study demonstrates exemplarily the reduced health risks by using improved cookstoves supported by EnDev.
Poverty/livelihood	• At least 40% reduction in household spending on firewood for households that switch from using a traditional cooking method to using an ICS. • Less time is spent on collection of firewood, allowing for more time to be spent on productive activities. • Rural stove artisans earn an additional income and are more resilient to seasonally fluctuating income. • 300 jobs created along the solar and stove value-chains during the up-scaling phase. • SMEs generate income, work more efficiently and create more jobs from productive use of energy.
Education	• 20% of the solar systems owners use them to let their children study at night. • Less time is spent on collecting firewood. Children and teenagers use the freed time for studying.
Governance	Government focusses on regulation and policy roles and reduces its involvement in implementing energy access projects.
Climate change	The annual reduction in CO_2 equivalents (CO_2e) emission is 32.05 t CO_2e for the cooking energy component and 4.25 t CO_2e for the solar component.

Impact	Possible indicators
Gender	At least 40% women share among the rural stove artisans trained through EnDev's partner synergy approach.
Market development	• 30% growth in annual sales of Pay-As-You-Go solar systems • 10% growth in annual sales of ICS outside Kampala • 10 rural solar outlets and 8 decentralised stove hubs established during the up-scaling phase • 150 active sales agents for picoPV systems and 50 well-trained technicians and sales agents for SHS • 300 rural stove artisans active in providing low-cost firewood ICS to rural communities in Northern Uganda

4. Possible risks and potential ways to mitigate them

Risk 1: Partner companies in the stove and solar sectors fail to implement projects as planned, e.g. due to unexpected competition, slow service delivery along the value chain, administrative problems.

- The impact would be a slow or failed implementation of planned projects.
- In order to mitigate this risk, EnDev carefully selects partners, drafts performance-based contracts that encourage companies to set realistic targets and increase motivation to implement as planned. EnDev also partners with multiple companies to spread this risk in case one partner fails to perform as anticipated.

Risk 2: ESPs fail to deliver stove orders for partner organisations

- The impact would be a slow or failed implementation and ESPs might lose their businesses.
- In order to mitigate this risk, EnDev adjusts the number of linked/trained ESPs to the expected demand for improved mud stoves. EnDev also encourages group production of ESPs which increases efficiency and speeds up production.

Risk 3: Private sector stove companies are not interested anymore in partnering with EnDev since the World Bank's stove programme, and possibly others, offers larger funds.

- The impact would be a lesser number of partnerships than anticipated and thus reduced outcomes.
- In order to mitigate this risk, EnDev partners with multiple companies to spread this risk and aims at establishing a good cooperation relationship with the WB.

5. Budget

		EUR
1	Human resources and travelling	850,000
2	Equipment and supplies	400,000
3	Funding financing agreements/local subsidies	800,000
4	Other direct costs	600,000
5	**Total direct costs (sub-total)**	**2,650,000**
6	Mark up costs/administrative overheads/imputed profit	350,000
7	**Cost price**	3,000,000

Abbreviations

ABERME	Agence Béninoise d'Electrification Rurale et de Maîtrise d'Énergie / Agency for rural electrification and energy Control, Benin
ADEL	Agenda de Desenvolvimento Econômico Local
ADES	Association pour le Développement de l'Energie Solaire, Switzerland
ADES	Association pour le Développement de l'Energie Solaire, Madagascar
AHPROCAFE	National Coffee Growers Association, Nicaragua
ANADER	Agence Nationale de Développement des Energies Renouvelables et de l'Efficacité Energétique, Benin
ARENE	Autoridade Reguladora de Energia, Mozambique
AVSI	Associazione Volontari per il Servizio Internazionale, NGO
BBF	Bangladesh Bondhu Foundation
BDS	business development services
BEETA	Biomass Energy Efficient Technologies Association, Uganda
BMZ	the German Federal Ministry for Economic Cooperation and Development
BoP	base of the pyramid
BTC	Belgian Technical Cooperation
BTC	Belgian Technical Cooperation
CAP	Country Action Plan for Clean Cookstoves
CDM	Clean Development Mechanism
CNDC	National Committee for Charge Dispatch, Bolivia
CNELEC	Conselho Nacional de Electricidade, Mozambique
CO_2e	CO_2 equivalent
CPC	stove testing centre, La Paz, Bolivia
CREEC	Centre for Research in Energy and Energy Conservation
DEZA / SDC	the Swiss Agency for Development and Cooperation
DFAT	the Australian Department of Foreign Affairs and Trade
DFID	the UK Department for International Development
ECSO	energy service company
EdM	Electricidade de Moçambique/ Energy Public Utility, Mozambique
EELA	Energy Efficiency Program in Artisanal Brick Industries in Latin America programme
ENDE	national electricity utility in Bolivia
EnDev	Energising Development programme
ERA	Electricity Regulatory Authority, Uganda
ERT	World Bank funded Energy for Rural Transformation programme
ESME	Energy SME programme, WB, Rwanda
ESWG	Energy Sector Working Group
FASERT	Fund for Sustainable Access to Thermal Energy
FDI	foreign direct investment

FEDESMO	Forum for Energy and Sustainable Development of Mozambique
FI	financial institution
FOCAEP	Central American Fund for Access to Sustainable Energy and Poverty Reduction
FODIEN	Electricity Industry Development Fund, Nicaragua
FONCODES	Programme “Haku Wiñay/Noa Jayatai” of the Peruvian Social Fund, Peru
FONERWA	Rwandan Climate Fund
FUNAE	Fundo de Energia, Mozambique
GACC	Global Alliance for Clean Cookstoves
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GPOBA	Global Partnership on Output-Based Aid
GTP	Growth and Transformation Plan, Ethiopia
HDI	Human Development Index
HEP	national household energy platform, Bangladesh
HH	households
HIVOS	Humanistisch Instituut voor Ontwikkelingssamenwerking
IBNORCA	Bolivian Institute for Norms and Standards
ICF	Conservación y Desarrollo Forestal, Honduras
ICS	improved cookstove
IDB	Inter-American Development Bank
IDCOL	Infrastructure Development Company Limited
IDTR II	Access and Renewable Energy Project, Bolivia
IEBS	Injera electric baking stoves, Ethiopia
IFC-LG	International Finance Corporation - Lighting Global
ILF	International Lifeline Fund
INDC	Intended Nationally Determined Contribution
KPI	key performance indicator
KPT	kitchen performance test
LA	Lighting Africa
LPG	Liquefied Petroleum Gas
LWF	Lutheran World Federation
MEEM	Ministre de l’Energie, de l’Eau et de Mines / Ministry of Energy, Water and Mines, Benin
MEM	Ministry of Energy and Mines, Nicaragua
MEMD	Ministry of Energy and Mineral Development, Uganda
MFA / DGIS	Netherlands Ministry of Foreign Affairs Directorate-General for International Cooperation
MFA-NOR	the Norwegian Ministry of Foreign Affairs
MFI	micro finance institution
MHP	micro hydropower

MI	Market Intelligence
MIDIS	Ministry of Development and Social Inclusion, Peru
MINEDU	Ministry of Education, Peru
MINEM	Ministry of Energy and Mines
MININFRA	Ministry of Infrastructure, Rwanda
MIREME	Ministry of Mineral Resources and Energy, Mozambique
MMAyA	Ministry of Environment and Water, Bolivia
MNP	Madagascar National Parks
MoEF	Ministry of Environments and Forests, Bangladesh
MoU	Memorandum of Understanding
MoWIE	Ministry of Water, Irrigation and Energy, Ethiopia
MPEMR	Ministry of Power, Energy and Mineral Resources, Bangladesh
MRV	Measurement, Reporting and Verification
MVCS	Ministry of Housing, Construction and Sanitation
NICSP	National Improved Cookstove Programme, Ethiopia
PAYGo	Pay as You Go
PDP	Project Development Programme, BMWi/GIZ, Mozambique
PER	Rural Electrification Programme, Bolivia
PERER	Rural Electrification Programme for Renewable Energies, Bolivia
PEVD	“Electricity to live with Dignity” programme in Bolivia
picoPV	pico photo voltaic
PNESER	Programa Nacional de Electrificación Sostenible y Energías Renovables, Nicaragua
PO	partner organisations
PPP	public private partnership
PREDs	public renewable energy demonstrations
ProCEAO	Programme pour l’Energie de Cuisson économique en Afrique de l’Ouest/ Cooking energy in East-Africa
ProEcon	Economic Development Programme, GIZ/BMZ, Mozambique
ProEducaçao	Education Programme, Mozambique
PU	productive use of energy
PUE	productive use of electricity
PVTMA	Photovoltaic Targeted Market Approach
RBF	results-based financing
REA	Rural Energy Agency
REFIT	Renewable Energy Feed-in Tariff
REG	Rwanda Energy Group
RESCOs	Renewable Energy Service Companies
RVO	Rijksdienst voor Ondernemend Nederland
SBEE	Société Béninoise de l’énergie électrique/ Benin Electric Energy Society, Benin

SDREDA	Sustainable and Renewable Energy Development Authority
SE4All	Sustainable Energy for All initiative
SERNA	General Directorate of Energy / Secretary of Environment and Natural Resources in Honduras
SHS	solar home system
SI	social institutions
SICA	Central American Integration System
SIDA	the Swedish International Development Cooperation Agency
SME	small and medium enterprise
SNV	Stichting Nederlandse Vrijwilligers / Netherlands Development Organisation
SPD	Small Power Distributors
SREP	Scaling Up Renewable Energy Programme
SSHS	small solar home systems
SWH	solar water heaters
TA	technical assistance
TAREA	Tanzania Renewable Energy Association
TC	Technical Committee
TDBP	Tanzania Domestic Biogas Programme
TERT	thermal renewable energy technologies (mainly ICS and improved ovens), Peru
TIB	Tanzania Investment Bank
TICS	Tanzania Improved Cook Stove programme
TVET	Technical Vocational Educational and Training
UEM-F	Eduardo Mondlane University 'Foundation, Mozambique
UNACC	Ugandan National Alliance on Clean Cooking
UNBS	Uganda National Bureau of Standards
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UOB	Urwego Opportunity Bank
WHO	The World Health Organisation

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