



# Annual Planning 2017 Update

## Energising Development – Phase 2

Draft Version for the Governing Board



### Partnership between

**The Netherlands Ministry of Foreign Affairs**

**The German Federal Ministry for Economic Cooperation and Development**

**The Norwegian Ministry of Foreign Affairs**

**The UK Department for International Development**

**The Swiss Agency for Development and Cooperation**

**The Swedish International Development Cooperation Agency**

With co-financing from **The Australian Department of Foreign Affairs and Trade, Irish Aid** and the **EU**

### Coordinated and implemented by:

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH  
Rijksdienst voor Ondernemend Nederland (RVO)

Netherlands Development Organisation (SNV)

Association pour le Développement de l'Énergie Solaire Suisse (ADES)

Collaborative Labeling and Appliance Standard Program (CLASP)

Humanistisch Instituut voor Ontwikkelingssamenwerking (HIVOS)

MAEVE

Practical Action

#### Published by:

Deutsche Gesellschaft für  
Internationale Zusammenarbeit (GIZ) GmbH  
Registered offices: Bonn and Eschborn, Germany  
P.O. Box 5180  
65726 Eschborn, Germany  
T +49 61 96 79-0  
F +49 61 96 79-11 15  
E info@giz.de  
I www.giz.de

#### Contact:

Energising Development  
Dr Carsten Hellpap  
T +49 6196 79-6179  
F +49 6196 79-806179  
E endev@giz.de  
I www.endev.info

#### Photos:

© GIZ, EnDev

#### Responsible:

Dr Carsten Hellpap  
Signature:



# Contents

- A. Introduction ..... 1**
- B. Screening procedure for up-scaling country projects..... 2**
  - B.1 General description of the screening procedure ..... 2
  - B.2 Up-scaling criteria..... 2
  - B.3 Assessment of up-scaling concepts of country projects ..... 3
  - B.4 Review of up-/ downscaling proposals of RBF projects..... 3
- C. Overview about planned country activities in 2017 under EnDev 2 ..... 4**
- D. Up-scaling proposals..... 7**
  - Central America (Guatemala, Honduras, Nicaragua)..... 8
  - Ethiopia..... 15
  - Ghana..... 22
  - Malawi ..... 37
  - Peru..... 50
  - New EnDev regional refugee activities ..... 61
- E. RBF project revision documents..... 62**
  - RBF Bangladesh: Output-based picoPV systems development ..... 63
  - RBF Bangladesh, Kenya: Accelerate the uptake of off-grid solar technologies with results-based financing.. 64
  - RBF Benin: Lifting up 3 off grid PV market segments to the next level ..... 65
  - RBF Kenya: Kenya Higher Tier Cookstoves Market Acceleration Project ..... 66
  - RBF Kenya: Market Creation for Private Sector Operated Mini-Grids..... 67
  - RBF Malawi/Mozambique: Access to Modern Cooking Energy for Poor and Vulnerable Groups in Malawi and Mozambique ..... 68
  - RBF Nepal: Result Based Financing for Sustainable Hood-stove Market in Nepal ..... 69
  - RBF Peru: Getting to universal access in thermal energy services ..... 70
  - RBF Rwanda: Sustainable Market Creation for Renewable Energy Village Grids ..... 71
  - RBF Rwanda: Sustainable Market Creation for Solar Lighting ..... 72
  - RBF Vietnam: Creating a Market Driven Biogas Sector ..... 73

## Tables and Figures

Table C.1: Ongoing country activities under EnDev 2 <b>without changes</b> .....	4
Table C.2: Country activities intended to <b>be extended</b> without up-scaling .....	5
Table C.3: Country activities intended <b>to be scaled up or down</b> .....	5
Table C.4: Country activities intended to be <b>scaled up or down and extended</b> .....	6
Table C.5: Ongoing EnDev sector development activities <b>without changes</b> .....	6
Table C.6: <b>New</b> EnDev regional refugee activities .....	6

## A. Introduction

The Governing Board of EnDev approved the Annual Planning 2017 during the 15th meeting on November 16th and 17th 2016. End of 2016 BMZ committed additional EUR 10 million for 2017. As a result of the additional funding up-scaling of some country projects became possible which are is described in the present Annual Planning 2017 update document.

To strengthen the performance-based approach of the programme, the EnDev management applied again as last year a rigorous 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 2017. Chapter D 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

As a result of the discussion during the last board meeting in Bonn EnDev management revised the screening process for up-scaling of country measures giving more weight to those activities which facilitate access to modern energy at higher tiers and where energy is used for economic activities or for providing social services. 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 level of access, 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, economic and social 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 describing this in the proposal EnDev management aims to further strengthen the performance of the programme.

Projects in need of (or seeing good opportunities for) up-scaling are invited by EnDev management to fill in a short proposal format (7-10 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 financially balances 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.

<b>Up-scaling criteria</b>	
Cost efficiency (current and anticipated)	
Sustainability (proven/expected)	
Impact (with special emphasis on economic activities and social services)	
Degree of market/sector development & scalability	
<b>Conditional criteria</b>	
Administrative & financial clean track record (per GIZ standards)	
<b>Bonus criteria</b>	
Least developed countries	Higher service level access
Strategic importance for (individual) EnDev donors	Remote areas
Electrification activities	Concrete gender strategy

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

Six projects were invited to submit a short proposal for evaluation because of a) a shortage of funds related to the current project end-date, or b) the opportunity (Ethiopia) to receive substantial co-funding on the country level (or a combination thereof).

Assessing the short proposals in an early phase of the up-scaling process proved to be 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.

EnDev management had capped the overall budget for this up-scaling round at EUR 3.5 million. The remaining additional contribution from BMZ was used to unblock funds that had already been allocated to country projects in previous up-scaling rounds subject to additional core funding from donors. The cap resulted in project budgets being cut on the basis of the quality of the proposal and their performance in the past.

Of the **six** submitted short proposals, **one** (the Ethiopia project) will receive funds that are earmarked for this country. Therefore, only the quality of the Ethiopian proposal was discussed but not the size of the additional budget. The financial cap was applied for the remaining 5 project proposals. **One** project presented a convincing market development strategy, based on experience and excellent performance so far. This country project was invited to present a full proposal with an increased additional budget and without stringent recommendations. **One** proposal was selected with recommendations for the full proposal and a slight reduction of the additional budget. **Two** more projects were recommended with significant cuts of the additional budget, because one project will start its exit phase this summer, and the other project will have to improve its strategy and performance. Finally, **one** project was recommended without additional funding as there was no immediate need of additional funding to carry out the activities presented in the proposal. The total amount of the full proposals amounts to EUR 3 million.

### B.4 Review of up-/ downscaling proposals of RBF projects

In addition to screening the up-scaling of “classic” projects, EnDev management and DFID evaluated RBF projects of round one and two regarding their current status and performance with a focus on up- or downscaling projects if needed. Two RBF round three projects were also included which lead to a total of thirteen RBF projects that were discussed in detail. As a result, it is proposed cost-neutrally extend seven of the RBF projects under review with some of them proposing adjustments to their original key performance indicators (KPIs) and for one additional project only adjusting KPIs. Two projects are proposed to be scaled down and one to expand its geographical scope. For two RBF projects the decision on exact up- or downscaling amounts was made conditional on certain achievements until July 2017 and will as such be newly considered then and changes proposed in the Annual Planning 2018.

The proposed budget and timeline changes, as well as readjusted KPIs are provided and briefly commented in the chapters below. 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 2017 under EnDev 2

The total budget of the second phase is currently EUR 312.5 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 2017 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.5 presents ongoing regional sector support initiatives and table C.6 activities to facilitate access to modern energy for refugees.

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
<b>Benin stoves</b>	stoves	10/09	08/18	7,768	1,400,000
<b>Bolivia</b>	solar, stoves, grid	10/09	08/18	15,000	886,100
<b>Burkina Faso</b>	solar, stoves	09/16	12/18	7,597	1,600,000
<b>Burundi</b>	solar, stoves	09/10	06/18	3,200	130,000
<b>Indonesia</b>	biogas	12/12	12/18	2,500	61,750
<b>Indonesia</b>	solar, hydro	05/09	07/18	11,960	172,000
<b>Liberia</b>	picoPV, SHS, mini-grids, solar dryers and cooking	05/12	11/18	4,428	45,000
<b>Madagascar</b>	stoves	12/12	06/18	800	130,000
<b>Mali</b>	picoPV, SHS, mini-grids, energy kiosks	01/13	12/18	4,500	140,000
<b>Senegal</b>	solar, grid, stoves	04/09	12/18	16,701	1,765,000
<b>Tanzania</b>	stoves, solar-RBF	12/12	10/18	5,660	560,000
<b>Uganda</b>	stoves, solar, hydro, grid	04/09	08/18	12,250	707,800
<b>RBF Mekong (Cambodia, Laos, Vietnam)</b>	stoves	03/15	02/19	4,096	600,726
<b>RBF Kenya, Tanzania, Uganda</b>	biogas	03/15	02/19	3,870	128,940
<b>RBF Mozambique, Uganda, Sub-Saharan Africa</b>	grid densification	03/15	02/19	4,421	200,000



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
<b>Cambodia</b>	biogas	12/12	06/18	04/19	2,550	34,000
<b>Kenya</b>	stoves, picoPV, SHS, mini-grids	04/09	02/19	06/19	21,435	7,130,000
<b>Mozambique</b>	solar, stoves, hydro, grid	10/09	02/18	12/18	14,500	549,000
<b>Nepal</b>	stoves, hydro, grid	05/09	12/18	06/19	7,915	478,500
<b>Vietnam</b>	biogas	07/13	06/17	06/18	3,740	275,000
<b>RBF Bangladesh, Kenya</b>	off-grid solar	03/15	02/19	02/19	4,110	1,111,200
<b>RBF Malawi, Mozambique</b>	stoves	03/15	03/19	06/19	1,258	640,000

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
<b>Bangladesh</b>	solar, stoves, solar-RBF	06/09	05/19	25,250	24,069	7,050,500	6,792,500
<b>Central America</b> (Guatemala, Honduras, Nicaragua)	grid, solar, hydro and Stoves	09/09	12/18	16,790	17,590	451,420	475,370
<b>Rwanda</b>	solar, hydro, biogas	10/09	06/19	15,440	14,640	825,430	815,730

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
<b>Benin r.e.</b>	solar, stoves, grid, picoPV	10/09	12/18	06/19	8,260	8,260	558,689	416,107
<b>Ethiopia</b>	stoves, solar, hydro	01/10	04/19	12/20	29,393	34,651	2,119,250	2,210,000
<b>Ghana</b>	solar, stoves, grid	01/10	06/17	05/18	3,150	3,675	Only SI+SME	Only SI+SME
<b>Malawi</b>	stoves, solar	12/12	06/17	06/19	2,500	3,700	725,000	755,000
<b>Peru</b>	grid, solar, stoves, other	06/09	06/18	06/19	16,920	17,520	1,231,500	2,058,851

Table C.5: Ongoing EnDev sector development activities *without changes*

Countries	Title	Budget EUR
<b>Bangladesh, Ghana, Kenya, Uganda</b>	Cooking sector support and coordination	2,000,000

Table C.6: *New* EnDev regional refugee activities

Countries	Title	Budget EUR
<b>Kenya, Uganda, Somalia</b>	EnDev support to refugee activities	985,000

# D. Up-scaling proposals

## Central America (Guatemala, Honduras, Nicaragua)

### 1. Summary

<b>Promoted technologies</b>	Grid, Solar, Hydro and Stoves				
<b>Project period</b>	old	09.2009 – 12.2018	<b>Budget (EUR)</b>	old	16,790,000
	new	unchanged		new	17,590,000
		<b>old targets</b>		<b>new targets</b>	
<b>Energy for lighting / electrical appliances in households</b>		178,120		196,270	people
<b>Cooking / thermal energy for households</b>		273,300		273,300	people
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		985		1,010	institutions
<b>Energy for productive use / income generation</b>		1,500		1,525	SMEs
<b>Lead political partner</b>	Nicaragua: Ministerio de Energía (MEM); Honduras: Instituto de Conservación y Desarrollo Forestal (ICF); Guatemala: Ministerio de Energía (MEM)				
<b>Implementing organisation</b>	Nicaragua: Empresa Nacional de Transmisión Eléctrica (ENATREL); Honduras: Oficina de Electrificación Social (OES-ENEE); FOCAEP: Fundación de Energía (BUN-CA) and local NGOs and MFIs.				
<b>Implementing partner</b>	GIZ and FOCAEP-BUN-CA				
<b>Coordination with other programmes</b>	Nicaragua: FODIEN, FUNDENUSE, ADIM; Honduras: OES-ENEE, AHPROCAFE; Guatemala: FAFIDESS				
<b>Key interventions</b>	<ul style="list-style-type: none"> <li>• Co-financing of grid extension and densification</li> <li>• Establishment of microfinance revolving funds for Solar Home Systems</li> </ul>				
<b>Main strategic changes introduced with up-scaling</b>	<ul style="list-style-type: none"> <li>• Co-financing of grid infrastructure</li> <li>• Microfinance revolving funds for Solar Home Systems</li> </ul>				
<b>Project manager</b>	Klaus Hornberger				

The proposal is focused on higher tier rural electrification by up-scaling the project's experiences with co-financing in the following technologies:

- Grid extension and densification in Honduras and Nicaragua.
- Solar Home Systems with a generating capacity of 50 to 100 W<sub>p</sub> for rural households in Honduras, Nicaragua and Guatemala.

### 2. State of market/(sub) sector development

According to the SEforALL RAGA (Rapid Assessment Gap Analysis) of **Honduras** there are still about 392,000 households without access to electricity. Only 10% of these can be reached by the grid in the next years (39,200 households). This means that about 352,800 households will have to be electrified with other technologies, such as solar homes systems or hydroelectric plants in the coming years.

The SEforALL RAGA of **Nicaragua** states about 268,000 poor rural households with no access to electricity services. Out of these only 30% to 50% can be addressed with strategies that involve market mechanisms, requiring the participation of the user and market practices. The other 50% to 70% require strategies where the state participates with the majority of the investment.

According to the current estimations of the Rural Electrification Plan (PER) about 700,000 people will not have access to the power grid in **Guatemala** by 2030. These are 3,422 settlements with about 140,000 households in the Departments of Alta y Baja Verapaz, Petén, Quiché y Huehuetenango. These are communities for which electrification is not scheduled in the long term, either due to their distance to the distribution network, their topographic locations and their low consumption, that increase the costs beyond the defined limits for network extension. It is also important to note that these Departments with a low electrification level are those with a higher poverty index.

## 2.1 Rural electrification with grid extension and grid densification

As the national interconnected electricity grids in both Honduras and Nicaragua are owned by the state, the development of the grid infrastructure is standardized by the central governments that define the standards and regulations regarding the materials to be used and installation services to be provided by private companies under the quality control by public sector institutions. There are about three to five private companies in both countries that supply the necessary materials and services needed for extending the grid infrastructure and household connections. Grid projects are usually financed by public funds that are leveraged by multilateral development banks and/or bilateral development institutions.

In **Honduras**, the Office of Social Electrification (OES) of the National Utility ENEE is planning the rural electrification activities on behalf of applications channelled by the Congress. However, OES-ENEE is only engaging in the extension of the primary grid, while the local governments have to invest in the secondary distribution grid and the household connections. In both cases public funds are channelled by the central government to OES-ENEE and the local governments. For many years, the funds for OES-ENEE have been much lower than needed for the grid extension activities planned, which results in a long waiting list of many projects that cannot be concluded for lack of necessary funds. In the last years EnDev has been able to co-finance some of the projects that have been on the waiting list for many years (at least three) by contributing with grid extension materials to OES-ENEE, and with materials for the distribution grids to the local governments (posts, cables, isolators, transformers, etc.). The projects planned by OES-ENEE to be finished with priority are selected by EnDev. The tendering process for the materials needed to conclude the projects is implemented by EnDev with the result of obtaining lower prices, as if tendered by the government. The materials are then used to complement the materials provided by OES-ENEE for the grid extension activities, and/or are distributed to the local governments for grid distribution activities to be concluded in the communities. Total project costs are shared between EnDev (material and transport), OES-ENEE (grid extension) and the communities (household connections).

In **Nicaragua** all grid extension and densification activities are coordinated and implemented by the central government. The local governments only play a role in planning, by presenting the need for electrification of the municipalities and communities to the Ministry of Energy (MEM) or the National Transmission Authority (ENATREL). Beside the coordination and organization of the local level, they have no role in the implementation of the projects. The National Electrification Fund (FODIEN) coordinated by MEM and ENATREL is responsible for the technical planning and the implementation of the electrification projects on a national level. The projects are funded by public funds (National Treasury Fund) or by multilateral loans for the National Electrification Programme (PNESER). EnDev has been co-financing grid densification activities with FODIEN, responsible for financing the grid extension activities, and EnDev the household connections and/or internal wiring of the households. With this cooperation EnDev has enabled FODIEN to reach more communities and households as were planned with the available national funds alone. Total project costs are shared between EnDev (materials, transport and labour), the Treasury Fund (grid extension), FODIEN (planning and

monitoring), the utility (electricity meters) and the beneficiaries (connection fee and safety inspection).

## 2.2 Electrification of rural households with Solar Home Systems

The business development of solar technology providers in both Honduras and Nicaragua, where the project has been active up to now in this technology field, has mainly been driven by project investments rather than wholesale and retail of solar products directly sold to clients. This is mainly due to the fact that clients live in remote areas and there is no free capital available on the companies' end to be invested into stock without the perspective of selling bigger quantities in a clearly defined period of time. However, the projects implemented by EnDev with its partner organisations have induced further investments by the partners, such as in the case of AHPROCAFE and HdH in Honduras, and ADDAC and El GORRION in Nicaragua. In the absence of clearly defined numbers of solar home systems to be installed with guaranteed payments, the sector is forced to search for project financed alternatives, like for example energy efficiency projects of NGOs or private companies investing in solar projects with private or bank loans, guaranteeing reimbursements by lowering the monthly electricity bills considerably. Other opportunities are the electrification of the communication infrastructure in rural areas, or loan financed irrigation projects investing in solar pumping facilities.

Both countries though see an increase in financing for solar home systems (SHS) and other household lighting appliances provided, by micro finance institutions (MFIs) under a "green business" approach due to the growing investments of loan capital providers with international, regional or national funding opportunities for first and second tier loan investments.

In Nicaragua and Honduras EnDev has installed nearly 10,000 SHS with a subsidy approach for rural households. Subsidies were constantly lowered as the cost of the technology has been decreasing over the years. However, households always had to cover the majority of the cost of the systems at their own expenses (81%:19%). Today it is widely recognized in the sector that EnDev has significantly and sustainably contributed to the development of the SHS market in both countries by:

- Defining high quality technical specifications for the components and systems.
- Providing technical assistance for high quality tender procedures.
- Implementing stringent quality control during the installation process.
- Building local technical knowledge for installation, maintenance and after sales services.
- Providing technical assistance for business development to solar providers.

The success, in terms of sustainability of the technology and impacts on households are mainly owed to the simultaneous implementation of activities on all levels of the technology value chain, including the organisation and training of the beneficiaries, the formation of local technicians, and the technical assistance for the partner organisations and for the providers of high quality solar technology.

## 3. Intervention strategy

### 3.1 Market development vision

#### 3.1.1 Grid extension and densification

As rural electrification activities in Honduras and Nicaragua are planned and implemented by government structures with public financing on the basis of defined projects with co-financing options, the market development vision is defined by the national electrification planning procedures. In both countries rural electrification is considered as a key for economic development. Therefore the development plans of both countries are likely to maintain the importance of rural electrification in the near future, but nevertheless co-financing partners will still be needed to guarantee implementation.

#### 3.1.2 Solar home systems

Up to 640,000 households in Honduras, Nicaragua and Guatemala will not be connected to the national grids in the coming years. SHS constitute one option for these households to get access to electricity.

Based on the project estimations, it is expected that approximately 40% of these HH will be served through social projects by NGOs and other stakeholders. However, another 60% will not be attended and hence constitute the potential retail demand for the solar companies in the region. With the offer of MFI loans slowly growing and becoming available more broadly to end consumers, it is expected that this retail demand also becomes increasingly interesting to the private sector, increasing the number of active players in the market and their outreach and services in terms of sales points as well as maintenance.

### 3.2 EnDev conceptual approach and intervention strategies per (sub)sector

#### 3.2.1 Grid extension and densification

The EnDev approach in this sector is guided by the previous experiences gained in Honduras and Nicaragua. New grid extension and/or densification activities will be identified with the partners that can be concluded within a year. These will comprise various communities and at least 3,500 rural households, 35 social institutions and 35 productive enterprises to be connected. The selection of the activities will be based on the following three criteria:

- Priority of the areas to be electrified.
- Number of communities and households to be connected.
- Total cost of connection per household (value for money).

The expected cost distribution between the actors will be: EnDev 15%, partners 80% and beneficiaries 5%. With the contribution of EnDev it will be possible to conclude village electrification activities that could not be finalized and have been stalled for several years due to lacking funds or materials. It will also enable the partners to reach electrification schedules faster and enable them to surpass defined targets.

#### 3.2.2 Solar Home Systems

This component will be implemented by the Central American Fund for Poverty Oriented Energy Access (FOCAEP). This basket fund has been established by EnDev and Hivos as a financing instrument for sustainable poverty oriented access activities in the region. FOCAEP is offering grants and credit schemes for co-financing of improved cookstoves, micro hydro plants and going forward also including solar home systems. EnDev is cooperating with technical assistance in technical, operational and institutional aspects, and in the monitoring of outcomes and impacts.

FOCAEP has lately been successful in consolidating its planning activities within the hydropower sector by the acquisition of a financing agreement with US-AID for the implementation of the technical pre-feasibility studies of its hydro portfolio in Guatemala, Honduras and Nicaragua. The financing agreement will be accompanied by technical assistance for restructuring the acquisition strategy and identifying funding opportunities for the regional fund in the near future. With the inclusion of the solar component to the fund's portfolio, FOCAEP will be able to offer financing services in the three core technologies for poverty oriented energy access in the Central American region.

FOCAEP has only recently negotiated co-financing schemes for loan revolving funds with poverty oriented MFIs for improved cookstoves (ICS) in Guatemala (FAFIDESS), Honduras (AHPROCAFE) and Nicaragua (ADIM and FUNDENUSE). As these MFIs have a pro-poor focus they are working with lower interest rates for their customers, and are also increasingly interested in investing in loans for solar home systems. FOCAEP will leverage the investments of these MFIs in a 1:1 ratio.

FOCAEP will also contribute with the technical assistance to design and incorporate the new loan product of SHS into the MFIs' portfolios and control systems.

Three revolving loan funds will be established with at least three national MFIs to finance a total of 1,000 solar home systems per year in the three countries. According to the performance of the revolving funds the total number of solar home systems should be more than doubled within a total of three cycles.

EnDev will be responsible for the technical assistance in the quality control of the solar products, the procurement procedures and the technical training for MFI staff, beneficiaries and local technicians.

### 3.3 Cooperation with others

Up to now Honduras and Nicaragua only have drafted their country analysis within the international SEforALL process. There is still no approved concrete action plan published and available by both governments. Therefore the cooperation with other institutions will be concentrated on national institutions. In the grid component these are the local government structures as municipalities and communities in Honduras, and the public institutions governing the grid infrastructure in Nicaragua. The activities in the solar sector are planned to be implemented together with at least one MFI per country under a funding leverage agreement of at least 1:1:

- Guatemala: Fundación de Asesoría Financiera a Instituciones de Desarrollo y Servicio Social (FAFIDESS)
- Honduras: Asociación Hondureña de Productores de Café (AHPROCAFE) or Fundación Microfinanciera de Hermandad de Honduras (HdH-FM)
- Nicaragua: FUNDENUSE S.A or Asociación Alternativa para el Desarrollo Integral de la Mujer (ADIM)

## 4. Planned Outcomes

### Technology 1: Grid extension and densification

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	18,550	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access	35	
No of enterprises gaining access	35	
No of households gaining access to at least level 2 cooking systems		
No of jobs created along the value chain	175	
Renewable electrical power generation capacity installed (in W)		
Investments by households, private and public sector (in EUR)	2,850,000	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	612	
<b>Market development indicators</b>		
Indicator 1		
Indicator 2		
Indicator 3		



## Technology 2: Solar Home Systems

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	5,400	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access		
No of enterprises gaining access		
No of households gaining access to at least level 2 cooking systems		
No of jobs created along the value chain		
Electrical power generation capacity installed (in W)	60,000W	
Investments by households, private and public sector (in EUR)	650,000*	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	184	
<b>Market development indicators</b>		
Indicator 1: Access to microfinance services	1,000*	
Indicator 2: No. of additional MFIs offering green loans with a pro poor focus	at least 5	

## 5. Sustainability

Grid electrification is the most sustainable energy access in Central America. Clients have to pay according to their individual consumption. A consumption of up to 150kWh per month is cross subsidized by the governments for rural households in Honduras as well as Nicaragua. The grid infrastructure is maintained by the governments and steady improvements are made regarding the quality of the service.

In the case of solar home systems, the investment of the users required to own a solar home system has been crucial for the sustainability. Other preconditions for the sustainability of the solar technology in rural areas are the technical training of users and the establishment of local knowledge for maintenance and after sales services.

In 2011 EnDev has conducted a field study about the sustainability of the solar technology in rural areas of Nicaragua. The most important findings were that 92% of the families still had their solar home system in use after a period of four to five years, 35% of the families had changed the batteries of their system, and the technical performance of the other system's components was fully satisfactory.

## 6. Impact

Electrification enhances quality of life at the household level and stimulates the local economy. The immediate benefit of electrification comes through improved lighting, which promotes clean indoor air, household chores are made easier, especially for women and extended hours of study and reading contribute to better educational achievements. Electrification can also benefit many other household activities, such as sewing by women or communication services, social gatherings and security after dark, improved medical services and many others. Electronic devices such as radios and television also improve the access to information by rural households and can provide entertainment to family members. In addition, households' economic activities both inside and outside the household can benefit from electricity, as small businesses can be operated longer hours in the evening and electric tools and machinery can impart efficiency and production growth to artisan enterprises.

An Impact Monitoring Study implemented in 2013 in Honduras revealed the following impacts of household electrification with solar home systems for the families:

- Households spend over 80% less for lighting, about 60% less for batteries and 100% less for charging cell phones.
- Women appreciate far easier house cleaning, cooking and attending the family with light in the early morning and at night. It is also easier to prevent snake and scorpion bites.
- Households are emission free and clothes free of smut, throats no longer ache during the night and in the morning.
- Social life has improved by night visits and communal events; better security is felt especially by women.
- Children are using night hours for homework and reading, women use night hours for economic activities as sewing.

## 7. Budget

Cost Category		EUR
1	Human resources and travelling	220,000
2	Equipment and supplies	215,000
3	Funding financing agreements/local subsidies	265,000
4	Other direct costs	20,000
<b>5</b>	<b>Total direct costs (sub-total)</b>	<b>720,000</b>
6	Mark up costs/administrative overheads/imputed profit	80,000
<b>7</b>	<b>Cost price</b>	<b>800,000</b>

## Ethiopia

### 1. Summary

<b>Promoted technologies</b>		Stoves/ solar / hydro; the up-scaling funds will only be used for solar and hydro activities			
<b>Project period</b>	old	01.2010 – 04.2019	<b>Budget (EUR)</b>	old	EUR 29,393,000
	new	01.2010 – 12.2020		new	EUR 34,651,000
		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		409,250	500,000	people	
<b>Cooking / thermal energy for households</b>		1,710,000	1,710,000	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		2,160	2,214	institutions	
<b>Energy for productive use / income generation</b>		4,900	5,008	SMEs	
<b>Lead political partner</b>		Ministry of Water, Irrigation and Electricity (MoWIE)			
<b>Implementing organisation</b>		GIZ			
<b>Implementing partner</b>		MoWIE, Ministry of Health, Regional Governments/Agencies/Bureaus of Energy, Education, Health, Women Affairs and Agriculture; universities; Solar Energy Development Association of Ethiopia; Hydropower Association of Ethiopia; regional development and women associations; private companies such as Solarkiosk Ethiopia; World Food Programme; various NGOs such as NABU and World Vision			
<b>Coordination with other programmes</b>		Sustainable Land Management (SLM) Programme; Strengthening Drought Resilience of the Pastoral and Agro-Pastoral Population in the Lowlands of Ethiopia (SDR); Sustainable Training and Education Programme (STEP); Oxfam; Lighting Africa Ethiopia			
<b>Key interventions</b>		<p><b>Solar</b></p> <ul style="list-style-type: none"> <li>• Capacity Building of village technicians and retailers</li> <li>• Marketing support for solar products</li> <li>• Electrifying vital rural social institutions</li> </ul> <p><b>MHP</b></p> <ul style="list-style-type: none"> <li>• Upgrading watermills into micro hydropower plants (MHPPs)</li> <li>• Capacity building for community-based operator models</li> </ul>			
<b>Main strategic changes introduced with up-scaling</b>		<p>The project will predominantly continue its strategies in the different components: Main changes and modifications are: :</p> <ul style="list-style-type: none"> <li>• Establishment of functional warranty systems and awareness in cooperation with solar retailers &amp; wholesalers</li> <li>• Stronger promotion of female owned solar enterprises</li> <li>• Facilitating MFIs' capital for energy access through market intelligence, technical support and capacity development</li> <li>• Promotion of energy access through enhanced cooperation with cooperatives and rural saving and credit associations</li> <li>• Up-scaling MHP development from pilots to replicable approaches through implementation of 30 MHP mini-grids</li> </ul>			

## 2. State of market/(sub) sector development

EnDev Ethiopia will use the up-scaling funds for supporting access to picoPV system as well as Solar Home Systems and the installation of mini-grids based on mini and micro hydropower.

### 2.1 Access to solar lanterns, solar kits and solar home systems

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<sup>1</sup>. 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 EnDev 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.

### 2.2 Mini grids based on mini and 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. However, only a fraction of this potential is used as the sector is facing many barriers, such as 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. Mini-grids in Ethiopia are generally economically not feasible in the sense that investment costs 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. Potential micro hydropower sites are widely used by traditional watermills for grain milling, especially 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.

---

<sup>1</sup> Merkato is the name for a marketplace in the Addis Ketema district of Addis Ababa. It is the largest open air market in Africa, covering several square miles and employing an estimated 13,000 people in 7,100 business entities.

### 3. Intervention strategy

#### 3.1 Market development vision

##### 3.1.1 Solar

In five years, a robust solar market will be established with a functional warranty system for picoPV products, access to finance through MFIs and skilled retailers and technicians. Customers, who do not have the necessary capital at their disposal, will have access to corresponding financing solutions.

For Solar PV systems installed at social institutions a maintenance and repair system will exist that ensures the sustainability of installations.

##### 3.1.2 Micro hydropower

The majority of micro hydropower plants being installed with the help of EnDev will still be operational after five years. Operation and maintenance will be covered by the electricity tariffs. For replacement of parts and necessary repairs a special fund is established that acts like an insurance in case a hydropower plant is broken down and needs to be repaired.

#### 3.2 EnDev conceptual approach and intervention strategies per (sub)sector

##### 3.2.1 Solar

EnDev is supporting market development for solar products for households and small and medium enterprises and the electrification of social institutions with solar technologies

###### 3.2.1.1 PV systems for the residential sector

Beginning in 2010, EnDev started promoting smaller PV systems like solar lanterns and solar home systems (SHS) for households. Until end of 2016, more than 240,000 solar lanterns and 10,000 SHS have been disseminated by EnDev trained retailers during EnDev 2 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.

To strengthen market development EnDev is implementing the following key interventions:

**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.

EnDev will support Microfinance institutions to develop loans schemes for households to purchase solar products. The cooperation with the MFIs will also include measures to assure a high quality of the products to avoid problems with the repayment of loans (see also next point).

**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. EnDev will inform consumers and retailers about quality characteristics of solar products. In addition, the introduction of product warranties will be discussed with the majority of wholesalers in Ethiopia, the solar association and relevant governmental bodies. From a legal point of view, any seller has to provide at least one year warranty on a solar product. However, most PV products in rural areas are sold through a chain of distributors and brokers which makes it very difficult to claim and track warranty rights for end-customers. 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.

**Key Intervention 3: Capacity Building:** All the above mentioned interventions include a capacity building component to supply the market with practical technological and entrepreneurial knowledge to strengthen retailers, service technicians and installation companies. EnDev aims to continue training

companies and technicians on installation, service and maintenance of solar systems. These trainings shall follow mainly an on-the-job approach in the framework of installing solar PV systems for social institutions and promoting solar home 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. For instance, EnDev shall support MoWIE to develop technical capacity to conduct basic performance tests of small solar systems, also to facilitate and enhance the ministry's policy development and regulatory function in the 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.

#### 3.2.1.2 PV systems for social institutions

Since 2008, EnDev has electrified more than 429 social institutions with PV systems ranging between 1.5 to 2 kW<sub>p</sub> 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. The main challenge for the electrification of social institutions with solar technologies 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.

EnDev will equip another 100 rural, off-grid social facilities including schools, health posts (HP) and community centres (CC) with larger PV systems to provide basic electricity for light and the needed appliances of the respective facility. EnDev will support solar village technicians to design and install the solar systems at the social facilities for training purposes as well as to support the establishment of their business.

In addition, EnDev will develop a maintenance and repair system based on regular inspections and a repair fund that shall be established in consent with the respective partner ministries.

#### 3.2.2 Micro hydropower

EnDev has tested the feasibility of upgrading 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 and a operation model for community cooperatives developed. As a result, close to 5,800 individuals, 49 social institutions and 114 SMEs gained access to electricity. Based on these results EnDev will upgrade another 30 watermills into MHPP out of a list of more than 400 potential watermills sites. This way, EnDev will contribute to the target of the Ethiopian government to construct 105 MHP sites in the coming five years. The average generation capacity will be in the range of 20 kW per site. The intervention will provide at least 3,000 households as well as several hundred social institutions and SMEs with electricity. The power plants will be operated by MHP cooperative committees 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. Members of the community cooperative and the operators will receive comprehensive trainings on aspects like operation and maintenance, basic service repair, entrepreneurial skills and community organisation. 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, shareholders and project partners. The two main revenue

sources are 1) electricity connections from households, social institutions, and SMEs; and 2) mechanically or electrically operated flourmills as an important productive use in rural Ethiopia.

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 finance part of the activities as they manage dedicated community service budgets 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 examine the commitment of potential university partners, socio-economic and technical pre-feasibility assessments are outsourced.

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 professionalism within the sector, and decreased prices for small MHP turbines.

Through these partnerships and contractual arrangements, capacity will be built along all key segments of the value chain. Starting from site scouting and feasibility studies through local consultants and universities, the manufacturing of critical components and spare parts in the country by local SMEs, grid construction and household level connections by local contractors and technicians, to operation and maintenance tasks by local labour, the organic feasibility of further MHP developments in Ethiopia will be greatly enhanced.

### 3.3 Cooperation with others

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. EnDev is cooperating specifically with the IFC/World Bank Lighting Africa Programme. EnDev and Lighting Africa support the Ethiopian Conformity Assessment Enterprise (ECAE) to set national standards for solar products and in the implementation of consumer awareness campaigns. Together with 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

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.



## 4. Planned Outcomes

### 1. Technology: Solar and MHP

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	90,750	4.5 million will be used for electrification. An average cost efficiency of EUR 50 per person is assumed;  For the other indicators the standard target per EUR 100.000 were used. Only the resiöt for power generation was doubled
No of social institutions gaining access	54	
No of enterprises gaining access	108	
No of jobs created along the value chain	270	
Electrical power generation capacity installed (in W)	40,000	
Investments by households, private and public sector (in EUR)	9,000,000	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	21,600	
<b>Market development indicators</b>		
Indicator 1 increase of the overall turnover of retailers with picoPV products	by 10% per year on average	
Indicator 2 sustainable business models for MHPs are developed and implemented		
Indicator 3 regular maintenance scheme and a repair fund are designed and discussed with partners		

## 5. Sustainability

### 5.1 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.

### 5.2 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. In addition, EnDev will strive for the establishment of a repair fund for hydropower plants that acts like insurance.

## 6. Impact

Impact	Possible indicators
<b>Health</b>	<ul style="list-style-type: none"> <li>Improved access to medical services in connection with electrified health centres</li> <li>Reduced child / prenatal mortality</li> <li>Reduction in low birth weight - reduced risk of a variety of children diseases</li> <li>Reduction in number of fire related incidents with infants and toddlers</li> <li>More free time for prenatal and postnatal care and treatment</li> <li>Reduced risk of assault, injury and polluted indoor air</li> <li>More time to rest</li> </ul>
<b>Poverty/livelihood</b>	<ul style="list-style-type: none"> <li>Number of people gaining access to modern energy technologies</li> <li>Earnings from PV system / turbine sales</li> <li>Number of solar technicians actively employed</li> <li>Jobs created through productive use of energy</li> </ul>
<b>Education</b>	<ul style="list-style-type: none"> <li>Number of students regularly attending school</li> <li>Night time courses offered</li> <li>Opportunity for improved school attendance</li> <li>More time for students to finish homework</li> </ul>
<b>Governance</b>	<ul style="list-style-type: none"> <li>Cooperation on Regional / District / Woreda level</li> </ul>
<b>Climate change</b>	<ul style="list-style-type: none"> <li>Reduction in air pollutant concentration</li> </ul>
<b>Gender</b>	<ul style="list-style-type: none"> <li>Number of female solar technicians</li> </ul>

## 7. Budget

		EUR
1	Human resources and travelling	2,635,055
2	Equipment and supplies	845,900
3	Funding financing agreements/local subsidies	1,030,000
4	Other direct costs	126,620
5	<b>Total direct costs (sub-total)</b>	<b>4,637,575</b>
6	Mark up costs/administrative overheads/imputed profit	620,425
7	<b>Cost price</b>	<b>5,258,000</b>

## Ghana

### 1. Summary

<b>Promoted technologies</b>		Solar / stoves / grid			
<b>Project period</b>	old	01.2010 – 06.2017	<b>Budget (EUR)</b>	old	3,150,000
	new	01.2010 – 05.2018		new	3,675,000
		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>					people
<b>Cooking / thermal energy for households</b>					people
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		0	50		institutions
<b>Energy for productive use / income generation</b>		1,180	2,080		SMEs
<b>Lead political partner</b>		Ministry of Energy (MOE)			
<b>Implementing organisation</b>		GIZ and SNV			
<b>Implementing partner</b>		Ministry of Power, District, Municipal and Metropolitan Assemblies, Local Business Associations, Electricity Company of Ghana (ECG), Northern Electricity Distribution Company (NEDCo), Ministry of Food and Agriculture (MoFA), and their District Agricultural Departments, Association of Ghana Solar Industries (AGSI), National Board for Small Scale Industries (NBSSI) Departments, Ghana Alliance for Clean Cookstoves (GHACCO), Global Alliance for Clean Cookstoves (GACC), Energy Commission, SEforALL Secretariat			
<b>Coordination with other programmes</b>		Capacity for a Successful Implementation of the Renewable Energy Act (C-SIREA), Market-Oriented Agriculture Programme (MOAP), Powering Agriculture, Green Innovation Centre for Agricultural and Food Sector – all BMZ/GIZ, Ghana Energy Development and Access Project (GEDAP), Rural Enterprise Programme (REP) –AFDB/IFAD, Rural Dev. Fund (RDF), Forest Landscape Restoration Project of International Climate Initiative (BMUB), Support for Clean Cooking Sector Facilitation and Advocacy (RVO, USAID - Sustainable Fisheries Management Project)			
<b>Key interventions</b>		Support 300 small scale farmers to access and use solar pumping systems for irrigation; facilitate access for grid irrigation for 375 farmers; access to ICS for 225 agro-processors and to 50 social institutions (school feeding programme)			
<b>Main strategic changes introduced with up-scaling</b>		<p>Shift focus from individual beneficiary to facilitation role with farmer groups that will bring significant scaling effect</p> <ul style="list-style-type: none"> <li>• Establish partnerships with local financial institutions to overcome high upfront costs of solar water pumps for farmer groups</li> <li>• Play a facilitation role for PUE promotion using the grid and reduce subsidies (working mainly with distribution utility)</li> <li>• Bring scale to institutional ICS for Gari, Shea butter and local beer (Pito) and ICS for social institutions (school feeding programme)</li> </ul>			
<b>Project manager</b>		Steffen Behrle /Samuel Adoboe (samuel.adoboe@giz.de)			

## 2. State of market/(sub) sector development

### Electricity

As a result of a consistently implemented policy over the years, Ghana has an >80% household electrification rate, in SSA second only to South Africa. While most households have access to electricity and the remainder is still being actively addressed by the GoG, in contrast, there never was similar attention for electrifying Micro, Small and Medium sized enterprises (MSMEs) and farming or agro-processing. As a result many MSMEs do not yet have access to electricity, which particularly holds for farms or 'rural MSMEs' which constitute the largest share of all MSMEs in Ghana. In addition, rural MSMEs stretch out over far bigger areas in comparison to urban environments and are therefore mostly far from the grid. The most prominent area where the lack of access to electricity is hindering development and (economic) growth of farms is irrigation.

### Thermal

Contrary to the attention for electrification (albeit just at household level), historically no similar attention was paid to efficient and clean use of thermal energy or biomass. Partly as a consequence thereof, Ghana today has very high deforestation rates with all associated effects. Moreover the lack of attention for efficient use of biomass, and the subsequent lack of availability of related technologies, again is restraining development and (economic) growth of MSMEs involved in (thermal) agro-processing: like gari roasting, shea butter and pito-production.

### EnDev in Ghana

Partly related to the high household electrification rate, EnDev in Ghana – contrary to EnDev interventions in other countries – never addressed (consumptive) access to energy for households. Instead from the onset it focused on facilitating access to energy for productive use, as an indispensable pillar for increased productivity and economic growth.

In a first phase, the focus was on local economic development and access for small businesses in light industrial zones (LIZ), with a strong focus on job creation. Responding to the core vision of the SEforALL Ghana Country Action Plan, in 2014 the focus shifted to PUE in agriculture and agro-processing to increase productivity and profitability in small scale intensive agriculture linking energy to water and food security. Subsequently it was considered that facilitating access to energy and stimulating energy-efficiency for 'rural MSMEs' would serve a larger need and might contribute more strongly to economic development.

The second phase of EnDev in Ghana thus took the form of facilitating access to electricity for irrigation as well as stimulating energy efficiency for thermal agro-processing.

### 2.1 Grid Irrigation for Small Scale Farming and Enterprises

Access to reliable supply of energy is key to achieving economic and social development. Ghana has the second highest electrification rate in sub-Saharan Africa, after South Africa. The rate increased from 25% in 1991 to 82% in 2016. It is projected to reach 95% around 2018. The national goal is to achieve universal access to electricity by 2020 e.g. through the Fifth Self Help Electrification Scheme (SHEP-5). Despite this tremendous success, with regard to access to the grid<sup>2</sup>, actual connections (in terms of utility customers) to the grid are lower<sup>3</sup>, particularly in peri-urban and rural areas where many MSMEs as well as farming and agro-processing activities are concentrated and where productive uses of electricity are lagging behind household electrification. The limitations for PUE are manifold: (i) the grid is only available in residential areas; (ii) grid extensions and connections are costly; and (iii) in some areas the electricity distribution network coverage is not adequate. Under the National Electrification

---

<sup>2</sup> Definition under NES of access to electricity: "primary focus of the Government of Ghana (GOG) towards achieving strategic objective of universal access to electricity was to extend the reach of electricity to all communities with population of 500 and above by 2020" (NES Master Plan Review, 2011-2020, Arthur Energy Advisors, 2010).

<sup>3</sup> Afrobarometer Report of 2015 and Ghana Statistical Service 2012.

Scheme (NES) and because EnDev Ghana “has held up the flag” of PUE since 2007, the Ministry of Energy and the utility (ECG) are now actively targeting customers that require electricity for productive uses! Averagely, the small scale farmer (farm size .23ha) needs to invest a minimum of EUR 500 to cover the cost of grid connection, electric pump and irrigation pipes including installation. Estimated annual additional income due irrigation is EUR 1,155 and discounted O&M cost (including energy) is EUR 1,070. This farmer could pay back in 1.4 years. Such category of farmers benefitted from a subsidy that reduced payback by 1.2 months. With small agro-credits from local MFIs, such farmers could invest in grid connections. In fact the subsidy paid by the project mitigated the risk of land tenure. Cooperation would be sought with MFI’s to support grid connections with credits. The reason is, despite the increasing cost of electricity and occasional problems of outages, grid electricity is still the lowest cost, least limited and preferred option for small scale farmers. In 2016, grid electricity was costing the small-holder farmers in the Volta Region EUR 57/ha/month compared with petrol which costs EUR 185/ha/month during active season<sup>4</sup> (9 out of 12 months for vegetable farming). Electric water pumps are 25% cheaper to maintain than petrol pumps. However, diesel or petrol pumps are still being used as back-up by some farmers who have access to the grid. Demand for grid connections for PUE is high. The utility should have good reasons to connect more of these customers - because commercial customers pay higher tariffs (on average by 43%) compared to residential customers (in particular lifeline tariff customers), and connection cost are largely borne by them as well (which overall enables the utility to recover distribution costs) – the utility is presently not pursuing its own interest.

The elections in December 2016 brought a change in government, which provides a new chance for the EnDev project to address this unnecessary barrier (because domestic connection schemes would in fact profit from more PUE connections): The new administration pursues new policies for local economic development and employment (‘One District, One Factory’ and ‘One Village, One Dam’). These policies would be well suited as a direct platform for our EnDev dialogue with the utility, and may allow a much wider reach of our diffusion strategy to farmers (also for the next component below), and are thus expected to allow the decisive additional element to finally reach scale in this previously lagging segment of utility efforts. In addition, linkages to the previous LIZ component and other donor’s programmes (e.g. the EU Delegations ‘Productive Investments in Agriculture’ funded from the 11<sup>th</sup> EDF) can be strengthened thanks to this new opening.

## 2.2 Solar Pumps in Irrigation

Solar water pumps are a highly appropriate solution to meet a specific PUE service demand in Ghana because of the high and seasonably stable solar irradiation country-wide, the excellent match of demand and supply (that is, no additional cost due to energy storage and storage or transport losses) compared to other solar applications, and as a sustainable source of energy for agriculture in areas that are far from the grid. There is a well-developed market for conventional electric, diesel and petrol pumps. These are affordable and can be accessed in all district capitals. However, the high cost of diesel and petrol on the one hand, and the falling Capex of PV on the other hand, are seen as main potential drivers for the slowly increasing demand for solar pumps for PUE in off-grid areas. This is most important in the Northern regions where electrification rates are low and most communities are not within the reach of the grid. Very low rainfall as well as variability in rainfall patterns makes irrigation a must so as to ensure food security and sustain and increase crop yields. The choice of energy source is determined by affordability, reliability and availability. Promoting solar water pumps is in line with the Ghana Energy Strategy to achieve universal energy access and for this reason also a key national SEforALL objective. While there is increasing awareness on the technology and the potential of solar water pumps for irrigation globally<sup>5</sup> and in Ghana, the take-off of this promising fuel

---

<sup>4</sup> This is based on an average consumption of 199.2 kWh per ha and the uniform, country-wide commercial tariff of GHS0.97 (EUR0.22 as of 1/9/2016) per kWh plus service charge of GHS10.55 and 27.5% levies and taxes. The price of petrol is also uniform across Ghana and was GHS3.80 on average in 2016.

<sup>5</sup> Powering Agriculture/GFA, 2016, Manual and Tools for Promoting SPIS.

switch option in Ghana has been slow, both pre project and in the project to date: An assessment of the sector done by the project in 2015 indicates there are only about 350 solar powered water pumping systems installed in Ghana and only some 25 are used for irrigation. The existing systems are mainly for domestic and community water supply, indicating the need for market development interventions for solar pumps in irrigation. This is in spite of the fact that they have reached economic viability under specific conditions of use<sup>6</sup>. Most of the systems were financed with strong individual donor support in form of grants with little or no own contributions by the beneficiaries. The current approach supports selected companies with sales-based grants of up to 40% of system cost to market and to sell up to 30 systems. Six solar companies and installers of solar pumping systems have been trained in the use of a manual and tools for solar pumping promotion, design, set-up and operation and maintenance and have established linkages with micro-finance institutions (MFIs) and funding agencies to provide financing for solar irrigation. The current intervention has identified the key barriers to increasing uptake of solar pumps as being high initial costs of systems<sup>7</sup> and the small number of players in a market that has not yet reached scale. Besides, the installers pay high annual licencing charges, import tariffs and freight costs<sup>8</sup>. A main lesson learnt in the current phase is the perceived very limited viability of solar pumping for individual **very small scale farmers** because of the high system cost. Some small to medium-sized commercial farms have purchased systems with a small grant component of 10-30% in the current phase.

In sum, we think that the main reasons for slow project take-up to date are:

- the specific problems of **very small farmers**;
- in spite of globally falling Capex, the high local (fully loaded) **upfront cost** of PV (at present small market scale and thus high shares of soft cost in unit cost) is still a stiff barrier to most MSMEs and requires lending;
- the present lack of awareness and “assurance” regarding the actual lifetime and savings of offered systems leads to a high perceived risk (for both farmers’ equity and – if available at all – debt lending FIs) so that today’s implied weighted average capital costs (whether explicitly quantified or simply a “gut feeling” of the farmer) are much higher than the actual “objective” discount rate and therefore investment still seems unattractive while it really is not any more (this can be changed by both information and more projects on the ground);
- the small intervention size in numbers of supported pumps/installers/farmers in the current phase has not led to economies of scale e.g. in terms of bulk importation of solar pumping systems and keeping various pump sizes in stock (which in addition to falling Capex for PV can add up to 20% reduction in unit prices according to several installers).

Therefore the shift in focus towards solar pumping in this proposal, creating more awareness and introducing innovative technology and financing as well as training to overcome the barriers and reach scale.

### 2.3 Improved Institutional Stoves for Gari Processing (implemented by SNV)

A large variety of traditional agricultural products which are major contributors to food-security and livelihoods in rural areas, including Shea nuts, palm kernels, peanut seeds and cassava are processed using thermal energy before these are consumed or traded. These MSMEs use thermal energy based on wood fuels in combination with inefficient stoves, when processing traditional agricultural products. This results in high production cost, unhealthy working conditions and negative impacts on the environment, mainly in terms of deforestation. Most of the small-scale thermal agro-processing are female dominated trades in Ghana, in particular for cassava, Shea and ‘Pito’ (local beer) brewing. LPG use for cooking could be a cleaner alternative, but there is a need to work towards elimination of

---

<sup>6</sup> Powering Agriculture/GFA, 2015, Multi-Country Stocktaking and Analysis Report.

<sup>7</sup> Especially to small-holder farmers going from manual to individual solar irrigation systems who face a cost 3 times their annual income.

<sup>8</sup> Totalling 16.3% of the total system cost.

the barriers for its adoption in terms of awareness, stove and fuel availability, as well as safety issues. Gari, Shea and 'Pito' production is a female dominated trade in Ghana.

The use of efficient stoves and ovens is still very limited because of low market penetration of improved institutional cookstoves and ovens for small and medium scale industries. Existing barriers are:

- Limited awareness on availability of relevant technologies, financial viability of switching to ICS, as well as the economic benefits of switching
- Few competent suppliers of improved institutional fuelwood stoves with weak entrepreneurial skills
- Limited access to adequate financing to enhance the demand and supply of improved cooking technologies

The project's support thus far has focused on the introduction of improved institutional stoves for Gari processing to reduce fuelwood consumption, increase productivity of Gari roasting and significantly reduce negative health impacts. The project provides grants for demonstrations and building the capacity of (artisanal) stove builders to install stoves; initially with some level of subsidy, which was reduced after 30 demonstration stoves were built. A number of artisan-developed stoves were identified together with limited business support to strengthen two SMEs to build a total of 300 improved Gari roasting stoves. It became apparent during the roll-out phase that both the capacity and technologies of the artisan-led SMEs were more limited than at first thought. With delays in implementation resulting from the need to revise the financial model, the only stove producer with an EnDev-compliant stove is only scaling production towards the end of the current phase with its proprietary design but at a rate that is unlikely to reach target. The new financial model is succeeding, with 3 MFIs over 12 regional branches engaging with the project and over 215 customers approved for loans. As the project has limited resources with which to assist the stove manufacturer, or to engage and develop new SMEs, an alternative Gari-roasting stove product Gari Elephant was identified, and BURRO, the Ghanaian company developing it engaged.

### 3. Intervention strategy

#### 3.1 Market development vision

##### 3.1.1 Productive uses of electricity

In the next five years, the utilities and the Government (Ministry of Energy) proactively target and connect potential PU customers to the grid under the National Electrification Scheme (NES), while giving special attention to small-scale farmers practicing irrigation in areas that are close to the low voltage distribution grid. Although the Government does not formulate an explicit national PUE target for grid irrigation (beyond the Ghana SEforALL target of 250 grid connections for irrigation by 2020 already achieved by EnDev alone), by 2022, additional 2,000 connections can be envisioned. To this vision EnDev can make a significant contribution of at least 50 percent.

##### 3.1.2 Solar Irrigation Systems

These will be a cost-effective, clean and affordable alternative for individual very small-scale farmers, for very small scale farmers in groups, for small, medium and large scale commercial farmers who are far from the grid and cultivate more than 2ha of land; and small, medium to large scale commercial farmers with an out-grower scheme. The market is developed in such a way that competition between technology providers/installers leads to lower system prices and at least 10,000 solar irrigation systems are installed with coverage of 20,000ha nationwide<sup>9</sup>. EnDev's contribution over the period can be significant as well (at least 25 percent or 2,500 systems).

---

<sup>9</sup> 5 Year Target of Draft RE Master Plan, Energy Commission



### 3.1.3 Improved agro-processing stoves

These will be available in most regions of the country. Through technical assistance and further business development support, selected artisanal and industrial ICS producers in each project region will be able to build high quality, fuel efficient, low emission and affordable stoves. And that through continued engagements and knowledge development activities, financial institutions have recognised and taken advantage of the business potential in driving a viable cookstove market in Ghana through credit. The targets formulated vary between 3,600 and 18,000 institutional ICS by 2030 depending on the version of the draft 2017 RE Master Plan consulted. For the period of the coming 5 years, the vision varies between 2,600 and 6,000 institutional ICS. EnDev's contribution to either of these 5-year visions can be regarded as significant with at least 2,000 ICS.

## 3.2 Fit with policy ambitions and plans for energy access and climate change, in particular with SDG7/SEforALL country plan and NDC

As already indicated in earlier chapters, the planned activities are well in line with national energy policies and plans.

This proposal responds to Ghana's SEforALL action agenda that mentions PUE in agriculture and agro-processing as a key objective and action based on grid electricity and renewable energy options. It also fits well with the National Electrification Strategy (NES) which objective is to achieve universal energy access by 2020 and also with the Draft Renewable Energy Master Plan.

Secondly, the proposal fits with Ghana's NDC which foresees the scale up of renewable energy penetration by 10% by 2030 and the adoption of market based cleaner cooking solutions and thus fostering the sustainable use of forest resources. Finally, it contributes to the attainment of SDG 7 that is to ensure universal access to affordable, reliable and modern energy services in order to thus increase substantially the share of renewable energy in the global energy mix by 2030.

## 3.3 EnDev conceptual approach and intervention strategies per (sub)sector

### 3.3.1 Grid and Solar

Over the last two years consequently approaches for providing electricity to farms for irrigation have been pioneered, whereby a distinction was made between farms that were still relatively close to a grid-line (and as such could realistically be connected to the grid) and farms far off the grid for which solar pumping was pioneered. While technically successful, it is realised that the (predominantly bottom up) strategy, including the use of subsidies, is labour- and cost-intensive and as such is difficult to bring to scale.

### 3.3.2 ICS for Agro-processing

More or less similar, the initially only artisanal production of ICS for Gari-processing required a substantial workforce of well-trained artisans that moreover needed to be able to pre-finance relatively costly materials (locally custom-made aluminium trays), in order to serve the market in any reasonable time-frame. This became a bottleneck for up-scaling.

With the above considerations it was concluded that in order to achieve the required scale the predominantly bottom-up strategy shall be replaced-with a more facilitating role of EnDev.

The vision is, that following up on the pioneering approach pursued so far, a next phase needs to be entered in which the economic benefit as well as the improved business case of the MSMEs concerned becomes the key driver for creating access to electricity and or for investing in energy efficiency (ICS). These concerns both, the MSMEs that need to come up with own financial investment, as well as the Government that needs to create the enabling environment. In the course of this process, also financing institutions should be able to recognise a business opportunity, so that appropriate credit lines should be available.

Concepts for such altered approach now need to be developed in detail. As such and in this proposal a first 6 month period is suggested in which these concepts will be developed with the assistance of

consultants as required. If credible approaches are identified these can be pioneered in the remainder of the one year period for which an additional budget is herewith requested.

### 3.3.3 Grid Irrigation

EnDev currently supports grid connections in the Volta and Greater Accra Regions (Keta and Ada East Districts) for productive uses in irrigations through trainings and connection subsidies. Potential beneficiaries were identified, mobilised, payment and application procedures were developed together with the local and regional offices of the utility (Electricity Company of Ghana - ECG). This involved, purchasing, completing submitting application forms to ECG; carrying out installations of own electrical network by using certified installers; ECG inspecting network and assessing connection costs; customer paying contribution to ECG before the subsidy is paid by the project. The Electronic Customer Management System (CMS) installed at the utility since the beginning of 2016 enabled the speedy processing of applications and approvals. Actual connections are completed within 3 days of payment of the connection fees. To date close to 270 connections have been realised as against the target of 250.

In order to reach scale, the project will facilitate, provide policy support and initiate steps that will put the electricity distribution utility in the driving seat to effect grid connections for PUE. This may involve further improvements of the processes and procedures of the utility at all levels in three regions and supporting the training of farmers in good agricultural, irrigation and business practices where necessary.

#### **Key Intervention 1: Policy Support and Collaboration to Integrate PUE in SHEP**

The project will also collaborate with the Government (Ministry of Energy) to plan and integrate PUE needs into the Self Help Electrification Programme (SHEP 5) and target specific PUE customers in the selected regions so that they extend the networks within the reach of these customers. With regards to limited policy support the project will also follow closely the implementation of the new administration's rural development policies ('One District, One Factory' and 'One Village, One Dam') that provide further potential demand for grid electricity for productive use and participate in them and share experiences as far as possible. The new President has clearly outlined in his first state of the nation address: "We have to irrigate our lands and equip farmers with the skills needed to make farming a well-paying business. We aim to popularize farming by encouraging many people to take it up as a full or part time activity. A National Campaign, PLANTING FOR FOOD AND JOBS, will be launched to stimulate this activity. We have decided to embark upon a programme to provide water to enable all-year farming. We are calling it the one-village, one-dam policy. It is a programme that is expected to rapidly get the support of the population, and should help to transform food insecurity in our country. The three northern regions, in particular, will benefit from the availability of water to enable all-year farming, so that the enforced yearly migration can be minimized and food production become more predictable." This gives EnDev a new opportunity to participate in policy discussions and influence the choice of particular productive uses that are in line with the nexus approach (e.g. grinding, milling, cold storage, processing of agricultural produce).

#### **Key Intervention 2: Improving Utility Processes and Procedures**

In order to achieve further scale the project will now build on past results and experiences working with the utility, while keeping the agricultural and irrigation training as an accompanying measure for sustainability. Thanks to new synergies with the GIZ on-grid RE programme in Ghana (see below), EnDev Ghana will be able to work more closely with the utility and facilitate further improvements to customer service processes that enable PUE customers to apply and be connected. We will engage with key utility structures in regions and districts, support utility PUE awareness campaigns, development of standard forms and procedures, training and capacity building of key staff.

#### **Key Intervention 3: Mobilising and Capacitating FBOs and Developing Financing Options**

The project develops financing options with MFIs to support grid connections as part of their support with short-term agro-credits as a way of increasing farmer profitability. EnDev Ghana will also identify and sensitize FBOs and support with agri-business trainings that enhance their appreciation of



irrigation and the use of technology and inputs to increase productivity. The project shall focus on Central, Greater Accra and Southern Volta Regions that fall within the Southern dry Savanna. This shift to a facilitation role and the addition of one more region (Central) will enable a scaling of the approach and connect three times as many farmers as in the ongoing phase.

#### 3.3.4 Solar Irrigation Pumps

A further development of the market for solar water pumps in irrigation will involve strategic partnerships with financial institutions to introduce a financing model and as well develop and pilot innovative approaches for the small scale farmers particularly in groups, focusing on the Northern and Southern Savanna Agro-Ecological Zones. The objective is to eliminate the barriers that have been identified by the end of the pilot phase in order to achieve significant scale (10-15 times).

##### **Key Intervention 1: Development of Financing Options**

The approach to solar pumps builds on past experience and will focus on facilitating partnerships with (local) financial institutions and agencies to develop financing products to address the financing gap in a differentiated, output-based and private sector/installer-led incentive scheme. The project will also collaborate with the Powering Agriculture Project for the training of stakeholders on the use of the manual for promoting solar pumps in irrigation and the DANIDA Rural Development Fund that will provide financing to selected banks for on-lending to small scale farmers.

##### **Key Intervention 2: Piloting Innovative Approaches, Policy and Regulation**

Through consultancy support, project shall develop innovative approaches for overcoming the financing barriers to all categories of farmers. This may involve the Pay As You Go (PAYG) or the Small Irrigation Service Company (Micro-Utility) schemes. With the assistance of the consultant various options shall be identified and suitable loan products developed. The project will also engage on policy, regulation and financing solar pumping interventions with Government and other stakeholders. These approaches will help reduce the upfront costs to favour the very small scale farmer. The initial pilots shall target the following:

- Very small scale farmer (<.25ha land) for piloting the scaled down system;
- Very small scale farmers in groups (10 members and 2ha land) well organised to own and operate 1,500 W<sub>p</sub> systems;

##### **Key Intervention 3: Awareness raising and Capacitation of Installers and FBOs**

The project will facilitate and capacitate local installers and maintenance providers through awareness campaigns, trainings and partnerships that will bridge the financing gap. Such partnerships shall be between installers, finance institutions and FBOs.

##### **Key Intervention 4: Targeting Geographic Areas and Farmer Groups**

The project will target geographic areas of the Northern and Southern Savanna zones for vegetable farming during the dry season (lasting 6 to 9 months) and will differentiate between target groups in order to significantly scale up the uptake of solar pumps in irrigation.

The case for the improved chance of immediate scale-up of this component is based on the following improvements over the initial project years:

- A new Government with a specific strategy that fits (discussed in previous component)
- PV Capex have further fallen and may have reached tipping point with support and information (the tipping point without such support would be much later due to the above mentioned 'perceived risk' issue under barriers so that many farmers would invest far too late and EnDev support would minimize the resulting welfare losses by building scale and demonstrating viability ahead of time)
- Shift of support: more specific information to address the identified specific farmer investment hurdles and broader diffusion thanks to the new channels

- synergies with ongoing German bilateral TA programme on grid-connected RE implemented by GIZ (C-SIREA): while previous C-SIREA activities have focused on working with the utilities and bulk power customers in Ghana, the programme has widened this approach to include all sizes of SME, so that EnDev can use this new awareness and capacity building channel for PV fuel switch (including simple financial return on invest examples in information documents to utility clients). It is expected that offgrid PV will profit from the approach as well.

### 3.3.5 Improved Institutional Stoves for Gari, Shea and Pito Processing (implemented by SNV)

The new intervention seeks the scaling-up of the productive use of thermal energy in agro-processing. In addition to improved cookstoves for Gari processing, the scale-up seeks to incorporate new types of stoves for Shea butter and Pito production as well. SNV has extensive experience of working on ICS for these new agro-processing sectors through the implementation of the 2-year EPGAP project (2014-2015). About 350 improved woodstoves were installed under the EPGAP Project, for Shea butter production, Rice parboiling and Pito brewing in Northern Ghana and parts of the Ashanti Region through a partnership with some financial institutions and Village Savings and Loan Associations (VSLA).

Furthermore, the existing project will be up-scaled geographically to regions and districts that were not previously targeted but which have now become relevant due to the expanded scope and high potential for ICS penetration. For the total ICS target, about 30% each is projected to be installed for Gari, shea and pito processing. Apart from agro-processors, ICS for school feeding will also be targeted during the up-scaling phase. This will be linked to the Ghana School Feeding Programme. The remaining 10% of stoves is therefore allocated for the school feeding market. A key success factor in achieving the current number of stoves installed has been the partnership with the financial sector, which allowed customers to pay for the stoves in instalments. This approach will be further refined in the new phase. In the previous phase, there was an overreliance on limited ICS producers who were mainly emerging entrepreneurs. This affected the achievement of targeted stove numbers in good time and in some cases, the maintenance of product quality standards. This will be addressed by expanding the roster of producers, facilitating training sessions for them, technical assistance and award schemes. A more rigorous app-based verification process will be setup for quality assurance; GPS coordinates and a picture of all stoves will be stored and random samples will be visited to make sure quality is high enough.

The approach will shift from only artisanal stove production to include in particular industrial or semi-industrial products to achieve scale, like Burro, InStove and Envirofit. The components of these stoves are produced at scale abroad and then shipped to Ghana where they are locally assembled; this potentially leads to much higher production volumes. We will support these industrial producers with a range of services, related to demand creation, supply strengthening, access to finance, R&D and policy. Under demand, we will support them in awareness creation through multi-media campaigns. Under supply, we will provide targeted business development support and create market linkages, building on our networks. Under finance, we will provide financial incentives to the firms and we will link them to financial institutions that can provide end user finance. Under R&D, we will collaborate with testing institutions to confirm stove efficiency and emission reduction of the stoves as compared to the baseline. Under policy, we will advocate for favourable VAT and import duty regulations for (the components of) these stoves.

## 3.4 Cooperation with others

The Ministry of Energy (MOE), the Ministry of Food and Agriculture (MoFA) and the Energy Commission's SEforALL Secretariat shall be the main coordination points for all interventions. Regarding solar pumps in irrigation, the project will explore further cooperation with the international 'Powering Agriculture' project (USAID/GIZ) and liaise with NGOs and development aid agencies such

as DANIDA and USAID to focus on group financing approaches for small holder farmers as well as individuals who are willing to invest in PV pump systems above 2kW<sub>p</sub>. The project is likely to participate in a co-financing arrangement between the EU and the GIZ – Market Oriented Agriculture Programme (MOAP) on ‘productive investments in agriculture’ to provide capacity building for the dissemination of solar irrigation systems. Furthermore, the project will collaborate with others for innovative technologies that reduce the upfront costs. The project with the support of an integrated expert (CIM) will facilitate the introduction and testing of new technologies that are available. Regarding grid electricity for irrigation, ECG and the Northern Electricity Distribution Company (NEDCo) are key operational partners. At local level, the project will cooperate with the utilities’ regional, district and area/zonal offices in respective target areas. Other partners are the Metropolitan, Municipal and District Assemblies and their Agriculture Departments. With regard to cookstoves, the project will cooperate with GHACCO, SNV and the GACC in the implementation to achieve synergies. The up-scaling proposal fits in neatly with the UN’s Sustainable Development Goals (SDGs), specifically goal number 7, thus “ensure access to affordable, reliable, sustainable and modern energy for all”.<sup>10</sup> The proposal also aligns with the 2012 SEforALL Ghana Country Action Plan.

It is expected that further synergies will be created between EnDev Ghana and the new project on ‘forest landscape restoration and sustainable value chains for wood energy’ under the International Climate Initiative (IKI) of the German Ministry of the Environment (BMUB) jointly implemented by GIZ and IUCN Netherlands as of 08/2017 with regard to the institutional ICS component.

#### 4. Planned Outcomes

##### Technology 1: Grid Electricity for Small Scale Irrigation

Indicator	Target	Calculation / means of verification	
<b>Outcome indicators</b>			
No of people gaining access		EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.	
No of social institutions gaining access			
No of enterprises gaining access	375		
No of households gaining access to at least level 2 cooking systems			
No of jobs created along the value chain	67		
Renewable electrical power generation capacity installed (in W)			
Investments by households, private and public sector (in EUR)			
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)			
<b>Market development indicators</b>			
Indicator 1: Dedicated desks for PUE access established by utility (Regions, HQ and Districts)	2		
Indicator 2: At least x districts are targeted by NES for PUE access	3		

##### Technology 2: Solar Pumps in Irrigation

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		

<sup>10</sup> UN Sustainable Development Goals, URL: <http://www.un.org/sustainabledevelopment/energy/>.

<b>No of people gaining access</b>		EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
<b>No of social institutions gaining access</b>		
<b>No of enterprises gaining access</b>	300	
<b>No of households gaining access to at least level 2 cooking systems</b>		
<b>No of jobs created along the value chain</b>	35	
<b>Electrical power generation capacity installed (in W)</b>	95,000	
<b>Investments by households, private and public sector (in EUR)</b>		
<b>Annual reduction in CO<sub>2</sub> equivalents (CO<sub>2</sub>e) emission (in t CO<sub>2</sub>e)</b>	85	
<b>Market development indicators</b>		
<b>Indicator 1: Staff of financial institutions, installers, farmers, extension officers trained to use SPIS Manual and tools</b>	50	
<b>Indicator 2: At least 7 companies are selling and servicing SPIS in Ghana</b>	7	

### Technology 3: Improved Institutional Stoves for Agro-processing

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
<b>No of people gaining access</b>		EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
<b>No of social institutions gaining access (secondary target)</b>	50 Schools (averagely, about 17,000 school children)	
<b>No of enterprises gaining access</b>	225	
<b>No of households gaining access to at least level 2 cooking systems</b>		
<b>No of jobs created along the value chain</b>	30 (in ICS production, R&D, Distribution and Marketing )	
<b>Renewable electrical power generation capacity installed (in W)</b>		
<b>Investments by households, private and public sector (in EUR) (an average of €120,000 in all)</b>	€200/ICS	
<b>Annual reduction in CO<sub>2</sub> equivalents (CO<sub>2</sub>e) emission (in t CO<sub>2</sub>e)</b>	Our research showed that 1 stove reduces 17.53 tons of wood per annum. 3,945 tons of wood use will be avoided per annum for 225 stoves. This gives around 6,375 tons of CO <sub>2</sub> emissions avoided per annum for 225 stoves.	
<b>Market development indicators</b>		
<b>Indicator 1: Number of new cookstove models available for Gari and Shea/Pito/Rice par-boiling respectively. Normally, because cooking under Shea/Pito/Rice par-boiling is done with a round bottom pot, one stove could be suitable for all.</b>	2	
<b>Indicator 2: Number of stove enterprises with capacity to build either one or more of the stoves to be promoted. Thankfully, the ICS technology for Shea/Pito/Rice par-boiling is an SNV open-source technology so there wouldn't be a need to struggle over proprietary issues.</b>	5	
<b>Indicator 3: Number of financial institutions providing loans &amp; other financial services for potential users</b>	10	

## 5. Sustainability

With regard solar irrigation, a stocktaking and analysis study carried out by GFA indicates that solar irrigation is a viable and sustainable energy option for medium to large scale farms with a market

oriented approach to production. It further affirms that it has potential for small-holder groups according to pilot systems analysed. This is the key target of the proposal. These small groups are organised with ready access to markets. They are also able to apply for group loans from rural banks and MFIs. MFIs also are more comfortable lending to them if they have a good credit history. Partnerships with MFIs to develop suitable products and providing support with regard to trainings for farmer groups, installers and funding institutions will further build trust and strengthen the market leading to further sustainability and increased demand. Sustainability shall also be assured by training of installers, agricultural extension agents on the promotion, design, installation and operation and maintenance of SPIS systems. Farmers shall also be trained in good agricultural, irrigation practices, business and environmental management. These trainings will ensure sustainable use of water resources, operation and maintenance of the equipment.

With regard to grid electricity for irrigation, formation of local technical committees to receive and vet applications on site in addition to trainings in basic business and agriculture and irrigation ensures that farmers use electrical connections provided productively. This is further strengthened by the farmers' own contribution toward the irrigation system. Final approval is not given until the farmer installs the irrigation system including the electrical wiring. Electrical wiring is also to be earthed and properly terminated with circuit breakers. Farmers were able to increase production after connecting to the grid. To further enhance sustainability, subsidies shall be reduced in the next phase. Complementary trainings in good agricultural, irrigation and business practices are to further enhance sustainability. Studies have shown that access to irrigation alone does not increase productivity unless there is an increased use of production enhancing inputs<sup>11</sup>. The implementation of power sector reform which opens the way for private sector participation in electricity distribution shall introduce more competition resulting in increased efficiency of service delivery and sustainability.

The project will continually work with entrepreneurs who are already active in the sector and can assume to remain active after the close of the project. The growing demand for improved cooking solutions within the over 500,000 agro-processing industries in Ghana is not expected to decline, so demand for these stoves will remain high. Impact

Preliminary data collected on farms that practiced manual irrigation in the past recorded increased production and therefore increased income. Further, robust studies would be carried out to confirm in future. For some farmers the key impact from solar irrigation is the availability of irrigation water previously purchased in tankers to fill storage tanks for drip irrigation. These farmers therefore save costs and improve the profitability of the business. Other farmers have expanded the plot size under cultivation, in some documented cases it has doubled, because of having access to electricity for irrigation. Solar irrigation will ensure dry season cropping in Northern Ghana and sustain livelihoods and incomes.

## 6. Impact

For some farmers the key impact from solar irrigation is the availability of irrigation water previously purchased in tankers to fill storage tanks for drip irrigation. These farmers therefore save costs and improve the profitability of the business. Other farmers have expanded the plot size under cultivation, in some documented cases it has doubled, because of having access to electricity for irrigation. Solar irrigation will ensure dry season cropping in Northern Ghana and sustain livelihoods and incomes. Preliminary data collected on farms that practiced manual irrigation in the past recorded increased production and therefore increased income. Averagely, the small scale farmer (farm size 0.23ha) needs to invest a minimum of EUR 500 to cover the cost of grid connection, electric pump and irrigation pipes including installation. Estimated annual additional income due to irrigation is EUR 1,155 and

---

<sup>11</sup> Yao and Shively 2007; Smith 2001; Wichelns 2003; Morris et al; FAO 2005; Mikkelsen et al 2015; Have Suggested strong complementarities between irrigation and input intensification that lead to higher productivity and improved efficiency.

discounted O&M cost (including energy) is EUR 1,070. In 2016, grid electricity was costing the smallholder farmers in the Volta Region EUR 57/ha/month compared with petrol which costs EUR 185/ha/month during active season<sup>12</sup> (9 out of 12 months for vegetable farming). Electric water pumps are 25% cheaper to maintain than petrol pumps.

The expected goal of the institutional cookstove component is to reduce the carbon intensity of using thermal energy for agro-processing. Our overarching objective is to install 600 improved fuelwood stoves for Gari, Pito, Shea and rice parboiling in two years.

The main impacts will be:

Impact	Possible indicators
<b>Climate change</b>	<p>Avoided CO<sub>2</sub> and 'black carbon' emissions through the avoided utilization of diesel and petrol for irrigation; Reduced CO<sub>2</sub> emissions as well as substantially reduced emissions of 'black carbon' by reduced and improved combustion of biomass.</p> <p>Annual reduction in CO<sub>2</sub> equivalents (CO<sub>2</sub>e) emission (in t CO<sub>2</sub>e): 6,460 tons of CO<sub>2</sub> emissions will be avoided per annum for 225 stoves and 75 solar irrigation pumps This can lead to low deforestation, climate change, expenditure on fuelwood.</p>
<b>Environment</b>	<p>The dissemination of improved institutional cookstoves will reduce demand for firewood and thus decrease pressure on forest stocks.</p> <p>Renewable electrical power generation capacity installed (in W): 95,000 W will be installed for 75 solar irrigation pumps.</p>
<b>Education</b>	-
<b>Gender</b>	Improved institutional cookstoves offer the main women agro-processors a better working environment (less heat, smoke and PM); Reduced Usage of fuelwood allows savings, and the women also benefit from productivity improvements leading to better incomes.
<b>Governance</b>	The promotion of the 'informal' irrigation sector, which is recognized on the policy level but neglected in support schemes, is expected to contribute to increased support by the Ministry of Food and Agriculture (MoFA) and the Ghana Irrigation Development Authority (GIDA) as well as the state-owned distribution utilities ECG and NEDCo. Promoting PV-pumps for small-scale irrigation will increase awareness about the benefits of the technology among policy makers and can support the emergence of further promotion schemes.
<b>Health</b>	<p>Increasing the production of fresh vegetables supports balanced diets of smallholder families and increases affordable access to off-seasonal vegetables on local markets. Reduced indoor air pollution through improved institutional cookstoves reduces respiratory diseases and eye irritations.</p> <p>No of households gaining access to at least level 2 cooking systems: The project focusses on Productive Use of Energy (not on activities at household level).</p>

<sup>12</sup> This is based on an average consumption of 199.2 kWh per ha and the uniform, country-wide commercial tariff of GHS 0.97 (EUR 0.22 as of 1/9/2016) per kWh plus service charge of GHS 10.55 and 27.5% levies and taxes. The price of petrol is also uniform across Ghana and was GHS 3.80 on average in 2016.

Impact	Possible indicators
<b>Market development</b>	<p>Market development addresses following three areas of intervention: Sector development improved for grid irrigation which is further expected to improve with a strategic change in the approach towards a facilitation role. Medium scalability is given. Market for solar pumping systems still in early stage. Further steps envisaged to be taken through focus on financing options and groups of farmers/clusters. Scalability is good but depending on financing options and clustering. ICS has potential for scaling to other agro-processing areas, other geographic areas and for incorporating more different producers.</p> <p>target indicator 1: Grid Electricity: At least 3 districts are targeted by the Ministry for PUE access promotion  target indicator 2: Solar irrigation: at least 7 companies are selling and servicing Solar pumps in irrigation  target indicator 3: ICS: At least 2 new stove models are available on the market</p>
<b>Leverage</b>	Investments by households, private and public sector (in EUR): 1,135,000.00
<b>Poverty/livelihood</b>	<p>Increased informal irrigation increases agricultural production and thus cash revenues of smallholder farmers and has a positive effect on food security especially in the dry season. Improved income for small-scale processors of Gari, mainly women.</p> <p>No of jobs created along the value chain: 132</p>

## 7. Budget

Estimate the required budget until 31.05.2018 EUR 3,675,000 in total (additional EUR 525,000).

	EUR
1 Human resources and travelling	289,000
2 Equipment and supplies	25,000
3 Funding financing agreements/local subsidies	130,000
4 Other direct costs	23,000
<b>5 Total direct costs (sub-total)</b>	<b>467,000</b>
6 Mark up costs/administrative overheads/imputed profit	58,000
<b>7 Cost price</b>	<b>525,000</b>



## Malawi

### 1. Summary

<b>Promoted technologies</b>		stoves / solar			
<b>Project period</b>	old	12.2012 – 06.2017	<b>Budget (EUR)</b>	old	2,500,000
	new	12.2012 – 06.2019		new	3,700,000
		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		100,000	105,000	people	
<b>Cooking / thermal energy for households</b>		625,000	650,000	people	
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		0	50	institutions	
<b>Energy for productive use / income generation</b>		0	0	SMEs	
<b>Lead political partner</b>		Ministry of Natural Resources, Energy and Mining			
<b>Implementing organisation</b>		GIZ			
<b>Implementing partner</b>		Maeve, RENAMA, MBAULA network (local NGOs); United Purpose (formerly known as Concern Universal); stove producers, solar companies, distributors, PR and marketing specialists			
<b>Coordination with other programmes</b>		National Cookstove Steering Committee (NCSC), Presidential Initiative “2 Million Stoves for Malawi by 2020”, Business Innovation Facility (DFID), Africa Clean Energy (ACE) Programme (DFID), PERFORM (USAID), ECRP and DISCOVER programmes (DFID, Irish Aid & Norway) with the main implementation partners Christian Aid, United Purpose (UP), COOPI, GOAL.			
<b>Key interventions</b>		A) ICS: Support to NCSC; ensure nationwide supply of Chitetezo portable stove; scale up urban and develop rural distribution systems; market development for institutional stoves B) picoPV: umbrella campaigns; leveraging distribution; marketing services and tailor-made start-up support			
<b>Main strategic changes introduced with up-scaling</b>		<ul style="list-style-type: none"> <li>• <b>ICS</b>: portable household stoves: matching demand and supply side by scaling production and regional warehousing; rural distribution; support stoves for SI</li> <li>• <b>picoPV</b>: focus on targeted umbrella campaigns; new strategic partnerships for product distribution; building marketing capacities of solar companies, provide tailor-made start-up advice and market information</li> <li>• <b>both components</b>: more diversified partner structure</li> </ul>			
<b>Project manager</b>		Véronique Hirner ( <a href="mailto:veronique.hirner@giz.de">veronique.hirner@giz.de</a> ); Ezgi Başar ( <a href="mailto:ezgi.basar@giz.de">ezgi.basar@giz.de</a> )			

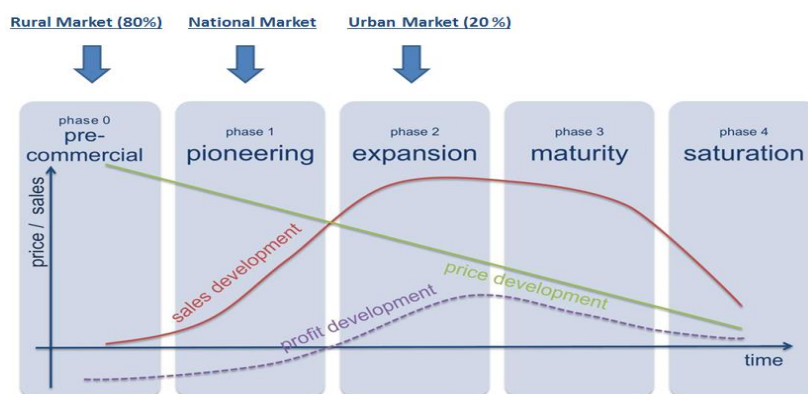
## 2. State of market/(sub)sector development

### 2.1 Improved Cookstove (ICS) Market

In the urban and peri-urban areas of Malawi, firewood is still the main cooking fuel and it is becoming scarcer and more expensive day by day. In 2013 the Malawian President declared the goal to promote **2 Million Cleaner Cookstoves by 2020**. A national taskforce was established comprising government, civil society, private sector and development partners to create a roadmap to reach the politically backed target. In 2015, this taskforce has transformed into the **National Cookstove Steering Committee (NCSC)** which is currently led by the Department of Energy of the Ministry of Natural Resources, Energy and Mining. In March 2016, with EnDev support, the Minister has launched the National Cookstove Roadmap to reach the 2 million cookstove target by 2020.

According to the NCSC monitoring system, there are currently **14 builders of fixed ICS** and **225 active production groups for portable ICS** across the country providing income for over 4,700 people (83% women). Most of them are subsistence farmers who make a complementary income from off-season stove production.

In 2014 EnDev conducted a study looking into the development of the Malawian cookstove market, using its “Energy Access Market Development Model”. This model splits the development of a market into five phases: (0) Pre-Commercial (1) Pioneering (2) Expansion (3) Maturity (4) Saturation. The study has been used as a framework for assessing EnDev’s interventions to date, as well as in determining the future interventions presented under this concept note.



**Image 1: EnDev Market Development Model for the Chitetezo Mbaula in Malawi**

On a national level, the ICS market has transitioned from the **pre-commercial** to the **pioneering phase**. This phase is typically characterized on the supply side by a smaller number of companies in the market, working through short supply chains, with generally low market penetration: the bulk of the 50,000 CM sold in the first semester of 2016 were produced by only 20 out of the 225 groups. So far, **5 large producers** with monthly outputs above 1,000 ICS have emerged.

With raising consumer awareness and expansion of stove distribution the demand for ICS in Malawi has grown exponentially. According to the national ICS monitoring system, a total of more than 500,000 ICS of different types were distributed countrywide from 2013 to 2016. The dissemination of these stoves was done through the following three approaches:

- **Commercial approach** supported through **EnDev**: EnDev’s implementing partner MAEVE has linked rural producers of *Chitetezo* stoves with urban demand. Over 126,000 ICS attributable to EnDev were sold in urban areas since 2013 through 85 formal retail outlets and roadshow sales.
- **Project driven approach**: Stoves are sold or distributed for free in rural areas and stove uptake is usually limited to the project period and geographical area. Currently over 30 NGOs include stoves in their programmes. This comprises relief aid with stoves distributed to flood victims.
- **Distribution and sales in the context of social welfare programmes**: In 2015 a new concept was explored by Irish Aid to distribute ICS for free to beneficiaries of the governmental Social Cash Transfer (SCT) programme, reaching the bottom 10% of the rural population. A first pilot resulted

in an equal number of stoves being sold to rural population in parallel to the stove distribution to SCT beneficiaries. EnDev is scaling up this approach through an RBF project implemented by United Purpose (UP). Currently UP pilots the subsidized sales of stoves linked to Public Works programmes in the context of the USAID-funded PERFORM programme.

In order to minimize the risk of destroying market development efforts through non-commercial approaches, EnDev coordinates closely with other donors and NGOs. The project lobbies for limiting free give-aways to vulnerable groups that cannot afford to buy stoves. It is important to note that without reaching out to the poorest of the poor, the national target of 2 million stoves – i.e. two thirds of all Malawian households – could not be reached. Concerns that free distribution of stoves to social welfare beneficiaries would give the ICS a poor-people's image did not prove true. Quite the contrary, free distribution of stoves have made the product known in rural areas and triggered commercial demand.

Even though the stove production grew by 43% in the past year, currently **supply still does not meet the fast growing demand**. Profits of producers start rising as various bulk buyers compete for stoves. The willingness of consumers to pay **higher prices for stoves** has also increased as benefits are better known. Fuel scarcity and hiking fuel prices in urban areas allowed a retail price increase from MWK 1,000 to MWK 1,500 (ca. EUR 1.5 to EUR 2). As another step towards a functioning market the formal retail price is no longer set by NGOs. Yet the retail price is still far from full market price. **Marketing and distribution** are still NGO-driven and subsidised by donor funds. Carbon income previewed for the stove projects have not yet materialised to substitute or complement donor funds.

However, with the business getting more commercial **VAT is becoming a barrier** distorting the market as the *Chitetezo Mbaula* sold through commercial mostly urban outlets (supermarkets, filling stations etc.) is subject to 16.5% VAT which decreases competitiveness against urban baseline charcoal stoves sold on informal markets without VAT. It is also a disincentive for larger producers to scale production beyond the threshold where they will be subject to VAT.

Various **donors and NGOs** support improved cooking in Malawi. Besides the EnDev donors, the stove sector is mostly supported by Ireland followed by the EU and the USA. The MBAULA network was created in 2012 as a platform gathering all stakeholders in the ICS and biomass energy sector.

Albeit the successes in market development that EnDev contributed significantly to the project still lags behind its targets. Until end of 2016 EnDev has facilitated the sales of a total of about 126,000 stoves translating into 206,000 beneficiaries. The current targets were set too ambitiously. Apart from the fact that initially the prospect of acquiring co-financing by Irish Aid of EUR 500,000 was factored in – which did not materialize – the following aspects were not sufficiently taken into consideration: the fast growing demand from other projects to reach the national target which producers could not keep up with, the limited absorption capacities of local partners to scale production in a short time and increasing logistical efforts when reaching out to more districts.

## 2.2 PicoPV Market

In Malawi only 9% of the population is connected to the national electricity grid, the rural electrification rate being as low as 4%. This means that 3.15 million households in Malawi do not have access to electricity. Those that are connected to the grid face frequent load shedding and blackouts. Despite the obvious need for affordable and durable energy solutions, the **market for picoPV** is relatively **immature**. It is estimated that about 13% of off-grid households (400,000 HH) are using solar lighting<sup>13</sup>. However, this includes also solar products of unknown and uncertified quality. Currently, there are **7 companies and NGOs** that market and distribute Lighting Global certified picoPV products.

EnDev has been supporting the picoPV sector in Malawi since 2015. Despite all the market challenges, a total of over 30,000 systems were sold with EnDev support, rising from 4,700 in the second half of 2015 to nearly 25,000 in 2016. This represents a tremendous success of EnDev's activities in the PV

---

<sup>13</sup> Off-grid lighting and phone charging study, Business Innovation Facility (BIF), August 2016.

sector considering the low financial investment by the project amounting to only 15% of Malawi's budget spent until end of 2016.

The big majority of the solar systems have been sold by the social enterprise SunnyMoney. Two companies, SunnyMoney and Recapo, both offer PAYG-solutions to allow consumers to pay systems in instalments and therefore reduce the entry barrier for the initial capital investment. The concept shows promising response on the consumer side, however, Recapo lacks capacities to scale the business. SunnyMoney has piloted the business model with small picoPV units and is planning to roll it out in several districts in 2017.

Most of the private sector actors in the picoPV business in Malawi have limited business skills (marketing and finance) and struggle with the high cost of distribution into rural areas. The majority of the businesses rely on donor funding to recover their operational expenses. The inability to pass on the increased cost to the consumer has further eroded already thin profit margins. Some commercial actors start shifting their focus to larger PV-systems and appliances for the institutional market. Limited market intelligence, especially on consumer insights, results in inefficient marketing strategies.

Solar products are charged 16.5% VAT, which negatively impacts the affordability of solar products, but also leads to unfair competition between NGOs that are exempt from VAT and (social) enterprises that are not. Although officially exempt from import duties, companies report that customs clearance is time-consuming due to an unclear definition of what constitutes a (pico)PV product. Quality standards are ill-defined and insufficiently reinforced, leading to an influx of substandard products. The Renewable Energy Industry Association (REIAMA) has been dormant. Therefore, there are no formal advocacy activities on behalf of the picoPV sector in Malawi. A steep devaluation of the Malawian Kwacha – 350% over the past 5 years – has not only significantly increased the local prices of solar lamps, but also negatively impacted the purchasing power of consumers due to increased cost of living.

The lack of foreign currency in 2012 led to a fuel shortage and caused rural consumers to substitute paraffin for low quality torches that are now the dominant source of lighting. Unlike kerosene, a low quality torch is a challenging competitor, as the main arguments favouring solar energy (health and safety) do not apply and other key arguments (cost savings, quality of lighting) become less relevant. In addition, prevalence of substandard solar products has caused mistrust and a hesitance to invest in higher-priced and certified quality picoPV products among consumers. With a base interest rate of 34% in Malawi, access to finance represents one of the main challenges for business as well as for consumers.

Despite its challenges, the Malawian market for household solar systems bears great potential: With its high population density the existing infrastructure serves more people in a smaller catchment area than in neighbouring countries which leads to comparatively lower distribution costs. Retail chains, like Chipiku Stores, Farmers World and Agora, offer an organized distribution channel up to peri-urban areas, whereas a network of Village Savings and Loan (VSL) groups offer a potential entry-point into 600,000 households in rural communities as well as a solution to overcome the up-front investment barrier. Rural penetration of mobile phones is estimated at 30% to 50%; mobile money penetration is low but increasing. The telecommunication and mobile money companies are starting to become aware of the potential business opportunities linked to solar products.

So far, only few donor activities are targeting the off-grid solar market: DFID's regional Africa Clean Energy (ACE) Business programme is currently working on policy advice with a specific focus on VAT exemption for solar systems. It has started providing business support since beginning of 2017. The World Bank initiative Scaling-up Renewable Energy in Low Income Countries Program (SREP) will start implementation in Malawi in 2017, including picoPV, however, not being a priority.

### 3. Intervention strategy

EnDev will continue supporting the improved cookstove as well as the picoPV sectors in Malawi.

### 3.1 Market development vision

#### ICS

- By 2020 market volume has steadily increased to reach the presidential goal of 2 million stoves.
- An annual production of 500,000 ICS with an average life span of 3 years is sustained to service at least 50% of the estimated 3 million households. The bulk of the supply comes from a dozen full-time professional stove producers in strategic locations, which produce at least 2,500 stoves per month throughout the year on a semi-industrial level.
- Stove production and warehousing capacities are geographically spread across the country to ensure sustainable access to ICS for all, minimise transport costs and buffer seasonal discrepancies between supply and demand.
- Stove production is a reputable and profitable business, allowing investment into marketing and increased production capacity out of proceeds.
- The value chain from supply to retail functions on a commercial basis and markets are economically viable without donor support, for both household and institutional stoves.

#### picoPV

- Solar companies have progressed towards sustainable and scalable business models that can absorb (donor) funding.
- Consumer finance mechanisms are available through PAYG solutions and loans offered by Village Savings and Loan (VSL) groups.
- Wide-spread and trusted marketing and distribution channels are in place that generate sales traction and attract picoPV manufacturers and larger, more capitalized enterprises to start business in Malawi.
- Consumers are able to differentiate high quality solar systems from substandard products and appreciate the value of Lighting Global certification.
- PicoPV allows consumers to get acquainted with and gain trust in solar technology, which paves the way for demand for larger solar products over time.
- A rich market database is available with sales data and consumer insights to attract stronger manufacturers and distributors.

### 3.2 Fit with policy ambitions and plans for energy access and climate change, in particular with SDG7/SEforALL country plan and NDC

EnDev Malawi has been supporting the National Cookstove Steering Committee (NCSC) by undertaking the coordinator role since 2015. The NCSC has been working towards the Malawian national cookstove target of “2 million cookstoves by 2020” since 2013. During this period, the NCSC developed a National Cookstove Roadmap with the support of EnDev and other stakeholders in the Committee. Since its endorsement by the Government, EnDev has supported its implementation in all targeted areas: Through the organisation of the yearly Cleaner Cooking Camp event EnDev and NCSC are building the capacities of Malawian cookstove stakeholders. By supporting the MBAULA Network, EnDev strengthens the national advocacy and communication for cleaner cookstoves in Malawi. Irish Aid and EnDev supported the start of quality assurance mechanisms for cleaner cookstoves by forming a stove testing team in the country. Finally, EnDev has also contributed to the review and harmonization of relevant policy and regulatory frameworks that are under development in the country as mentioned below.

During 2016, the Malawian Ministry for Natural Resources, Energy and Mining has been working on two important policy documents: the National Energy Policy and the National Renewable Energy Policy, which are expected to be launched in 2017. Both of these policies took the National Cookstove Roadmap as the guiding document to feed into the biomass sections thanks to the efforts of EnDev and other NCSC stakeholders. The Malawi SEforALL agenda is currently under development; amongst others it sets (biomass) cooking energy and off-grid electrification through PV as priority areas. Both, the SEforALL action agenda and the National Energy and Renewable Energy Policies, clearly indicate

the increased reduction of biomass consumption in the country as one of the essential action points. Moreover, the promotion of picoPV systems is also included under the action agendas of all policy documents to support off-grid electrification towards universal electricity access by 2030 as SDG7 indicates. Activities to promote picoPV systems are foreseen to be mostly undertaken by development partners.

According to its Intended Nationally Determined Contributions (INDC), Malawi aims to reach by 2030 more than double of the current amount of PV systems installed and to augment its national forest cover by 2%.

### 3.3 EnDev conceptual approach and intervention strategies per (sub)sector

#### Component A – Improved Cookstoves (ICS)

In order to achieve the “Vision 2020”, EnDev will continue supporting the NCSC, professionalizing and scaling-up stove production while strengthening distribution to urban markets. So far EnDev assumed some of the logistics and costs of distribution as a contribution for the market development in the pre-commercial phase. For the next phase donor reliance needs to be reduced while transitioning to full recovery of costs for logistics of distribution from end user prices of stoves. Costs should be reduced through denser supply networks and shorter supply chains. Costly feeder transport from rural producers to regional warehouses needs to be assumed by the private sector. This will lead to increased stove prices to further enhance profitability along the value chain, which is key for the long-term sustainability of continued stove supply. EnDev will support this transition and further support the sector development by adding new components that target **rural markets** where around 80% of the population live. This will be achieved by building on, and creating synergies with, the ongoing EnDev-RBF programme. Moreover, EnDev will work to enhance markets for fixed institutional stoves in the context of school feeding programmes.

#### A1: Support to the National Cookstove Steering Committee (NCSC)

EnDev will continue rendering secretarial and policy advisory services to the NCSC. This includes lobby-work for VAT exemption of locally produced ICS, regular updating of the Malawi national cookstove database to monitor the achievement of the national cookstove target, support in quality assurance of ICS and sensitizing government and the public about ICS benefits. Further EnDev will support the organisation of the annual Cleaner Cooking Camps and national awareness campaigns.

#### A2: Ensure sustainable nationwide supply of the *Chitetezo Mbaula* (CM)

EnDev will strategically support the increase of both geographical coverage and production volumes:

- Establish **mechanisms to coordinate supply and demand** for the *Chitetezo Mbaula* according to regions. This shall minimise transport, increase profitability and satisfy bulk orders. Initially EnDev will support the MBAULA network in this coordination role. Once that demand is directly linked to producers in their vicinity it is expected that no further coordination will be required.
- Regional warehousing is seen as a strategic element to serve as **logistical hubs** to consolidate consignments, reduce transport costs, build stock and buffer seasonal supply variations to enhance capacity for bulk orders. A priority is to establish a warehouse in the Southern region close to most of the SCT demand. Producers there will need to be kept incentivised to maintain production after the end of the SCT-stove project. EnDev will explore potential cooperation with corporate agricultural entities to utilise spare **storage capacities** in their off-seasons.
- Enhance **professionalization of ICS production**: another 5 large scale producers will be brought to a monthly production of 1,500 stoves or above. Selection criteria will be defined with partners and will include production performance, readiness for co-investments and geographical suitability of production sites. A loyalty programme for producers will be created by EnDev partners to ensure their own access to stove supply. Learning from the success of EnDev Tanzania, a stove point system will be introduced to incentivize the best



performing stove businesses and help them to take their business forward with tailor-made needs-based investment into production assets, storage capacity or business development.

#### A3: Scale up distribution and sales of the CM in urban / peri-urban areas

On the sales side EnDev will further strengthen the cooperation with existing commercial retail partners and will identify additional ones. EnDev will continue supporting sales staff incentives, roadshows, door-to-door sales and informal outlets. Stove producers will be encouraged to find own transport to deliver smaller quantities of stoves to regional warehouses where larger consignments will be consolidated. This should allow more cost-efficient transport with hired larger trucks on the main routes and eventually bring in entrepreneurs to manage this on their own.

In order to respond to specific urban demand EnDev will explore opportunities to start promoting additional technologies already available on the market. This might include upmarket improved woodstoves to cater for more affluent urban customers and larger efficient stoves for restaurants and street food vendors.

#### A4: Support Commercialisation of CM in the Rural Market

So far EnDev has concentrated on (peri-)urban markets where firewood is a commodity. Even though the rural market is in the pre-commercial phase, the 80% of rural population offers a big potential to reach the two million ICS goal. To tap into that potential EnDev will build on the CM supply chains which are strengthened in the eight districts targeted by the SCT programme through the EnDev RBF. With additional funding EnDev will increase the number of commercial sales carried out in parallel with the SCT distribution. Sales will be made by rural stove vendors identified in the context of the RBF project, through rural shops, roadshows or by the production groups themselves right at the production sites. Bundling interventions of the RBF-SCT programme and commercial sales is expected to raise stove visibility and market penetration in the target districts to up to 30%. This will in turn build the basis for a sustainable rural ICS market.

#### A5: Market Development Support for Institutional Stoves

GIZ's Nutrition and Access to Primary Education (NAPE) as well as the Food and Nutrition Security Programme (FNSP) are supporting school feeding programmes. They have approached EnDev for assistance to support them in introducing improved cookstoves at schools. The *Mayankho* stove, a fixed brick stove that evolved from EnDev-ProBEC, is now in high demand. However, there is only a handful of certified expert builders across Malawi who are not linked to potential clients. In addition, they have partly lost technical skills after long periods of inactivity, resulting in poor stove quality. EnDev will increase the capacity of institutional ICS builders to become certified builders (including after-sales services). Further, EnDev will link the ICS builders with existing demand (e.g. *Marys Meals*, WFP, Welthungerhilfe and Government initiatives like the *Girls Wards*), support them in marketing efforts and create an institutional stove builder database. The support of institutional stoves will be carried out with a very limited budget. EnDev will mainly play a facilitating and advisory role building on EnDev-ProBEC's previous experiences. By supporting the institutional stoves it is expected for EnDev to enhance its visibility and the awareness about improved cookstoves in non-energy related sectors in Malawi.

### **Component B – picoPV**

Currently, the EnDev support is exclusively focused on rural marketing and distribution. However, learnings from experience suggest that in order to create a sustainable market, a more integral approach is required: Apart from marketing and distribution support, EnDev will provide market intelligence. Marketing efforts will be more focused in order to effectively address all purchase barriers. As the market is still young, more regular market monitoring is necessary to learn and identify best practices. Therefore, EnDev will follow a dynamic continuous learning approach based on the principles *design-test-evaluate-adapt*. EnDev will actively engage the solar businesses, partners and stakeholders in the design of activities and jointly evaluate them in periodic stakeholder meetings. As detailed below, EnDev Malawi's key interventions will focus on nation-wide umbrella campaigns, leveraging sales and distribution and marketing support for companies. Additionally, in close

collaboration with the DFID Business Innovation Fund (BIF), EnDev will inform businesses about grant opportunities and provide support to access them.

#### B1: Targeted Nation-Wide Umbrella Campaigns

EnDev used to offer tailor-made marketing support to each company according to its specific business strategy. This turned out to be time-consuming, costly and not always to the consumer's advantage due to the limited selection of products. Instead, EnDev has started to move towards creating nation-wide umbrella campaigns promoting the whole range of solar products equally while protecting the end user interest. EnDev will apply qualitative research to create an insight-based marketing campaign. This will ensure that promotion is based on an in-depth understanding of consumer needs, desires, purchase drivers and barriers. For campaign implementation EnDev will diversify the implementing partners and invest in building marketing capacities within solar companies. In order to maximize effectiveness and efficiency, the campaigns will be linked to major volume driver events (e.g. harvest, Christmas, mother's days) and only be implemented in suitable regions where the companies ensure the stock, and where ideally there are end user financing tools already established. The marketing campaign will focus on creating end user awareness on high quality products and ultimately ensuring the consumers building trust in solar energy.

#### B2: Leveraging Sales and Distribution through Strategic Partnerships

EnDev will transition from supporting businesses individually in distributing products to rural areas towards leveraging effective, well-established sales and distribution channels for picoPV systems. This will be done via strategic partnerships. Apart from commercial retail outlets, EnDev will also explore the opportunities with Village Savings and Loan (VSL) groups and telecommunication companies. Those offer trusted and well-established distribution channels into rural communities, and in the case of VSL groups also offer a solution for consumer financing. The telecommunications companies provide an opportunity for targeted marketing campaigns based on expenditure on mobile phone credit and mobile money and also offer the possibility of introducing PAYG business models.

Different solar businesses have already started developing partnerships with VSL groups; however these approaches would need to be further developed to be brought to scale. EnDev's role will be to link different partners, share good practices from other countries, invest in market research to identify and validate market opportunities and facilitate pilot projects to test different models and develop learnings and best practice.

#### B3: Fee-based Marketing Services and Tailor-Made Support to Start-Up Companies

EnDev's main strategy will focus on umbrella campaigns; however, most of the solar companies lack human and financial resources for their marketing strategy. In order to motivate the companies to start investing in their marketing, EnDev will introduce a small fee-based private support service alongside the umbrella campaign to be offered by EnDev's implementing partners.

Since the Malawian solar sector is in its infancy, there will be an additional tailor-made support for new start-up companies. This will be delivered in close coordination with DFID's Business Innovation Fund (BIF). Ideally, the BIF will first work with companies to validate their strategy and business model, after which EnDev will provide initial support in the execution of the marketing strategy. EnDev will put a stronger emphasis on linking support to companies' performance in order to increase the cost efficiency while supporting market development.

### 3.4 Cooperation with others

On the **Government** side EnDev closely cooperates with the Department of Energy of the Ministry of Natural Resources, Energy and Mining to influence policy and programmes. In the **ICS** sector EnDev is mainly cooperating with the NCSC, with Irish Aid as one of EnDev's front-running partners on improved cookstoves as well as with the MBAULA Network to mainstream cooking energy and increase supply and demand of stoves. More synergies with strategic partners like Total Landcare will be sought to couple ICS sales with access points for sustainable cooking fuel. For institutional stoves, a network will be created to enhance cooperation among stakeholders. EnDev will continue mainstreaming clean cooking among programmes dealing with food security, sustainable agriculture, reduction of hunger



and poverty, such as 'Feed the future' or others. In the **solar** component EnDev collaborates very closely with the DFID funded Business Innovation Fund (BIF) as described above. By the end of 2016, the Government of Malawi signed the DFID Energy Africa Compact aiming at policy reforms for the solar sector. EnDev will closely coordinate with DFID's ACE programme, EnDev's efforts to professionalize solar companies paving the way for solar companies to absorb the funds made available to solar businesses through ACE. Recently many NGOs, especially those that support VSL groups such as Trocaire, Christian Aid, and those that take an interest in Renewable Energy in the context of Climate Change and Adaptation such as United Purpose, commence integrating picoPV products into their projects. EnDev has already started collaborating with several of them.

## 4. Planned Outcomes

### Technology 1: Improved Cookstoves

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	+25,000	<u>Access</u> : reasons for limited no. of additional beneficiaries: initial target too ambitious due to expected co-financing, production increase slower than demand increase, low absorption capacity of implementers.
No of social institutions gaining access	+50	
No of enterprises gaining access	0	
No of households gaining access to at least level 2 cooking systems	0	
No of jobs created along the value chain	+ 18	
Renewable electrical power generation capacity installed (in W)	n.a.	
Investments by households, private and public sector (in EUR)	+ 112,212	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	+ 16,532	
<b>Market development indicators</b>		
<b>Indicator 1</b> In 2018 at least 10 semi-industrial groups produce each on average 1,500 ICS per month (2016 baseline: 5).	10 groups	Sales records (checked by EnDev)
<b>Indicator 2</b> There are at least 150 formal commercial retailers (e.g. supermarkets, filling stations) of Chitetezo Mbaula stoves in Malawi (2016 baseline: ~95)	150 retail branches	Monitoring by implementing partners
<b>Indicator 3</b> 2 regional warehouses for Chitetezo Mbaula are in operation (2016 baseline: 0)	2 warehouses	EnDev monitoring

## Technology 2: picoPV

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	+ 5,000	<p><u>Access</u>: no. of add. beneficiaries very low because of the fact that at the time of definition of old target a complete household (i.e. 5 persons) was counted per sold system independently of system capacity/ tier, i.e. 20,000 systems were initially targeted to be sold to achieve 100,000 people. (To date over 30,000 systems sold and a total of 62,000 systems are targeted).</p> <p><u>Investment/CO<sub>2</sub>/Watt</u>: 62,000 add. picoPV systems: investment, CO<sub>2</sub> and Watt figures projected based on average types of systems sold in 2016/12</p>
No of social institutions gaining access	0	
No of enterprises gaining access	0	
No of households gaining access to at least level 2 cooking systems	0	
No of jobs created along the value chain	+ 100	
Electrical power generation capacity installed (in W)	+184,248	
Investments by households, private and public sector (in EUR)	+ 773,220	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	+ 3,178	
<b>Market development indicators</b>		
<b>Indicator 1</b> EnDev partner companies increase their sales of small SHS <sup>14</sup> by at least 100% in the second semester of 2018 (baseline: total no. of SHS sold in second semester of 2016: 189)	at least 378	Sales records from partner companies gathered by EnDev
<b>Indicator 2</b> At least one commercially viable PAYG company with scalable business model in the country (baseline: RECAPO with non-scalable business model); first piloting of small systems by SunnyMoney)	at least 1	Information by the DFID BIF & Sales records
<b>Indicator 3</b> At least three companies are making use of fee-based marketing services to invest in marketing strategies and/or materials (baseline: 1 company)	at least 3	EnDev monitoring

## 5. Sustainability

**ICS:** The planned interventions are designed to move towards a commercial cookstove market with semi-industrial and commercial enterprises. Reduced logistic costs by densifying the supply networks and establishing warehouse hubs will help making the stove production a more profitable business. Targeted market penetration rates of 30% in rural areas covered by the project combined with urban

<sup>14</sup> Solar systems with a few lamps and at least a phone charging device (as opposed to single solar lanterns or lanterns with phone charging function)

market expansion is expected to give the stove a visibility that will create long-term demand. The efforts to match supply and demand, identify shortfalls in supply and enhance coordination will ensure continuous growth of the stove market. The institutional stove builder database should ideally continue under the lead of the Department of Energy to be connected with the future District Energy Officers. With the Government objective of 2 million cleaner stoves till 2020, the Department of Energy takes the lead of the National Cookstove Steering Committee, which is a sign of commitment of the Government of Malawi.

**picoPV:** As mentioned in the previous sections, EnDev Malawi’s picoPV project is designed to create solid and proven concepts in rural marketing and distribution, which the private sector may adopt afterwards. The periodic meetings, that will be used to discuss learnings and best practices, will help to build the commercial capacity and hence, sustainability of the current private sector. EnDev encourages solar companies to start investing gradually in their marketing materials and promotions to be able to create their own long term sustainable marketing strategy. Via strategic partnerships with retail chains, telecommunication companies and possibly MFI, EnDev aims to leverage well-established distribution networks and trusted, reputable brands to build financially viable and scalable models that generate sales traction and that will attract larger and well capitalized organizations. By closely collaborating with BIF and by investing in market intelligence and capacity building EnDev helps the private sector to improve their financial viability and scalability so they can absorb the grant money that will come into the country as part of the DFID ACE programme. Building market intelligence, in terms of quantitative data and qualitative market insights, will further help to attract manufacturers and investors to Malawi.

PicoPV systems are the entry level energy access technologies which will allow consumers to gain experience with solar products. Ultimately, the first experience with solar energy will create an end user demand for larger solar systems.

As mentioned further above, the devaluation of the local currency has been a challenge for solar companies and can put the business model at risk. Companies mitigate that risk by limiting their import quantities which in turn may lead to increased consumer prices. However, since more than a year the currency has stabilized.

## 6. Impact

Results from an impact survey on the Chitetezo from EnDev’s regional RBF programme conducted by the University of North Carolina are expected for end of 2018. For the picoPV component EnDev plans to conduct simple impact surveys using the EnDev tablet application in 2017 or 2018.

Impact	Possible indicators
<b>Climate change</b>	Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e): 70,000
<b>Environment</b>	67,000 tons of firewood saved within one year reduce deforestation in the country. In 94,000 households the use of dry-cell batteries and their unsafe disposal are avoided. Renewable electrical power generation capacity installed (in W): 289,000
<b>Education</b>	Improved lighting in 94,000 households creates the opportunity to increase study and reading hours by an average of 5 hours per day. <sup>15</sup> 81% of households using solar devices own a mobile phone as opposed to 58% in other households. This enables people to have easier access to information.
<b>Gender</b>	Through more efficient cookstoves women in rural areas spend less time for collecting firewood and the risk associated with it (assaults and rape). Especially women benefit from reduced health risks (see below).

<sup>15</sup> According to the *Off-Grid Lighting and Phone Charging Study* conducted by BIF (2016), off-grid households that are using solar lighting, are using lights about seven hours per day as opposed to two hours per day of usage of other light sources in other households.

<b>Governance</b>	Improved coordination in the stove sector; through NCSC's contributions the Government improves policy formulation and implementation in the sector; more evidence for policy decisions are available through the nationwide monitoring of stove and picoPV markets; EnDev supports lobbying efforts for picoPV system and stove tax exemptions.
<b>Impact</b>	Possible indicators
<b>Health</b>	Cleaner cookstoves lower the health risks in 363,000 households by reducing indoor air pollution in the form of unhealthy smoke and particle emissions. This benefits especially women and children under the age of 5. Both through substitution of three-stone fires with improved cookstoves and candles and kerosene lamps with solar lamps up to 457,000 households benefit from reduced lighting and fire hazards.
<b>Market development</b>	<p><u>ICS</u></p> <p>target indicator 1: In 2018 at least 10 semi-industrial groups produce each on average 1,500 ICS per month (2016 baseline: 5).</p> <p>target indicator 2: There are at least 150 formal commercial retailers (e.g. supermarkets, filling stations) of Chitetezo Mbaula stoves in Malawi (2016 baseline: ~95)</p> <p>target indicator 3: 2 regional warehouses for Chitetezo Mbaula are in operation (2016 baseline: 0)</p> <p><u>picoPV</u></p> <p>target indicator 1: EnDev partner companies increase their sales of small SHS<sup>16</sup> by at least 100% in the second semester of 2018 (baseline: total no. of SHS sold in second semester of 2016: 189)</p> <p>target indicator 2: At least one commercially viable PAYG company with scalable business model in the country (baseline: RECAPO with non-scalable business model; first piloting of small systems by SunnyMoney)</p> <p>target indicator 3: At least three companies are making use of fee-based marketing services to invest in marketing strategies and/or materials (baseline: 1 company)</p>
<b>Leverage</b>	Investments by households, private and public sector (in EUR): 2,000,000
<b>Poverty/livelihood</b>	<p>The promoted Chitetezo stove can save approximately 40% of firewood as compared to the traditional three-stone fire used. This reduces expenditures in urban areas where people pay for firewood, making more income available for other household expenses. Stove production has evolved into a major coping strategy for rural families to make up for shortfalls from agricultural production increasingly affecting the country due to climate change. Over 4,700 people out of whom 83% are women earn income from the Chitetezo production. This helps rural families manage seasonality of agricultural activity and income. Through the further professionalization of the business focussing to scale-up production of best-performing producers, more full-time employment and income will be created.</p> <p>No of jobs created along the value chain: ICS: additional 18; picoPV: additional 100 jobs</p>

<sup>16</sup> Solar systems with a few lamps and at least a phone charging device (as opposed to single solar lanterns or lanterns with phone charging function)

## 7. Budget

The required budget for the project to run until 30.60.2019 is estimated at EUR 3,700,000 in total.

Cost Category		EUR
1	Human resources and travelling	330,000
2	Equipment and supplies	13,500
3	Funding financing agreements/local subsidies	715,000
4	Other direct costs	37,062
5	<b>Total direct costs (sub-total)</b>	<b>1,095,562</b>
6	Mark up costs/administrative overheads/imputed profit	104,438
7	<b>Cost price</b>	<b>1,200,000</b>

## Peru

### 1. Summary

<b>Promoted technologies</b>		grid/solar/stoves /other			
<b>Project period</b>	Old	06.2009 – 06.2018	<b>Budget (EUR)</b>	old	16,920,000
	New	06.2009 – 06.2019		new	17,520,000
		<b>old targets</b>	<b>new targets</b>		
<b>Energy for lighting / electrical appliances in households</b>		325,000	702,233		people
<b>Cooking / thermal energy for households</b>		906,500	1,351,618		people
<b>Electricity and/or cooking / thermal energy for social infrastructure</b>		6,808	6,808		institutions
<b>Energy for productive use / income generation</b>		9,168	14,618		SMEs
<b>Lead political partner</b>		Ministry of Energy and Mines (MINEM)			
<b>Implementing organisation</b>		GIZ, Practical Action, Caja Arequipa and Inter-American Institute for Cooperation on Agriculture (IICA)			
<b>Implementing partner</b>		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, micro-finance institutions (MFIs)			
<b>Coordination with other programmes</b>		Global alliance of clean cookstoves (GACC), FONER (World Bank & MINEM), Improved cookstoves - United Nations Development Programme (UNDP) , Energy and Access (OLADE), QoriQ'oncha (Microsol), ProAmbiente (GIZ Peru), FONCODES (MIDIS), FISE (OSINERGMIN), National Programme for Rural Electrification, National Training Service for the Construction Industry (SENCICO)			
<b>Key interventions</b>		<ul style="list-style-type: none"> <li>• Technological development of last mile distribution channels for energy access technologies (EAT).</li> <li>• Technical assistance to scaling-up projects of the Government of Peru (GoP) concerning improved cookstoves (ICS) and solar home systems (SHS).</li> <li>• Technological innovation, standardization and validation in cooperation with academia and regulatory authorities.</li> <li>• Capacity development for entrepreneurs and partner institutions.</li> <li>• Development of information, education and communication strategies for energy access projects among public and private partners.</li> </ul>			
<b>Main strategic changes introduced with up-scaling</b>		<p>The project will focus on phasing out its activities until end of 2018 by:</p> <ul style="list-style-type: none"> <li>• Finalizing the transfer of knowledge to government institutions that implement improved cookstoves (ICS), solar home systems (SHS) and household wiring installation (HWI) programmes.</li> </ul>			

	<ul style="list-style-type: none"> <li>• Transferring knowledge to FASERT to continue and guarantee self-sustainability of the fund beyond EnDev.</li> <li>• Providing knowledge exchange to other countries in the region.</li> <li>• Consolidating the establishment of financial instruments.</li> <li>• Finalizing the transfer of knowledge to actors within the distribution chain.</li> <li>• Offering EnDev HQ knowledge and tools in i) the development of monitoring online platforms (SIMENDEV), ii) social and political communication strategies and iii) green microfinance.</li> </ul>
<b>Project manager</b>	Dr. Ana Isabel Moreno Morales, <a href="mailto:ana.moreno@giz.de">ana.moreno@giz.de</a>

## 2. State of market/(sub) sector development

EnDev Peru focuses on energy access markets for the following five technologies:

- Improved cookstoves (ICS): potential market estimated at 2.5 million households<sup>17</sup>
- Solar water heaters (SWH): potential market estimated at 0.5 million households<sup>18</sup>
- PicoPV: potential market estimated at 0.5 million households<sup>19</sup>
- Household wiring installations (HWI): potential market estimated at 0.5 million households<sup>20</sup>
- Solar dryers and pumps: potential market estimated at 0.5 million farmers (50%-50%)<sup>21</sup>

The markets for each technology have distinctive features and face different barriers. At present, EnDev has strengthened 20 importers, 12 manufacturers, 44 assemblers, 9 distributors and nearly 106 retailers – all of them dealing with at least one or more technologies. In addition, more than 15 MFIs (regulated and non-regulated) are offering microloans for EAT. The retail market for the above mentioned shows an increasing trend in the last two years (2015-2016), since more technologies were sold in this period than in the six previous years (40,000 vs 30,000) without any subsidy for the final user (whereas all other reported technologies were provided through governmental programmes with EnDev support).

### 2.1 Improved cookstoves

Before EnDev entered the country, there was almost 30 years of experience with several ICS initiatives in the country, however none of them from the energy access or market-based approach perspective. There were no official specific quality criteria or any institution that normed or regulated these technologies and, all kind of materials or installation services were part of donations without local involvement.

The supply, demand and supporting functions of the ICS market have evolved greatly since 2009. In the first two years, social programmes from public and private institutions were the main clients on the ICS market implementing projects that installed around 200,000 ICS. 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 by the GoP. In that time, the first Programme of Activities for carbon credits (PoA) for ICS was launched worldwide by Microsol in Peru aiming to use the yearly cash-flow for operation and maintenance (O&M) matters. Unfortunately after two years, the price of carbon credits dropped significantly,

<sup>17</sup> Source INEI: National Censuses 2007: XI Population Census and VI Household Census.

<sup>18</sup> Source: EnDev estimation.

<sup>19</sup> Source: General Directorate of Rural Electrification, MINEM.

<sup>20</sup> Source INEI: National Households Survey 2014, General Directorate of Rural Electrification.

<sup>21</sup> Source INEI: National Agricultural Census 2012.



leaving an unsatisfied demand for O&M, as the Berkeley Air Group stated in 2016 after testing ICS in the field that had been built at least five years ago.

With this institutional effort, which helped considerably to strengthen the supply of quality ICS and raising awareness among the target population, the ICS market evolved attending both the institutional as well as the slowly but steadily increasingly retail demand. To further support the supply side meeting the scattered retail demand, der Fond **Fondo de Acceso Sostenible a Energía Renovable Térmico** (FASERT) was created by EnDev in 2014 and a Results-based financing (RBF) component for portable ICS launched in 2015 both aiming to diversify the technological alternatives for the retail market. Until recently, only fixed ICS were common in Peru, but with the RBF and through FASERT portable ICS have now been introduced in the country reducing technology costs and decrease logistical and quality barriers, that are faced when retailing fixed ICS. In addition, in 2014 also MFIs started supporting the ICS market adding the important missing gap of end-consumer financing to the market that until then had not been served.

Today, at least 12 out of 24 regions in Peru have local companies attending social programmes and retail demand with fixed and portable ICS. In addition to its programmes promoting and distributing fixed ICS, the Government of Peru has launched i) a first tender for nearly 10,000 portable ICS and ii) an “off-grid NAMA” for rural cooking, electrification and thermal comfort. Both developments constitute great business opportunities for international manufacturers as well as the 2 local importers, 7 national manufacturers, 4 wholesalers, 12 assemblers and nearly 40 retailers that work actively in the market of ICS. The retail demand continues being supported by the microfinance sector represented by 4 MFIs, 10 agricultural cooperatives and almost 50 village banking units.

## 2.2 PicoPV and Solar Home Systems (SHS)

Over the last years, decreasing prices for solar panels and SHS components have stimulated the market solar worldwide. Peru has not been an exception and many different solar products have now entered the local market. A sizeable black market for panels and batteries has developed, offering low quality solutions without after sales service but serving an increasing demand that is looking for low-price products. This puts the solar technology reputation at a serious high risk. However, there are 3 importers that have developed their sales markets for picoPV systems at regional level in addition to 7 distributors and nearly 60 retailers that now provide quality picoPV systems. They focus on high-quality products with local technical service in order to build customers’ loyalty and to further develop a regional commercial retail network. The potential market for retail sales is huge: at least 500,000 households will not be attended by governmental SHS fee-for-service models or grid extension and will therefore remain without access to electricity for the next 10 years.

SHS importers, on the other hand, concentrate their efforts mainly on large public and private projects offering sophisticated engineering services. Thereby they largely leave the SHS retail market in the hands of the black market. Three solar companies share among themselves 90% of the Peruvian SHS market. All three have strong experience in public tenders and have installed almost 25,000 SHS in the last six years as part of a government fee-for-service model, where households pay a subsidized flat monthly tariff to a local utility without becoming the owner of the SHS. The operation and maintenance for these systems is provided by regional utilities (equally as for the national grid). However there are problems regarding customer satisfaction: households can use the energy for lighting purposes only, because no DC-appliances are available in the local market, leaving lots of energy unused and other energy needs unsatisfied. The market for SHS may become obsolete in the short to medium term taking into account the development of larger picoPV systems (in Peru referred as “mini PV”), which cover the same performance as SHS, but come at a lower price and complexity while at the same time offering higher quality. These technologies, however, are not yet widely available in the Peruvian market, and PAYG solutions as well as MFIs could boost their market penetration and distribution.

## 2.3 Household wiring installations (HWI)

For rural areas, electricity coverage reached 78% (1.4 million households) by December 2015, with a remaining gap of approx. 500,000 households. The focus of EnDev Peru in the field of HWI is to develop

the capacities of local electricians around currently running or upcoming rural grid extension projects financed by MINEM. These technical services, which will be provided by electricians, allow closing the electrical circuit within a household, thus reaching the “electrical last mile”, as well as improving the quality of access, especially with regards to health and safety (as the government’s grid extension projects do not include HWI). Stakeholders in these markets are i) MINEM, who decides on and finances grid extension projects (and has just started to also finance user and electricians trainings including HWI based on EnDev lobbying and the support previously given by EnDev), ii) regional utilities, who are responsible for informing electricians of the location of rural electrification projects, and iii) local electricians, who offer materials and services to carry out HWI (from the meter until within the house) to the households in the respective communities to be electrified. The main business for these electricians is in the medium to long term perspective: generally families access electricity through basic HWI in the beginning. Every time a household wants to expand its HWI (with a new bulb or a new plug) they hire a local electrician to do so. To date EnDev Peru has trained 900 local electricians, who have raised awareness on 400,000 people to carry out HWI and internal wiring. More than 25 assemblers, strengthened by EnDev, were formed from people who were trained. The greatest challenge for the government is finding funding for local training and working capital for electricians for all new grid extension projects.

## 2.4 Solar dryers

Solar dryers are the most mature technologies for productive use of thermal energy in the Peruvian market although its use is mainly concentrated amongst cacao and coffee farmers. There are three companies that import or even manufacture solar dryers in Peru. They are mainly in direct contact with their final clients making it difficult to find supply chain actors across the country. The companies usually work with farmers associations in the jungle region since they sell other technologies for coffee and cacao processing as well. The existing suppliers though offer few or no after sales services and the simplest version of the technology is only the plastic film, leaving the installation to the farmers themselves with a manual only. FASERT has started actively to enhance this market by working with agricultural cooperatives through micro-loans and driving an innovation and development (I&D) process for improving its application.

## 3. Intervention strategy

### 3.1 Vision

EnDev’s vision for its final two years in the country is to **assist Peru in paving the final path to achieve universal access to energy** through a dynamic and sustainable market for EATs.

In the context of the “off-grid” NAMA and with support of local organizations like non-governmental organizations (NGOs) and research institutions, the vision is for the market in the coming years is to (i) have a greater outreach: at least 50,000 people will be served directly through the retail market, and five regions will have an active EAT distribution hub targeting especially last mile customers, (ii) have better established structures: more than 200 active entrepreneurs in the supply chain will have gained more experience working with different products, customer groups, and financing arrangements and (iii) be more diverse: more than five technology types with over 50 models and more services will be available in the EAT market.

### 3.2 Intervention

This up-scaling is aimed at presenting an **exit strategy for EnDev in Peru**. While the key focus of this exit will be the **transfer of knowledge** to all relevant partners, in parallel this exit includes a gradual staff reduction from currently 15.3 full-time equivalent staff to a maximum of 9 people by the end of 2017 and a max. of 2 people until the end of 2018.

In the coming two years, EnDev will focus on transferring knowledge to its main partner, the MIMEM, by **supporting the design and implementation of an “off-grid” NAMA<sup>22</sup> focussing on energy access for rural cooking, electrification and thermal comfort**. All experiences gained by EnDev Peru over the last 10 years will serve as basis for the design of the programme and feed in during implementation, hence making use of this programme to fully handover to the GoP. In that context, not only technological and market development know-how will be transferred but also tools and methodologies such as on previous experiences with information campaigns and pedagogic and educational materials. To accompany the know-how transfer to MINEM, EnDev will in parallel promote further EAT research within some universities and SENCICO in cooperation with the GoP for certification matters.

In addition to the knowledge transfer to MIMEM, the following technology specific activities will be supported by EnDev in line with the strategy to sustainably phase out the project:

- Improved cookstoves: Experience with the implementation of mass dissemination programmes and capacity development methodologies will be transferred to MIDIS through support in the execution of currently ongoing programmes. In addition, EnDev will be part of a joint advocacy at national and subnational level that identifies and develops regulatory frameworks guaranteeing the availability of necessary resources for social programmes that promote universal access to energy. One example is the opportunity to use existing cross subsidies from the energy sector for “social and energetic inclusion” (until today only used for LPG stoves) to provide funds for regular O&M mechanisms for ICS and other EAT in such programmes.
- Household wiring installations: The knowledge transfer to MINEM in this field already started in 2016. Going forward, what remains to be transferred is supporting the development of a MINEM internal strategy for capacity development and social communication in the context grid extension projects, that includes the promotion of quality of energy access to households.
- PicoPV and Solar Home Systems (SHS): Capacity development will be provided to public officials and professionals of those public utilities in charge of the commercial operation of nearly 200,000 SHS across 5 regions to ensure and optimize the continuity of the government led SHS programme. In the line, the potential development of the DC appliances market as an extended business line will be explored in order to make the SHS and picoPV business more profitable and to increase user satisfaction thereby reducing the risk of payment delays towards the utilities.
- Solar dryers: Within FASERT, projects with close to 10 agricultural cooperatives have started not only for the promotion of ICS, but also for solar dryers for coffee and cacao beans. The grant provided to the cooperatives through FASERT is to be established as a revolving fund within their existing financial structure for exclusive use for EAT. These cooperatives with an average of 1,000 members each already have commercial linkages with some solar dryer suppliers, however they didn’t have the working capital for transformation processes like drying is. This strategy for solar dryers can easily be scaled up for more than 200 agricultural cooperatives in the country if FASTER can acquire additional funding from other organizations.

At the same time, EnDev will make use of the remaining two years to continue and further fine-tune its previous activities that aim at strengthening the EAT retail market actors before finally phasing out by end of 2018. The strategy behind this continuation in parallel to the knowledge transfer to the institutional partners, is to give a final EnDev induced boost to the EAT retail market by targeting specific remaining needs. Within this context, EnDev wants to further strengthen best performer’s supply chain actors in the Peruvian EAT market like manufacturers, importers and key wholesalers as

---

<sup>22</sup> Started as one of three NAMAs in the energy sector in 2016 to comply with the sector’s NDCs under a Memorandum of Understanding between MINEM and UNDP (under the Global Environmental Facility).

well as local shops or businessmen that integrate EAT in their regular product or service range from manufacturers and/or importers until “last mile entrepreneurs”. These activities will entail:

Continuation to promote **product diversification** with other types of EAT that are new in the local market and may represent more affordable and alternative products for the supply and the demand side (such as different types of portable cookstoves, larger picoPV systems, etc.). This will give market actors more alternatives to remain active in the market without saturating some niches.

Consolidation of the **supply chains** to neighbour regions (or even border areas) to widen existing retailer networks to areas where no EAT supply chains are in place or not being supported by other energy programmes.

Consolidate EAT importers, manufacturers and wholesalers by supporting them in **improving their access to finance** and other sources of innovative funding not yet common in the Peruvian financial market such as crowdfunding, impact investment, or specific support for commercial alliances abroad.

Complementing the efforts from another key actor in the know-how transfer and context of phasing out EnDev activities is IICA<sup>23</sup>. The aim is to **establish FASERT as a stand-alone tool** that IICA can present to and further develop with other donors. That means that a fundraising strategy shall be developed and presented to other donors to acquire new funds. The vision is that FASERT will be an independently function fund in the country for any kind of energy access matters, offering conventional grants and/or other financial schemes that support the further scale of the energy access market.

Last but not least, as a new focus constituting an important part of the exit strategy of EnDev Peru for global EnDev, the project will **design and pilot strategies for the regionalization of EnDev activities in Latin America and globally**. EnDev already cooperates closely with the Latin American Network for Clean Cookstoves as member of the Board, which is integrated in the National Autonomous University of Mexico and the Test Centre of the University of San Andres of Bolivia. One of the suggested intervention activities is to use EnDev Peru’s know-how and experience to contribute to universal access to energy in the region by consolidating this network, which is being supported by the GACC. After the first two meetings, where more than ten countries attended (2014 and 2016), there is a concrete request by the members to turn it from a practitioners network into an effective technical assistance support mechanism for those governments affected and interested but not yet active in the clean cooking sector (like Guatemala or Haiti for example). Starting with a market assessment determining the potential retail and institutional demand as well as potential supply side actors, a first product from EnDev will be a short- and middle term action plan for one of these countries. This plan should be supported by government authorities to ensure sector development actions like, establishing advocacy platforms to raise awareness of the issue in the political agenda, developing quality assurance measures, designing massive interventions and developing financing mechanisms that allow the development or optimization of the ongoing intervention in the energy for cooking sector in the country. EnDev would support and follow up these actions and alliances and facilitate experience exchange between the actors through adequate platforms.

In a similar way, a know-how interchange on innovative electrification technologies and approaches seems to be of interest for the Peruvian and Bolivian government and could contribute to a wider interchange among both countries in reaching universal access to electricity. The conventional electrification business model (based on regulation tariffs, O&M by utilities, cross-subsidies and PPPs) will be further analysed to determine if it is transferable to other technologies than only national grid, looking forward to the overarching concept of “rural energization” including cooking and heating.

Furthermore, EnDev Peru will offer to EnDev HQ or other regions concrete technical services based on existing day-to-day tools as an EnDev country. Development of online monitoring platforms

---

<sup>23</sup> IICA as an international technical cooperation agency in charge of stimulating, promoting and supporting the efforts of its member states to achieve their agricultural development and rural well-being, has within its 4 strategic objectives the topic of resiliency and risk management in agriculture. Hence, renewable energy thereby becomes a topic of high institutional importance.

(SIMEDNEV), know-how management (Amaray) or communication strategies (emprEnDev) are possible examples for this.

### 3.3 Cooperation with others

EnDev Peru cooperates with a number of actors both at national and international levels. At national level, the main political partner of EnDev in the country is the MINEM. Within its market development framework, EnDev cooperates very closely with companies, universities, micro-financing institutions and national NGOs such as Practical Action, and international ones such as the Clinton Foundation and the International Copper Association. One of the goals of EnDev's exit strategy is to introduce the market-based-approach as an institutional approach for players from the civil society or the academia. There are already expressions of interest in this line from IICA, Practical Action, Caritas and one local university. The project also cooperates closely with multilateral institutions such as the International Development Bank (IDB) through MFI and UNDP through its climate change programme. In the framework of the German cooperation EnDev is continuously in contact with the KfW and some BMUB projects implemented by GIZ to develop financing mechanisms for renewable technologies. At international level, EnDev cooperates very close with the Latin American Network for Clean Cookstoves as member of the Board. As well, we cooperate with the GACC in topics specifically related to the incorporation of women into the ICS distribution chain and in market promotion in general.

## 4. Planned Outcomes

### Technology 1: Improved Cookstoves.<sup>24</sup>

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	140,000	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access	726	
No of enterprises gaining access	0	
No of households gaining access to at least level 2 cooking systems	27,000	
No of jobs created along the value chain	13	
Renewable electrical power generation capacity installed (in W)	NA	
Investments by households, private and public sector (in EUR)	4,508,900	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	9,250	
<b>Market development indicators</b>		
Indicator 1 By December 2018, EnDev/Peru supported the creation of business links between 5 ICS importers/manufacturers and local distributors.	5	
Indicator 2 By December 2018, 7 companies have evolved into regional distributors with the help of EnDev/Peru.	7	
Indicator 3 By December 2018, ten additional rural ICS sales points have been created with the support of EnDev/Peru.	10	
Indicator 4: By December 2018, EnDev/Peru has convinced 2 MFIs to offer credits to acquire IO.	2	

<sup>24</sup> Including improved cookstoves and improved ovens.

### Technology 2: PicoPV

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	20,000	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access	-	
No of enterprises gaining access	-	
No of households gaining access to at least level 2 cooking systems	NA	
No of jobs created along the value chain	2	
Electrical power generation capacity installed (in W)	12,000	
Investments by households, private and public sector (in EUR)	400,000	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	360	
<b>Market development indicators</b>		
Indicator 1: By December 2018, EnDev Peru has managed to strengthen 10 new actors in the commercialization chain of picoPV systems.	10	
Indicator 2: By December 2018, EnDev Peru has carried out a study to determine the impacts of picoPV systems.	1	

### Technology 3: SHS

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	20,000	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access	-	
No of enterprises gaining access	-	
No of households gaining access to at least level 2 cooking systems	NA	
No of jobs created along the value chain	2	
Electrical power generation capacity installed (in W)	296,667	
Investments by households, private and public sector (in EUR)	1,600,000	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	720	
<b>Market development indicators</b>		
Indicator 1: By December 2018, EnDev Peru has managed to strengthen 5 new actors in the commercialization chain of Pico Pv systems.	5	
Indicator 2: By December 2018, EnDev Peru has contributed to a systematization study of SHS management in the BT8 framework.	NA	



#### Technology 4: HWI

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	150,000	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access	-	
No of enterprises gaining access	-	
No of households gaining access to at least level 2 cooking systems	NA	
No of jobs created along the value chain	13	
Electrical power generation capacity installed (in W)	NA	
Investments by households, private and public sector (in EUR)	1,500,000	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	5,400	
<b>Market development indicators</b>		
Indicator 1 By December 2018, EnDev Peru expanded the HWI in 2 regions of the country, especially where more people lack access to the grid.	2	
Indicator 2 By December 2018, EnDev Peru has strengthened 5 companies offering the service of HWI in different regions of the country.	5	

#### Technology 5: Solar dryers for productive use

Indicator	Target	Calculation / means of verification
<b>Outcome indicators</b>		
No of people gaining access	-	EnDev standard calculation methods should be used. The indicators can be calculated using the OCS. Please consult your country manager if in doubt.
No of social institutions gaining access	-	
No of enterprises gaining access	500	
No of households gaining access to at least level 2 cooking systems	NA	
No of jobs created along the value chain	-	
Electrical power generation capacity installed (in W)	NA	
Investments by households, private and public sector (in EUR)	200,000	
Annual reduction in CO <sub>2</sub> equivalents (CO <sub>2</sub> e) emission (in t CO <sub>2</sub> e)	NA	
<b>Market development indicators</b>		
Indicator 1: By December 2018, EnDev Peru has carried out innovation and development to improve the technology.	1	
Indicator 2: By December 2018, EnDev Peru will strengthen 5 actors from the commercialization chain to disseminate the technology in the market.	5	



## 5. Sustainability

The sustainability that EnDev Peru aims at implies that the energy access sector continues with the consolidation of markets and its actors for the supported technologies. In this sense, there are some elements that already are in place, and some that EnDev will continue working on in the next two years to improve sustainability of its interventions.

**Supply:** since the beginning of the project, the local supply of EAT has been strengthened through the development of supply and distribution chains, strategies for commercial promotion and constant introduction of new technologies. This allows the establishment of after-sales services that serve both, technologies provided by the institutional demand and long term retail demand. As well, mechanisms to guarantee the quality of products have been developed in public institutions (SENCICO) as well as in the academia, that allow to develop and apply international certification or validation standards for the different EAT.

**Regulatory environment:** the provision or at least development of an adequate regulatory framework and funding mechanisms for the development of the EAT market should be in place. Initiatives proposed by EnDev Peru to MINEM (such as quality HWI promotion or the design of the off-grid NAMA) are already being adopted and efforts continue.

**Demand:** several mechanisms to reduce the financial barriers for the supply and demand side were developed by EnDev. More than 15 MFIs that offer credits for EAT were started by EnDev and efforts are now complemented through activities by FASERT working with cooperatives on revolving funds.

## 6. Impact

Impact	Possible indicators
<b>Environment</b>	From July 2009 to December 2018, at least 2,211,040 Mega Watts of electricity installed based on renewable energy provided by EnDev Peru.
<b>Health</b>	From July 2009 to december2018, at least 173,617 households in Peruvian rural areas use tier 2 ICS pursuant to EnDev's classification, which reduces significantly health problems caused by smoke and soot.
<b>Poverty/livelihood</b>	From July 2009 to December 2018, at least 2,053,851 people, 6,808 social institutions and 14,618 small businesses or producers associations have sustainable access to modern energy services provided by EnDev.
<b>Education</b>	-
<b>Governance</b>	-
<b>Climate change</b>	From July 2009 to December 2018, at least 104,295 tons CO <sub>2</sub> is reduced or avoided through the technologies provided by EnDev Peru
<b>Gender</b>	From July 2009 to December 2018, at least 520,850 women and children benefit from use cooking systems that significantly reduce the health burden caused by smoke and soot
<b>Market development</b>	From July 2009 to December 2018, 1,033 jobs were promoted by EnDev Peru through technologies distribution chain and as a result of access to modern energy services.

## 7. Budget

Cost Category		EUR
1	Human resources and travelling	350,000
2	Equipment and supplies	40,000
3	Funding financing agreements/local subsidies	30,000
4	Other direct costs	100,000
<b>5</b>	<b>Total direct costs (sub-total)</b>	<b>520,000</b>
6	Mark up costs/administrative overheads/imputed profit	80,000
<b>7</b>	<b>Cost price</b>	<b>600,000</b>

## **New EnDev regional refugee activities**

In the annual planning 2017, an additional contribution of Norway of 1 million USD was announced for the design and implementation of activities in the refugee context. In addition, EnDev allocated EUR 300,000 from its core budget to complement an intended contribution from DFID for a refugees component in Uganda. Initial design of interventions in Uganda, Kenya and Somalia meanwhile have taken place. Kenya and Somalia activities will start in the second quarter of 2017 with pico-solar and cooking interventions, and with strengthening and expanding local mini-grid, respectively. Both activities aim to be concluded and share results and lessons learned before the end of the year.

Discussions with DFID Uganda have moved forward too, and an additional contribution of EUR 500,000 is anticipated for work on cooking and electrification (picoPV) in Ugandan camp and host community settlements. Works are anticipated to start in the second quarter of 2017 as well.

Because of their special nature the activities were not (yet) included in the regular up-scaling discussion. Typical EnDev indicators and criteria, like cost efficiency and sustainability cannot be reasonably estimated at this point.

Results of the pilots will be brought into relevant international initiatives like Moving Energy Initiative and UN SAFE.

**E. RBF project revision documents**

## RBF Bangladesh: Output-based picoPV systems development

### 1. RBF project revision

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

- Downscaled budget wise to: **EUR 577,500**

Since still no significant movements on the Bangladesh market for the picoPV systems targeted by the project can be observed, the project is scaled down.

IDCOL has suggested an increase of the per system incentive to 30 USD in order to push sales by the partner organisations. However, as this allocation would affect a parallel DFID funded project for smaller picoPV lamps also implemented by EnDev - which is already generating outputs and receiving good feedback from suppliers – this decision would also require changes in this second project setup.

EnDev and DFID in-country teams together with IDCOL will engage in further discussions in order to find a common solution that all parties can agree to. One option is to allow IDCOL to promote a fixed number of lamps (maximum 15.000) with an incentive of up to 30 USD per system provided this will not distort the market or affect the other picoPV project negatively in any way. Otherwise alternative solutions should be discussed. At the end of 2017 or beginning 2018 the segment of lamps that is currently promoted under the IDCOL project could be integrated into the other DFID-funded picoPV project if commonly agreed.

### 2. Adjustment of KPIs

With the reduction of budget and taking into account a possible increase in the per system incentive, the targets are adjusted accordingly.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	322,500	64,500
EUR per person gaining access	5.44	8.95
t CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	13,797	2,760
EUR per t CO <sub>2</sub> e emissions avoided	127.09	209.23
Private sector leverage ratio	2.5	2.5
Jobs created	10	2
Enterprises created / improved	5	1
Technologies deployed	75,000 picoPV	15,000 picoPV

## **RBF Bangladesh, Kenya: Accelerate the uptake of off-grid solar technologies with results-based financing**

### **1. RBF project revision**

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

- Regionally expanded to: **Rwanda, Tanzania, Uganda**

The project is being implemented by CLASP. The original Global LEAP+RBF project proposal specified Bangladesh and Kenya as the target markets. Over the course of the first year of implementation, however, stakeholder input from industry leaders and policymakers suggested i) the presence of a robust regional market for off-grid products clustered in the Great Lakes regions of Kenya, Tanzania, and Uganda, and ii) the rapid emergence of a growing off-grid market in Rwanda. It also became clear that many companies who sell solar home systems operate in some combination of those national markets. Including more countries in Africa will also increase alignment with the priorities of the project's new co-funder, Power Africa.

The expansion of geographic scope to include additional countries in East Africa will not result in significantly increased administrative costs for EnDev as the funding from Power Africa (USD 1,650,000) will be primarily used to cover these. Based on these factors, expansion of the project's geographic focus in Africa to include not only Kenya, but also Rwanda, Tanzania, and Uganda is recommended.

## RBF Benin: Lifting up 3 off grid PV market segments to the next level

### 1. RBF project revision

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

- Extended time wise until: **06.2019**

A time extension of the project is required since the market development is much slower than anticipated. This is because the PV market was quasi inexistent at the on-set of the project. Companies required considerably more time to establish relations with importers, source for inventory finance and to establish distribution networks in the country. Time delays in the solar water pump component were additionally caused by required coordination between donors on the topic of providing drinking water through the pumps. Municipal elections in 2016 constituted another factor delaying the market development, the nominations of new mayors being essential for investment decisions in the municipalities.

Strategic changes include to open the picoPV component to larger SHS in order to cater for the existing demand as could be demonstrated through a pilot conducted by the non-RBF funded part of EnDev-Benin. It was also decided to close the solar street light component. Reasons for this are the fact that there is no private demand for solar street lights contrary to initial expectations and that the public market is also limited and tender procedures seem unfair and not transparent.

### 2. Adjustment of KPIs

Based on the delays in the market uptake and the closing of the streetlight component as described further above, the targeted outcomes have been adjusted for all technologies. It should be noted that the targeted number of household solar systems reflect only those systems for which the sales will be actually verified. A greater number of systems imported to the country which are not yet sold at project end or for which no sales claims are submitted will not be counted.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	475,689	333,987
EUR per person gaining access	6.69	9.16
t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	33,288	25,971*
EUR per t CO <sub>2e</sub> emissions avoided	91.93	117.82*
Private sector leverage ratio	3.2	1.8
Jobs created	Not quantified	Not quantified
Enterprises created / improved	10	15
Technologies deployed	187,000 picoPV 2,500 streetlights 262 solar pumps	68,000 household solar systems 747 streetlights 125 solar pumps

\* Please note that these figures reflect the picoPV systems only. Neither SHS, nor pumps or solar streetlights are included in the calculation. The calculation tool is currently being revised to be able to calculate several technologies within one RBF project. Complete figures will be provided latest with next reporting.



## RBF Kenya: Kenya Higher Tier Cookstoves Market Acceleration Project

### 1. RBF project revision

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

- Extended time wise until: **06.2019**

This project revision recommends extending timewise up to June 2019 and shifting budgets. The following barriers have been reconfirmed during the last semesters: consumer entry cost, access to capital, availability, value proposition of higher tier stoves. To overcome these barriers the RBF incentives targeted MFIs and SACCOs. So far the uptake of incentives has been slow.

Therefore on one hand further cookstove distributors, whose business model addresses the barriers highlighted, shall be included, like distributors selling stoves on credit and providing trade credit to retailers. This is intended e.g. by the inclusion of stoves in the solar PAYG partnerships – stoves being bundled with PAYG solar – model implemented by Raj Ushanga. The lessons will be used to motivate other PAYG actors to bundle products.

On the other hand FIs categories will be expanded to include other categories such as Financial Services Authorities (FSAs) and rotating savings and credit associations (ROSCAs). In addition new beneficiaries, such as Equity Bank, with an elaborate network, are expected to contribute significantly to the outcomes.

### 2. Adjustment of KPIs

The reduction in incentives amount will not affect the targets as the average incentive amount is estimated at €12, therefore the incentive amounts will be sufficient for both stoves and alternative fuels. Therefore the access target remains the same. Difference in calculation however has led adjustment of KPIs CO<sub>2</sub>e avoided and jobs created.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	500,000	500,000
EUR per person gaining access	4.12	4.12
t CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	41,811	168,090 <sup>25</sup>
EUR per t CO <sub>2</sub> e emissions avoided	50.01	50.01
Private sector leverage ratio	1.7	1.7
Jobs created	50	100 <sup>26</sup>
Enterprises created / improved	10	10
Technologies deployed	100,000	100,000

<sup>25</sup> The calculations have been corrected as per EnDev Calculations.

<sup>26</sup> With the engagement of distributors, this is expected to increase as they employ agents to expand their outreach.

## RBF Kenya: Market Creation for Private Sector Operated Mini-Grids

### 1. RBF project revision

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

- Extended time wise until: **06.2019**

The market development assumptions are still valid by and large, because no significant mini-grid market take-off has happened yet. However, two larger off-grid projects have emerged (one by DFID/AFD and one by the World Bank (WB) (see section (b) below), both of which have explicitly and implicitly built on the initial GIZ/EnDev Kenya learning, concepts and market development activities.

Besides the learning, this mini-grids RBF project is relevant in the Kenyan market as it is the only intervention targeting small off-grid villages (less than 50kW generation capacity).

The recommended extension of the project takes into account the following challenges in the beginning of the project.

The identification of a suitable FI to implement the project took longer than expected. The process was further delayed due to uncertainties in BBK selling off their Africa operations and capacity building to operational staff of BBK took some time. The grant agreement was signed only in October 2016.

The national mini-grid regulatory framework and tariff structure is not yet in place. The outcome of the ongoing study on regulatory framework will impact the design of the framework, timeline and structure and respectively impact the RBF project respectively. The political climate during the period of general elections in August 2017 is expected to cause some delays in national regulation as well as in construction of the mini-grids due to the perceived political interference.

### 2. Adjustment of KPIs

The KPIs will not be changed.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	22,500	22,500
EUR per person gaining access	92.22	92.22
t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	5,106	5,106
EUR per t CO <sub>2e</sub> emissions avoided	406.38	406.38
Private sector leverage ratio	1.0	1.0
Jobs created	-	-
Enterprises created / improved	10	10
Technologies deployed	20	20

## RBF Malawi/Mozambique: Access to Modern Cooking Energy for Poor and Vulnerable Groups in Malawi and Mozambique

### 1. RBF project revision

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

- Extended time wise until: **06.2019**

Malawi: no changes.

Mozambique: Initially it was foreseen for the social enterprise of Eduardo Mondlane University (UEM Foundation) to act as the main RBF implementing partner in Mozambique. However, due to changes in the management and organisational structure, the Foundation eventually turned out to be unsuitable for the implementation of the project. This has led to substantial delays in starting the implementation. In the second half of 2016, EnDev has finally identified a new suitable implementing partner, the German NGO Welthungerhilfe (WHH). Currently final discussions about the contract with the WHH are taking place. Due to the late start of the project (expected for May 2017), the project period shall be extended until 06/2019 (current period until 02/2019). The overall targets remain the same.

### 2. Adjustment of KPIs

As of now, no adjustments of the KPIs are required.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	640,000	no changes
EUR per person gaining access	1.90	
t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	536,000	
EUR per t CO <sub>2e</sub> emissions avoided	2.22	
Private sector leverage ratio	2.60	
Jobs created	224	
Enterprises created / improved	35	
Technologies deployed	128,000	

## RBF Nepal: Result Based Financing for Sustainable Hood-stove Market in Nepal

### 1. RBF project revision

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

- **Extended time wise until:** **06.2019**

The review focused around the development in Nepal resulting from the Earthquake in May 2015, which had a direct impact on market development and hence on planned RBF activities. All the project districts are highly affected, more than 70% percent of the houses were severely damaged. **First adjustments in the RBF project (incl. KPI) were already agreed upon in November 2015.** However the market actors supported by the project still face difficulties to create enough demand in the existing project area. Moreover, raw materials for example plain Galvanised Iron (GI) sheets remain scarce, because the capacities of the companies producing GI sheets were absorbed by temporary shelter construction. Skilled human labour resources (including hood stove installers) were needed for house reconstruction. These developments caused challenges for the achievement of originally planned project results.

- **Further adjusted as follows:**

After the earthquake, many stakeholders have distributed portable cook-stoves for free at large quantities. It is likely that the project will not be able to achieve the targeted number of results in the existing project districts. **It was hence agreed to expand to new locations that are not affected by the 2015 earthquake.** Total costs for hood-stove fabrication increased by more than 25%. Moreover, while in new locations, due to business start-up costs, the cost per cook-stove is higher than the retail price, the cook-stove price and RBF incentives in old and new locations need to be kept uniform. On top of that, decrease of incentives on annual basis has been found counterproductive leading to confusion among customers. **Further adjustment of the RBF incentive level for portable stoves in the fourth year is recommended,** to compensate various costs arising from project requirements such as bookkeeping and monitoring. **Incentives level should hence be slightly decreased** to keep the price attractive as well as to maintain decreasing incentive levels in old project locations. RBF incentives are only set on a yearly basis and will be assessed every eight months.

Implementation of adjustments requires additional EUR 47,297. Practical Action offers to co-finance EUR 29,797, while the remaining EUR 17,500 will be managed through budget adjustment by shifting between budget lines.

### 2. Adjustment of KPIs

RBF Key Performance Indicators (KPI)	Old targets	Targets according to adjustments in Nov. 2015	New targets
People gaining access (EnDev counting method)	148,500	154,440	172,755
EUR per person gaining access	11,28	10,85	9,70
t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	268,000	313,600	343,200
EUR per t CO <sub>2e</sub> emissions avoided	6,24	5,34	4,88
Private sector leverage ratio	1:1.25	1:1	1:1
Jobs created	125	125	150
Enterprises created / improved	10	10	20
Technologies deployed	30,000	31,200	34,900

## RBF Peru: Getting to universal access in thermal energy services

### 1. RBF project revision

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

- Extended time wise until: **06.2019**

This project revision focusses on the solar water heater (SWH) component of the project only. A time extension of the project is required due to significant delays in identifying and contracting a suitable financial institution. As a result, the actual implementation bringing RBF incentives into the market for the SWH companies could only start in early 2016. Hence to allow for incentives to actually be in the market for a sufficiently long time a minimum extension of one year is requested.

Strategy wise, first experience clearly indicated that the companies are the drivers behind the SWH market and sales. The original proposal had foreseen micro finance institutions (MFIs) to take an equally important role by offering micro loans to potential SWH end customers and receiving incentives for this. This expectation has not yet been full filled. Furthermore, some companies are moving significantly faster than others requiring an adjustment of the target quotas per company as well as an adjustment in the medium term of the incentive structure (1:1 rural and urban sale ratio) towards a stronger emphasis on rural sales. Also the scope of the eligible SWH types will be expanded. SWH types like titanium flat collector technologies will be included in the future as long as companies can provide international quality accreditation for manufacturing in order to incentivize a demand oriented supply.

### 2. Adjustment of KPIs

Based on the very slow developments of MFIs placing loans for SWH, it is not realistic to expect that all SWH sales will be matched with micro loans as calculated in the original proposal. Therefore this part of the incentive budget becomes available to incentivize the actual sales of 1,000 additional SWHs. KPIs were adjusted accordingly.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	130,000	135,000
EUR per person gaining access	15.69	15.11
t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	195,875	209,438
EUR per t CO <sub>2e</sub> emissions avoided	10.41	9.74
Private sector leverage ratio	3.5	3.65
Jobs created	7	9
Enterprises created / improved	21	45
Technologies deployed	20,000 ICS 6,000 SWH	20,000 ICS 7,000 SWH

## RBF Rwanda: Sustainable Market Creation for Renewable Energy Village Grids

### 1. RBF project revision

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

- revised with regards to the KPI targets

Mini-grid development remains difficult in Rwanda as it is challenged by several barriers, which have been preventing market growth. The past inadequate policy framework, challenging access to finance and lack of technical capacities amongst local developers still hamper market development and are the hurdles that explain the slow, yet existing, uptake of this market. However, significant policy changes and the design of new instruments, in which EnDev has been strongly involved, constitute positive signs that market development could accelerate soon.

### 2. Adjustment of KPIs

As of now, there are 22 solar DC mini-grids and 1 hydro mini-grid constructed, amounting totally to 23 mini-grids. With 2 AC solar mini-grids likely to be funded after Round 3, and the 5 AC grids expected out of Round 4, EnDev will have funded a total of 30 mini-grids. So far, the KPIs were referring to individual technologies. As it is impossible to predict the type of mini-grids the private sector will apply for, EnDev proposes to make this indicator technology neutral and only count the number of mini-grids developed. In Round 3, most of the quality proposals received included higher Tier 2 or Tier 3 energy access with a larger part catering to productive uses of energy. This change resulted in higher costs per beneficiary, since providing Tier 3 access is more expensive than providing Tier 2 access. Connecting productive units and social institutions (PU&SI) is more costly to mini-grid developers, yet these are generally larger and more reliable customers, improving significantly their business cases. On average, the higher the share of PU&SI, the better the business case of a mini-grid and the higher the cost per person. The outcome of the RBF would decrease from 22,000 to 12,300 people. However, at the same time, the outcome targets for businesses would increase from 40 to 250 businesses.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	22,000 people	12,300 people
	40 PU	250 PU
	40 SI	40 SI
EUR per person gaining access	85.94	150
t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	11,534	3,359
EUR per t CO <sub>2e</sub> emissions avoided	163.95	562.97
Private sector leverage ratio	1.0	1.0
Jobs created	90	90
Enterprises created / improved	16	200
Technologies deployed	4 solar AC 80 solar DC 6 pico hydro 4 distribution	30 mini-grids

## RBF Rwanda: Sustainable Market Creation for Solar Lighting

### 1. RBF project revision

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

Extended time wise until: **06.2019**  
Downscaled budget wise to: **EUR 2,240,000**

Although the market has not taken off as fast as predicted, the dynamic is clearly positive. Crucial steps forward in the past year have been the approval of the Rural Electrification Strategy (RES) by the Government of Rwanda (GoR) and the prospects of the World Bank (WB)-managed Scaling up Renewable Energy Program (SREP) easing access to finance for customers and firms. Other elements have had a strong negative impact on the market. The drought affecting predominantly the Eastern Province resulted in customers defaulting on their payments to solar companies. A changed tax regime has resulted in higher costs for solar home systems and in delayed import processes.

We recommend extending the project until June 2019, together with a downscale of the incentive budget. This recommendation relates to both, the promises shown by the market and its inherent immaturity and fragility. On the one hand, expectations that the RBF could achieve its new targets are good, as the number of sales increases. It is also expected that the more favourable policy and financial context will trigger additional growth. On the other hand, most of the companies are still in the process of scaling up or streamlining and most of them are not operating at a profit yet, so they rely on the disbursements of this RBF for expanding their business.

### 2. Adjustment of KPIs

With the reduction of the incentive budget to EUR 1.4 million and with the same cost-efficiency of EUR 4 per beneficiary for the incentive part, the new outcome target is reduced to 350,000 beneficiaries. The scenario presented in the review further reduces the target for the number of systems to 90,000. This change is due to the fact that larger systems are more popular in the market. In past RBF claims, more than half of claimed systems are large Tier 1 systems, coming close to the threshold of Tier 2 and counting a full household per system. The change does not impact the outcome target for beneficiaries, as the number of people reached per system is growing.

RBF Key Performance Indicators (KPI)	Old targets	New targets
• People gaining access (EnDev counting method)	• 550,000	• 350,000
• EUR per person gaining access	• 5.54	• 6.4
• t CO <sub>2e</sub> emissions avoided (over the lifetime of the products sold during project)	• 40,500	• 16,556
• EUR per t CO <sub>2e</sub> emissions avoided	• 75.30	• 135.30
• Private sector leverage ratio	• 3.0	• 3.0
• Jobs created	• 50	• 31
• Enterprises created / improved	• 10	• 7
• Technologies deployed	• 220,000 picoPV	• 90,000 picoPV

## RBF Vietnam: Creating a Market Driven Biogas Sector

### 1. RBF project revision

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

- Extended time wise until: **06.2018**

After a fast start with good results, the implementation of the programme was slowed down by significant challenges with administrative procedures of relevant ministries. This was impacting on the speed in which the stakeholders of the bio-digester supply chain of the different provinces in the country were transformed from the old system of customer based post-paid subsidies to the full RBF. As a result, both objectives (a) the total number of digesters and (b) the extent of transformation have not yet been sufficient at the end of 2016.

In the initial proposal it is explained that the transition of the biogas sector in 45 provinces of the country will be done in stages, with some provinces piloting first and others joining stepwise later. This is how the programme has been implemented. It was clear from the beginning that at the end of the EnDev-RBF funds there will be still provinces which have not yet been fully transformed due to the large size of the national sector. It is therefore very likely that at the end of the current EnDev funding, there will be at least the last 27 Provinces which are not yet fully prepared for a phasing out of the RBF incentive. The original plan was to use the accumulated VGS funds to finance the costs related to the finalisation of the transition of the sector from the end of the EnDev support mid-2017 onwards.

However, the use of VGS funds in the programme has become subject to extensive administrative procedures within different government ministries. While a general approval of the use of VGS funds has been granted, it is not yet clear which cost norms will govern their use and what actually can be paid for from these funds. It is envisaged that until the next RBF progress review in 2018 the use of VGS funds will be clarified.

### 2. Adjustment of KPIs

No adjustments of targets as funding remains the same.

RBF Key Performance Indicators (KPI)	Old targets	New targets
People gaining access (EnDev counting method)	275,000	
EUR per person gaining access	13.60	
t CO <sub>2</sub> e emissions avoided (over the lifetime of the products sold during project)	4,469,000	
EUR per t CO <sub>2</sub> e emissions avoided	0.84	
Private sector leverage ratio	7	
Jobs created	960	
Enterprises created / improved	160	
Technologies deployed	55,000 biogas digesters	



## Abbreviations

<b>ADES</b>	Association pour le Développement de l'Energie Solaire, Switzerland
<b>AGSI</b>	Association of Ghana Solar Industries
<b>AHPROCAFE</b>	National Coffee Growers Association, Nicaragua
<b>BIF</b>	Business Innovation Fund, Malawi
<b>BMUB</b>	German Ministry of the Environment
<b>BMZ</b>	the German Federal Ministry for Economic Cooperation and Development
<b>CC</b>	community centres
<b>CDM</b>	Clean Development Mechanism
<b>CO<sub>2e</sub></b>	CO <sub>2</sub> equivalent
<b>COOPI</b>	Cooperazione Internazionale, Italy
<b>CRGE</b>	“Climate Resilient Green Economy” Strategy in Ethiopia
<b>CU</b>	Concern Universal, Malawi
<b>DEZA / SDC</b>	the Swiss Agency for Development and Cooperation
<b>DFAT</b>	the Australian Department of Foreign Affairs and Trade
<b>DFID</b>	the UK Department for International Development
<b>ECAE</b>	Ethiopian Conformity Assessment Enterprise
<b>ECG</b>	Electricity Company of Ghana
<b>EELA</b>	Energy Efficiency Program in Artisanal Brick Industries in Latin America programme
<b>EnDev</b>	Energising Development programme
<b>EREDPC</b>	Ethiopian Rural Energy Development and Promotion Centre
<b>FASERT</b>	Fund for Sustainable Access to Thermal Energy
<b>FOCAEP</b>	Central American Fund for Access to Sustainable Energy and Poverty Reduction
<b>FODIEN</b>	Electricity Industry Development Fund, Nicaragua
<b>FONCODES</b>	Programme “Haku Wiñay/Noa Jayatai” of the Peruvian Social Fund, Peru
<b>GACC</b>	Global Alliance for Clean Cookstoves
<b>GHACCO</b>	Ghana Alliance for Clean Cookstoves
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
<b>HH</b>	households
<b>HIVOS</b>	Humanistisch Instituut voor Ontwikkelingssamenwerking
<b>HP</b>	health posts
<b>HWI</b>	Household wiring installations
<b>ICS</b>	improved cookstove
<b>IDB</b>	Inter-American Development Bank
<b>IDB</b>	International Development Bank
<b>IFC-LG</b>	International Finance Corporation - Lighting Global
<b>IKI</b>	International Climate Initiative of the German Ministry of the Environment
<b>KPI</b>	key performance indicator

<b>KPT</b>	kitchen performance test
<b>MBAULA</b>	Movement for Bio-Energy, Advocacy, Utilization, Learning & Action in Malawi
<b>MEM</b>	Ministry of Energy and Mines, Nicaragua
<b>MFA / DGIS</b>	Netherlands Ministry of Foreign Affairs Directorate-General for International Cooperation
<b>MFA-NOR</b>	the Norwegian Ministry of Foreign Affairs
<b>MFI</b>	micro finance institution
<b>MHP</b>	micro hydropower
<b>MIDIS</b>	Ministry of Development and Social Inclusion, Peru
<b>MINEDU</b>	Ministry of Education, Peru
<b>MINEM</b>	Ministry of Energy and Mines
<b>MoE</b>	Ministry of Energy, Ghana
<b>MoFA</b>	Ministry of Food and Agriculture, Ghana
<b>MoU</b>	Memorandum of Understanding
<b>MVCS</b>	Ministry of Housing, Construction and Sanitation
<b>NBSSI</b>	National Board for Small Scale Industries, Ghana
<b>NCSC</b>	National Cookstoves Steering Committee, Malawi
<b>NEDCo</b>	Northern Electricity Distribution Company, Ghana
<b>NES</b>	National Electrification Scheme, Ghana
<b>OES</b>	Office of Social Electrification of the National Utility in Honduras
<b>PAYGo</b>	Pay as You Go
<b>PER</b>	Rural Electrification Plan in Guatemala
<b>picoPV</b>	pico photo voltaic
<b>PNESER</b>	Programa Nacional de Electrificación Sostenible y Energías Renovables, Nicaragua
<b>PPP</b>	public private partnership
<b>ProCEAO</b>	Programme pour l'Énergie de Cuisson économique en Afrique de l'Ouest/ Cooking energy in East-Africa
<b>PU</b>	productive use of energy
<b>RAGA</b>	Rapid Assessment Gap Analysis
<b>RBF</b>	results-based finance
<b>REFIT</b>	Renewable Energy Feed-in Tariff
<b>REIAMA</b>	Renewable Energy Industry Association, Malawi
<b>RVO</b>	Rijksdienst voor Ondernemend Nederland
<b>SCT</b>	Social Cash Transfer programme, Malawi
<b>SEforALL</b>	Sustainable Energy for All initiative
<b>SERNA</b>	General Directorate of Energy / Secretary of Environment and Natural Resources in Honduras
<b>SHS</b>	solar home system
<b>SI</b>	social institutions

<b>SICA</b>	Central American Integration System
<b>SIDA</b>	the Swedish International Development Cooperation Agency
<b>SME</b>	small and medium enterprise
<b>SNV</b>	Stichting Nederlandse Vrijwilligers / Netherlands Development Organisation
<b>SREP</b>	Scaling Up Renewable Energy Programme
<b>SSHS</b>	small solar home systems
<b>SWH</b>	solar water heaters
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>VSLA</b>	Village Savings and Loan Associations

Funded by:



## **Energising Development**

Deutsche Gesellschaft für  
Internationale Zusammenarbeit (GIZ) GmbH  
Registered offices Bonn and Eschborn, Germany

Dag-Hammarskjöld-Weg 1-5  
65760 Eschborn, Germany

E [endeve@giz.de](mailto:endeve@giz.de)

I [www.endeve.info](http://www.endeve.info)