

Progress Report 2015

Energising Development – Phase 2

Draft Version for the Governing Board



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Key achievements since 2005

Energy access for

15.5 million

people accomplished

11.7 million

household members with
improved cookstoves



3.8 million

household members with
electricity





Key achievements since 2005

1.7 million t of CO₂ saved per year – equivalent to planting of more than 4.1 million trees

A total installed power of **50** megawatt



34,000 small and medium enterprises with a modern form of energy for productive uses

More than **37,000** technicians, stove producers, sales men, etc. trained



17,800 social institutions with a modern form of energy: among them 8,400 schools and 700 health centres

6.4 million men, women and children with drastically reduced exposure to indoor air



A. Overview

The Energising Development (EnDev) programme is a coordinated and harmonized effort of several donors to improve energy access on global scale as main target. The donor partnership consisted in 2015 of:

- the Netherlands Ministry of Foreign Affairs Directorate-General for International Cooperation (MFA / DGIS),
- the German Federal Ministry for Economic Cooperation and Development (BMZ),
- the Norwegian Ministry of Foreign Affairs (MFA-NOR),
- the Australian Department of Foreign Affairs and Trade (DFAT),
- the UK Department for International Development (DFID), and
- the Swiss Agency for Development and Cooperation (DEZA / SDC).

In December 2015 the Swedish International Development Cooperation Agency (SIDA) on behalf of the government of Sweden joined the partnership as seventh donor.

EnDev aims to achieve sustainable access to energy for minimum 19 million people worldwide by 2019 (5 million in phase 1 from 2005 to 2009; additional 9 million in phase 2 from 2010 to 2015 and additional 5 million from 2016 to 2019) with a currently planned total budget of EUR 350 million. The strategy of EnDev is geared towards developing and promoting sustainable pro poor markets for energy services and off-grid products.

By December 2015, EnDev in its second phase has facilitated sustainable¹ access to modern energy services² to 10.47 million people. Households were connected to the national grid or isolated grids, or use electricity through photovoltaic systems. Others benefited from improved and cleaner cooking technologies, such as improved firewood and charcoal stoves or biogas plants (see table A.1). In addition, more than 17,878 schools, health stations and community centres got access to improved cooking energy or electricity, or other modern energy carriers. Furthermore, 34,060 small and medium enterprises gained access to modern forms of energy for productive use.

Table A.1: Adjusted number of people with access to modern energy services (EnDev 2)

lighting / electrical appliances	cooking / thermal energy	total household members
2.95 million	7.52 million	10.47 million

Facilitating access to modern energy service is a key requirement to reduce poverty, to improve the standard of living, and is a means to inclusive social, economic and low carbon development. Consequently, the success of the programme does not only depend on the number of people reached but also on the impact of the modern energy service provided on income, health, education and well-being.

EnDev continuously analyses the impacts of its country activities to verify the assumptions regarding the relation of energy access and sustainable development. In addition, the sustainability of the EnDev results and impacts are regularly investigated. Since 2009, EnDev has carried out almost 240 baseline, impact and sustainability studies. Major results of the studies are presented in the impact report “Empowering people” of EnDev which is annually updated (<http://endev.info/content/Downloads>). In the present progress report key findings of household surveys in four countries are summarized.

Financially, EnDev developed as scheduled. The expenditures for EnDev 2 activities in 2015 reached EUR 31 million.

¹ Sustainable access here refers to long-lasting access.
² The term modern energy service refers to electricity as well as to natural gas, LPG, and biogas as cooking fuels and to advanced cookstoves for solid fuels that have higher combustion efficiency (at least 40% in comparison to traditionally used stoves).

Cambodia: A prototype ATEC biodigester being field tested on a small island (Kor Island) that is prone to flooding, around 45 minutes from Phnom Penh.



Cambodia: A new model biogas stove produced by the NGO Development Technology Workshop in Phnom Penh and imported biogas rice cooker, both being field tested with the prototype ATEC biodigester.



Bolivia: The ICS "Ahorradora" saves firewood for chicha brewers in the Cochabamba region. The traditional, fermented alcoholic drink needs around four days of preparation. Compared to the traditional stove design, the ICS evades smoke through a chimney.

B. Current status of the EnDev 2 programme

By December 2015, the EnDev partnership comprised 29 activities in 25 different countries with side activities in additional 4 countries. In 21 countries EnDev is supporting access to improved cookstoves, in 17 access to off-grid solar technologies (solar home systems and solar lanterns), in 12 countries access to mini-grids (either solar or hydropower-based mini-grids), in 11 countries grid extension or densification are promoted and in 6 countries access to biogas. Table B.1 presents a summary of this information

Table B.1: Overview of technologies supported in EnDev countries

		stoves	biogas	other cooking/thermal	SHS	picoPV	solar mini-grid	hydro mini-grid	grid	other lighting/electricity
country projects	Bangladesh									
	Benin									
	Bolivia									
	Burkina Faso									
	Burundi ³									
	Cambodia									
	Ethiopia									
	Ghana									
	Indonesia									
	Indonesia biogas									
	Kenya									
	Liberia ⁴									
	Madagascar									
	Malawi									
	Mali									
	Mozambique									
	Nepal									
	Peru									
	Rwanda									
	Senegal									
Tanzania										
Uganda										
Vietnam										
multi-country projects	Bangladesh, Kenya ⁵									
	Central America (Honduras,									
	Kenya, Tanzania, Uganda									
	Malawi, Mozambique									
	Mekong (Cambodia, Laos, Vietnam)									
	Mozambique, Uganda									

By December 2015, EnDev 2 facilitated sustainable access to modern energy services and technologies for about **10.47 million people**. Out of these, 2.95 million people (28%) were connected to the central grid or a mini grid or used standalone systems. 7.52 million (72%) are now using

³ with some activities in Congo

⁴ with some activities in Guinea and Sierra Leone

⁵ focus is on off-grid appliances

⁶ with some activities in Guatemala

improved cooking technologies, such as improved firewood and charcoal stoves or biogas plants (see figure B.3 below). In addition, **10,377 social institutions** gained access to improved cooking systems or electricity and **22,100 small and medium enterprises** now have access to a modern form of energy for productive use.

The focus of the EnDev programme is on Sub-Saharan African countries. Around 58% of the committed EnDev 2 funds are currently allocated to this part of Africa (Figure B.1). The share of least developed countries (LDC) supported by EnDev is 62% (Figure B.2).

The figures reported here are verified in the field through detailed lists of customers of energy services and products, and sales figures of energy companies and retailers. EnDev does not simply add outcomes achieved in the course of the programme but tries to capture also those processes that reduce outcomes through so-called adjustment factors. Thus, figures of six-month reporting periods are adjusted downwards before the total number of beneficiaries is presented to donors and the public.

EnDev applies four adjustment factors:

- a “sustainability adjustment factor”, which takes into account that the access provided to modern energy technologies is not sustainable in all cases;
- a “windfall gain factor”, considering that some beneficiaries supported by EnDev would have gained access to modern energy services anyway even without support;
- a “double energy factor”, which accounts for beneficiaries which already have access to a modern energy service⁷;
- a “double EnDev counting factor”, which ensures that beneficiaries for whom both modern cooking energy and electricity have been facilitated through EnDev are only counted once in the aggregate figure.

Figure B.1: Funding by region

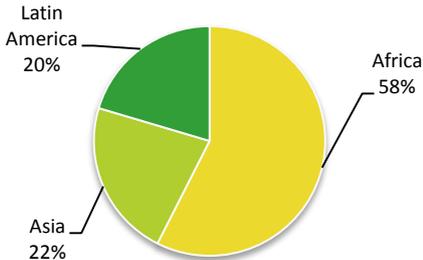


Figure B.2: Funding by countries

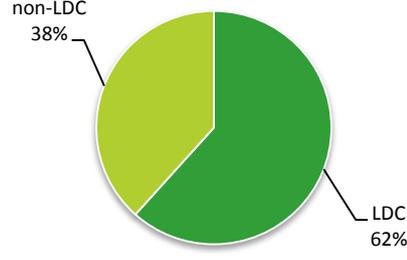
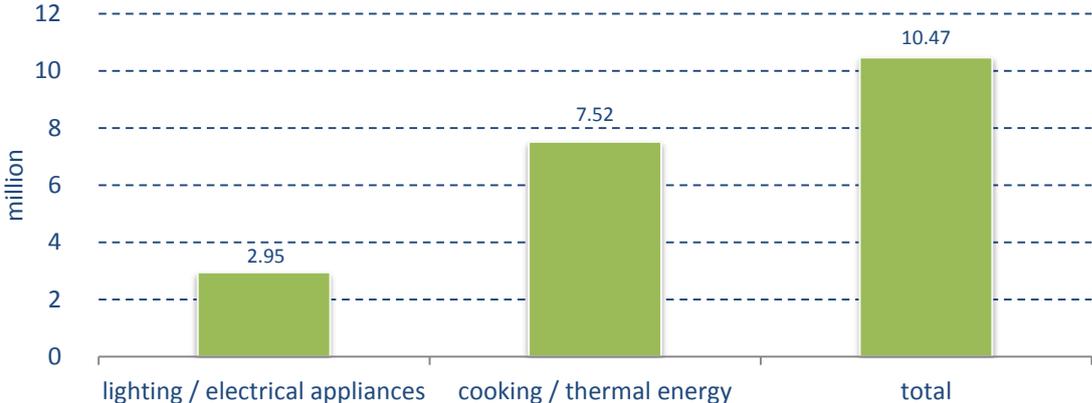


Figure B.3: Adjusted number of household members provided with modern energy services in a sustainable manner (EnDev 2)

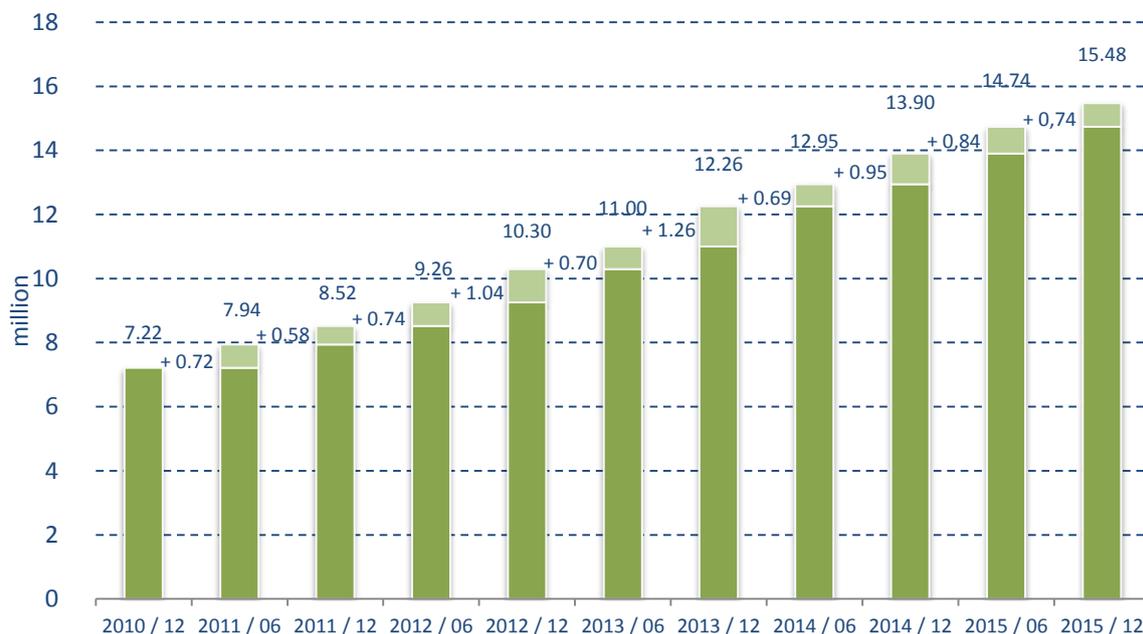


In addition, the EnDev figures already include a discount for replacement in order to consider the limited life span of some of the technologies promoted. This typically concerns cookstoves and picoPV devices: in order to continuously benefit from the service, the system may have to be bought

⁷ For example, a minigrid may arrive in a village where the village leader already has a solar home system. The leader cannot be excluded from the project, but should not be counted as new access either.

more than once over the course of the monitoring period. Later-stage sales may go to beneficiaries reported before. It would therefore be wrong to simply add up all sales numbers.

Figure B.4: Development of EnDev 1+2 adjusted figures per semester



EnDev uses a tier system for defining different levels of access to electricity and modern cooking. The EnDev tier system is aligned with the multi-tier framework of SE4ALL as described in the Global Tracking Framework (2013 and 2015) and in the ESMAP publication “Beyond Connections: Energy access redefined”. In the case of electricity the different access levels are defined in terms of services, for which both “energy” and a device turning the energy into a useful service are required. As it is often difficult to directly monitor a service, access can be claimed by demonstrating access to the respective device and the required energy. Alternatively, access can be claimed on the grounds of certain electricity consumption.

Based on this system the EnDev electrification outcome figures in the different tiers are as follows:

Tier	Services	Typical system	Number of people
5	tier 4 services plus use of devices typically requiring a few kilowatt like air conditioners	grid	312,380
4	tier 3 services plus use of devices typically requiring a kilowatt like water heaters, irons	limited grid	206,479
3	tier 2 services plus use of devices typically requiring a few hundred watt like rice cookers, refrigerators	mini-grid	127,639
2	bright light, radio, telephone plus use of devices typically requiring tens of watts like TV, video, fan	solar home system	1,839,359
1	medium bright light and, if possible, limited radio use and telephone charging	picoPV, battery charging station	461,460
		total	2,947,317

These figures reflect only those people that had no access to electricity beforehand. In several cases EnDev facilitated a better access (higher tier) for households that already had at least basic access to electricity (minimum tier 1). The number of beneficiaries whose access was raised to a higher level (i.e., in addition to the reported EnDev outcomes) is 184,104.

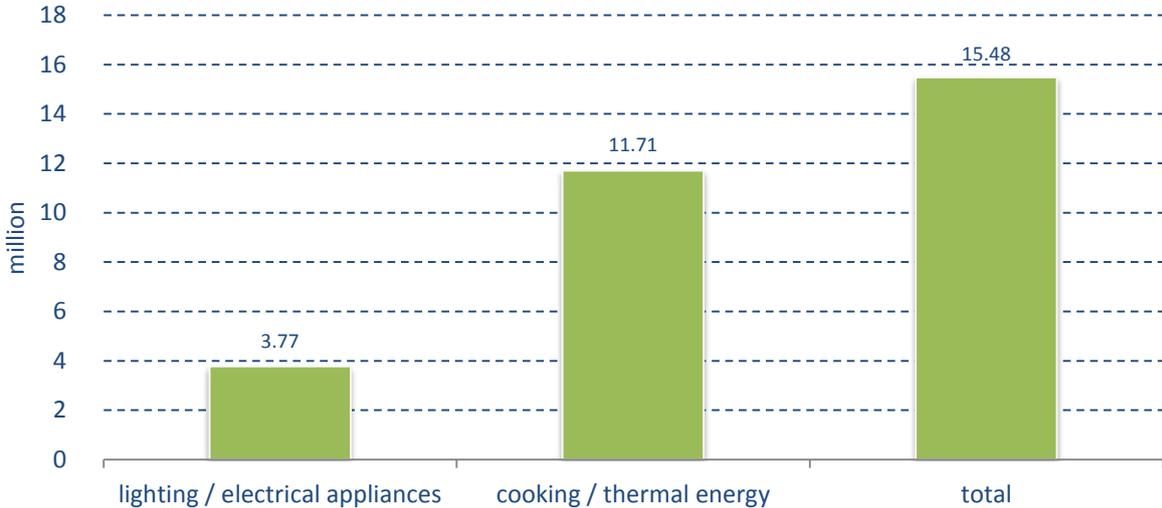
The SE4ALL tier system for improved cooking systems is still not 100% developed. Especially the health indicator is difficult to define for all levels. EnDev is involved in intense discussion with WHO, World Bank and partner organisations to finalize the matrix. The tier system currently implemented

by EnDev is in line with the current state of the multi-tier framework presented in the 2015 tracking framework. EnDev outcomes are attributed to the 5 tiers as follows:

Tier	Services	Number of people
5	Access to needed quantity of energy source: ≥ very high Health protection: ≥ very high Convenience: ≥ very high	0
4	Access to needed quantity of energy source: ≥ good Health protection: ≥ high Convenience: ≥ high	56,188
3	Access to needed quantity of energy source: ≥ fair Health protection: ≥ sufficient Convenience: ≥ sufficient	29,866
2	Access to needed quantity of energy source: ≥ limited Health protection: ≥ medium Convenience: ≥ medium	3,415,604
1	Access to needed quantity of energy source: ≥ deficient Health protection: ≥ low Convenience: ≥ low	3,931,630
0	Access to needed quantity of energy source: ≥ highly deficient Health protection: ≥ very low Convenience: ≥ very low	87,466
total		7,520,354

When looking at the overall EnDev programme, starting from phase one in 2005 up to December 2015 in phase two, the **total number of people** having gained sustainable access to modern energy services on household level amounts to **15.5 million** (Figure B.5). The total number of **social institutions** is about **17,800**, the total number of **enterprises** is around **34,000**, respectively.

Figure B.5: Adjusted number of household members provided with modern energy services in a sustainable manner (EnDev 1 and 2 combined)



The absolute numbers of verified beneficiaries (taking into account replacement but not the adjustment factors described above) are 18.8 million for EnDev 2 and 27.7 million for EnDev 1 and EnDev 2 combined.

Journey of Gregorio Poma, Bolivia



In April 2008, EnDev Bolivia organized a training workshop in the community of Bolinda, Caranavi in order to teach promoters from local communities how to build Malena stoves. One of the participants in this workshop was Gregorio Poma, from the Corpus Cristi community of the municipality of

Caranavi.

Until 2008, Gregorio Poma was selling Kisa (dried peach) soft drinks from his little stall located at the side of the road entering Caranavi. He prepared the peach drink on a traditional stove and charged 0.50 Bolivianos per glass (less than EUR 0.10). After the workshop, Gregorio started working not only as a promoter but also as a constructor of



Malena stoves in his community.



In early 2009 he decided to make several improvements to his soft drinks business. Gregorio decided to build a larger Malena stove to boil the water and eliminate the smoke during preparation. At the same time, he decided to start selling natural fruit drinks instead of Kisa as the sales of the latter had been quite slow. As demand for the natural fruit drinks grew, Gregorio built two additional Malena stoves in his shop. Nowadays, Gregorio produces 300 l of fruit drinks every second day. He serves his

lime, grapefruit and orange drinks in recycled aluminium bowls or small plastic bags. On average, he can sell 350 portions a day, at about 1.50 Bolivianos (EUR 0.20) per day.

Until 2008, Gregorio was also selling Chicharrón (fried pork skin), which he prepared on a traditional stove, each Sunday. Gregorio decided also to change to Malena stoves for the preparation of the Chicharrón. Since then, each Sunday he sells about 100 servings of "Chicharrón", each costing 30 Bolivianos (EUR 4.30). As the demand of for his Chicharrón increased, Gregorio built an additional stove in order to prepare larger quantities.



Seeing his business grow, in early 2014

Gregorio decided to hire Miguel Quispe to help, paying him a monthly salary of 1,000 Bolivianos (EUR 145). Then, in mid 2015, Gregorio decided to start selling chicken soup. Gregorio built a third large Malena stove inside his kitchen and hired a cook.

Gregorio, his wife Natividad Choque and their daughter Paola Poma, dedicate all of their time to his various businesses. The sale of soft drinks and Chicharrón was very profitable and this encouraged Gregorio to construct his own house. He decided to sell some land that he had in his home community to raise capital and to take a bank loan to finance the rest. With the profit that Gregorio makes with his different products, he will be able to pay back his bank loan in monthly instalments of 5,000 Bolivianos (EUR 715) over the next two years. Gregorio never imagined owning a home, but his growing and diversifying business has enabled him to achieve this goal.



Malawi: Night promotions with Powered by Nature in Mzimba. The suppliers of picoPV lamps are supported by a marketing campaign since the second half of 2015.



Burkina Faso: Roumdé is the brand name for several models of ICS. They are available in markets and resellers promote Roumdé easily recognisable on signs in front of their shops.

C. Impacts of EnDev 2

In addition to the main objective of the partnership to facilitate access to modern energy technologies and services, EnDev has 4 impact targets: **a)** climate mitigation, **b)** health prevention, **c)** improved gender balance, **d)** job creation, and 2 outcome targets: **e)** leveraging of funds and **f)** increase of power generation with renewable energies.

Climate mitigation, CO₂ savings

EnDev promotes the use of renewable energies for rural electrification, the substitution of fossil fuel-based technologies (e.g. kerosene lamps) and an increased efficiency of biomass-based energy applications (improved cookstoves, biogas plants). All three activities contribute to decrease greenhouse gas emissions.

An improved firewood cookstove, which saves 30% of firewood in practice and which is used to prepare 80% of all meals, saves around 0.50 t CO₂ per year (on average, over all EnDev stoves) compared to cooking on open fires. The total savings of all EnDev stoves for one year amount to approximately 1,366,144 t of CO₂. In addition, 214,651 t of CO₂ savings are generated for which emission reduction certificates are sold on carbon markets. Air pollutants as a result of incomplete combustion, including black carbon, are not included in this calculation.

One electric lamp powered by SHS and mini-grid or grid connections replaces at minimum two kerosene lamps, thus saving at least 0.18 t CO₂ per year. A solar lantern replaces approximately one kerosene lamp, saving 0.09 t CO₂ per year.

The total CO₂ saving of 2.7 million stoves and access to solar home systems, mini-grid connections or solar lanterns for 818,028 households supported by EnDev are 1,707,352 t of CO₂. For comparison: this amount corresponds to

- CO₂ emissions of all intra-European flights during 11,4 days, or
- annual household CO₂ emissions of a medium-sized city, for example, Potsdam, Portsmouth, Enschede, Trondheim, Ballarat (Queensland) or Bern and Basel together, or
- planting of more than 4.1 million trees on an area as big as 5,200 football pitches.



Health

Cooking with solid biomass and rudimentary stoves causes toxic emissions that lead to severe health problems such as chronic lung diseases, acute respiratory infections, cataracts, blindness, and adverse effects on pregnancy. EnDev's target is to reduce the health burden caused by smoke and soot in kitchens and cooking sites for at least 1,500 people for every EUR 100,000 spent.

As a result of EnDev activities the exposure level of indoor air pollution was drastically reduced for more than 4.1 million household members⁸ (particularly women and children). The improvement of the health protection was achieved by:

- reducing the quantity of emissions of particulate matters and CO through **a)** improved cookstoves with higher combustion efficiency and lower heat losses, **b)** improved fuel quality, and **c)** fuel switch;
- removing pollutants from the cooking site through chimneys, flues, hoods or ventilation; and
- reducing exposure to pollutants through changed cooking practices and placing of the stove and kitchen.

⁸ All members of households that use a stove fulfilling the level 2 criterion for the health attribute of the multi-tier matrix for cooking solutions.

Introducing a result-based market on portable improved cookstoves in Nepal

When Practical Action Nepal facilitated a call for applications to participate in the new result-based financing component on portable cookstoves in Dhading, there were hardly any candidates interested to participate. Potential entrepreneurs were not familiar with the products, they had already all running profitable businesses and did not see a reason for complicating their lives with a lot of paperwork. Only after the local NGO (who is the intermediate actor in this component) started to convince entrepreneurs in direct talks, six candidates decided to hand in their applications. One of them was Raj Kumar Shrestha, who already owned a shop for kitchen material and selected tools. Raj Kumar was highly sceptical towards the new cookstoves, of which he had not heard before. However, he learnt about the advantages of the stove, and in order to help earthquake victims, he finally agreed to test the market for charity reasons.

At first, he only purchased two cookstoves as an experiment. It took him five days to sell them. In a next step, he bought ten stoves, which he sold within seven days. He further accelerated until ordering 300 stoves. Raj Kumar says: "In the beginning I have not expected, that the cookstove business would become such a success, and I am now very happy about my decision to participate in the programme." Even though Raj Kumar turned into an advocate of the RBF approach on promotion of improved portable cookstoves, he also still struggles with the related paperwork. He has still not managed to open the requested bank account, because the bank asks for a number of documents and certificates that are very complicated for him to manage. Without having opened the bank account though, it is not possible for Raj Kumar to access the incentives from the bank. He says, that he will easily be able to sell more stoves, once the bank account will be in place. Having seen Raj Kumar's good business opportunities, also other entrepreneurs have now expressed their interest to participate in the programme.



Raj Kumar Shrestha in his store in Dhading, Beshi, selling Greenway stoves in the context of the new RBF component on improved cookstoves in Nepal.



The Namtar village Development Committee: Women's Savings- and Credit Cooperative; Chairperson and founder: Sukumaya Thing

Savings- and Credit Cooperative with initially 25 members. Meanwhile the group grew to 700 members, who all give monthly financial contributions.

The Women's Savings- and Credit Cooperative is now the local partner for the hood stove activities in Namtar VDC. They report to the District Cooperative Association about newly installed hood stoves on a monthly basis. Only then, incentives are paid. The cooperative already coordinated the installation of twenty hood stoves, with ten more in the pipeline. Before the earthquake, there were even seventy requests for stove installations. In order to encourage households to install hood stoves, Sukumaya suggested lowering the foreseen reduction of incentive payments for the future, so that financial burden for poor households will remain limited.

Namtar Village Development Committee (VDC) is located in one hour driving distance via mud road from the next junction to a concrete road, but two hours driving distance to the next district capital Hetauda. Namtar VDC is supported by a local NGO (called "MDRC") for rural development activities that presented the new RBF facility for hood stove installation to them. Sukumaya Thing, the chairperson of the local Women's Savings- and Credit Cooperative, was highly interested to participate, because she had seen a hood stove before in a neighbouring village. She had already hoped to introduce this technology in her village, because she saw, that the by hood stoves generated less smoke compared to traditional stoves. Moreover, the installed hood stoves allowed saving fuel wood, and the kitchen remained cleaner with this technology. Sukumaya has an important role for the development of her VDC: Seven years back, she has founded the Women's

The specific assessment of the health impact of promoted cooking solutions is based on the type of stove and fuel, the use of chimneys, flues or hoods, the degree of ventilation and the cooking place. Only cooking solutions classified as tier 2 or higher are considered as sufficiently safe regarding exposure of household members to indoor air pollution according to the EnDev tier system which is aligned with the Global Tracking Framework. These include all stoves using electricity or gaseous fuels as well as improved biomass stove (rocket stoves, gasifier stoves) used outdoor or with chimney or hood when installed or placed indoor.

Gender impact

EnDev has defined two specific indicators referring to gender-related impacts:

- a. *EnDev will pay attention to gender equality concerning access to and usage of modern energy technologies and services.*
- b. *EnDev fosters gender equality regarding job creation when facilitating access to modern energy technologies and services.*

Gender-disaggregated monitoring as well as several impact studies of EnDev realised until 2015 provide the following insights into gender-related impacts of EnDev measures.

Gender effects of access in households: Access to electricity is generally benefitting all household members to a similar extent. Men and women use electricity for light, radio, mobile phones and TV. However, the usage pattern is different. Men make more business phone calls whereas women with family members working abroad use the phone to stay in contact with their relatives. Men and women have also different TV viewing habits. Access to electricity in households is a source to increase productivity and earn money, too. Specifically women use electric light for processing of crops in the evening, or other income-generating activities such as sewing

Access to modern cooking technologies is mainly beneficial for women, in fact, in multiple ways: Health benefits for women due to reduced smoke and soot have been proven in numerous studies. Considering the above figure on the number of people with access to tier 2 cooking solutions and assuming that 1/5 of the household members are women and 2/5 young children it can be concluded that around 820,000 women and 1.64 million young children benefit from improved health protection. Beyond that, women reported more convenience and a better social atmosphere in their household due to ICS.

Gender effects of access in social institutions: Access to electricity in social institutions is generally benefitting boys and girls similarly. In the case of health centres the benefit for women is often higher as electrified health centres provide often services also after dark which is specifically important for women in the final stage of their pregnancy. Women feel also safer to visit health centres in the evening if they are illuminated.

Employment of men and women and income effects: Wherever EnDev has initiated markets for modern cookstoves and solar systems, new income sources have developed, both for women and men. However, the gender balance for newly created jobs varies significantly from country to country and depends on the specific technology and tasks. Whitesmiths as well as other metal-workers are mainly men, whereas pottery is dominated by women. The gender composition among retailers is roughly balanced, with a stronger representation of men in electric sales shops and a stronger representation of women in village shops. Hawkers which travel around and visit households are more often men, as travelling and even over-night stays is a particular problem for women for security reasons and because husbands might not allow such travelling and over-night stays. Altogether, EnDev has facilitated more than 10,000 new jobs (mostly part time) with a share of female employees of 40%.

A recently implemented impact study in Kenya (RWI, 2015) demonstrated that male and female entrepreneurs are almost equal in numbers. Compared to previous income situations before they started the business with modern energy technologies, both were experiencing an increase: ICS builders by approx. 55% and picoPV entrepreneurs by approx. 15%. In absolute figures, men still earn more than women in both sectors. Customers seem to buy equally from men and women.



Stove Producer Training in Liberia

After the Ebola epidemic broke out in Liberia in early 2014, EnDev was not in the position to actively move the ICS component forward. Public life almost came to a standstill: workers stayed at home, market places were not frequented as before, and project staff was restricted from movements in order to limit infection risks as far as possible.



Moreover, the focus of the project shifted to provide solar equipment for health centres. Luckily the stove producers, who had previously been trained by EnDev, continued to produce and sell stoves at small scale on their own initiative, thus the component still progressed, even though at slow pace.

Since ICS were still high on demand on the Monrovia markets, EnDev enforced the stove activities again starting in November 2015. In cooperation with the Monrovia Vocational Training Center, stove producer trainings were implemented at the premises of the centre.



Jackariah Bah, Joe Mulbah, Grace Howe, and Jacqueline Corfah were four of the participants, who attended the courses. They all have had metal work experience beforehand, but were enthusiastic about the new opportunity to learn how to produce ICS. They all tested the use of the improved cookstoves and were convinced to support a very useful initiative for the Monrovia market.



Job creation

Each EnDev project currently captures information about the time required for production of stove parts as well as for assembly and for installation. Based on the available data and the assumption of 240 working days per year with 8 working hours per day it can be calculated that 2,761 full-time equivalent jobs existed in the process steps of the production, assembly and installation of 1,318,053 stoves over the entire 12 months of 2015.

Most of these work steps are not done by full-time labour. About 2/3 of the EnDev stove projects capture additional data about the number of people working in the production of stoves. These captured values (which include part-time labour) can be compared to the calculated full-time equivalents. The comparison reveals that on average 3.4 persons are involved for each full-time equivalent. Based on this ratio a total of 9,387 people worked in the production and installation of EnDev stoves in 2015.

For calculating the number of jobs created along the distribution chain EnDev applied the methodology published by UNEP⁹. It was calculated that an additional 553 full-time equivalent jobs exist in the distribution chain for stoves. For PicoPV systems, which are mainly produced in China, the number of full-time equivalent jobs along the distribution chain was 587.

Altogether, 3,900 full-time equivalent jobs existed in the supply chain for stoves and picoPV in our partner countries.

The data presented in this chapter are still a preliminary description on the job creation impact of EnDev. EnDev is still working on an elaborate methodology to capture more precisely the job

⁹ Light and Livelihood: A Bright Outlook for Employment in the Transition from Fuel-Based Lighting to Electrical Alternatives; UNEP 2014.

situation along the value chains for energy products and services. In addition, EnDev will analyze the number of jobs that is created as a result of the use of modern energy technologies and services.

Leverage

The total value of all stoves and off-grid systems sold or installed by companies cooperating closely with EnDev was EUR 29.9¹⁰ million, which is a ratio of 1.73 in relation to the programme expenditures of EUR 17.3 million.

The total amount of investments along the market chain including intermediary products but excluding expenditures for private consumption is about EUR 81.3 million in the current semester alone, representing a ratio of 4.69 in relation to the EnDev programme expenditures.

Installed generation capacity with renewable energies

The total power capacity based on renewable sources installed since the start of EnDev 2 is 35.4 MW. Mini-grids contribute 44% to the total result (MHP: 8.4 MW, PV: 7.1 MW). The biggest share amongst the technologies is contributed by SHS (18.6 MW), while picoPV systems up to now have a total installed capacity of 1.3 MW. It is estimated that an additional 15 MW have been installed in the first phase of EnDev resulting in a totally installed capacity of 50 MW.



How drastically lives change when a village gains access to electricity: the case of Ocote Tuma, Nicaragua

The inhabitants of Ocote Tuma have experienced a drastic change in their lives since the installation of a mini hydropower (MHP) plant. Today, they live a more comfortable life than before and they seize the opportunities electricity offers them.

Ocote Tuma, a rural village in northern Nicaragua, gained electricity access nine years ago. EnDev Nicaragua, together with the villagers, decided to make use of the waterfall nearby and installed a hydropower plant. Since then, the little village in the rainforest has become an attractive place to live: the inhabitants are very content to have electricity and the population has quadrupled.

The benefits of electricity are wide-ranging. People have clean, safe light in their homes so that children can do their homework in the evening hours, they use refrigerators for chilling their food and beverages, and they can even watch TV. In addition to that, many people have started to use electricity for productive purposes, whether it is handicraft services from home or operating their own shops. The villagers also benefit from improvements in social infrastructure: the local school now has electricity access just as the health centre does.



The MHP plant is run by a village committee, which is very proud of the improvements their work has brought to the people. The committee has been involved in the whole development process: from the planning of the plant, to the installation, to the operation. . They now maintain the plant and ensure it is running in the most efficient and sustainable manner. Their job is not an easy one because the demand exceeds the supply by far. This is why they had to implement strict rules on the use of electricity provided. As the people of Ocote Tuma see that these rules work in their best interest, they comply. The villagers, together with the committee, have developed a strong sense of ownership for the MHP plant. Plans to optimise the electricity supply, and even the installation of a second turbine, are currently discussed. Thanks to the energy access, the people of Ocote Tuma look ahead with confidence.



For a more detailed story about the mini hydropower plant in Ocote Tuma, please have a look at the article "Power to the people" written by Klaus Ehringfeld published in "Akzente" 3/15. Available at: <http://akzente.giz.de/en/artikel/power-people>.

¹⁰ Investments made by the government of Indonesia into hardware of mini-grids were considered only with 25%.

Ethiopia: Interviewing for monitoring activities with the support of a tablet.



Bangladesh: Enumerators are trained in using the EnDev survey app.

D. Feedback from the beneficiaries

In 2015 EnDev carried out several household surveys to capture the view of the beneficiaries about the energy technologies and services that EnDev promotes in the different country projects. The results – positive as well as negative – of four of the surveys are presented in this chapter.

Bangladesh: User satisfaction with improved cookstoves

Background: Since 2010 EnDev Bangladesh has been supporting the dissemination of a prefabricated improved cookstove called “Bondhu Chula”. The stove is produced by local small entrepreneurs (so called sanitary shops) and exists in eight models. All models have a chimney. The prefabricated stove parts are assembled in the kitchen of the households. Marketing is supported by EnDev and the Bondhu Chula Foundation. By December 2015 more than 1 million households had bought a Bondhu Chula stove.

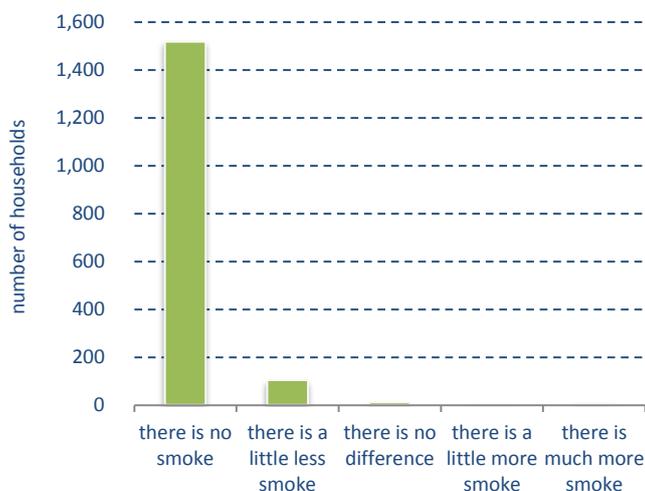
Under laboratory conditions the stove can reduce solid biomass consumption by up to 50%. However, the actual reduction in the field is expected to be lower (in the range of 20-40%) as it is also influenced by other factors such as users’ cooking habits and fuel quality. Depending on the size of the reduction of the fuelwood consumption household could save more than 100 Taka (more than EUR 1) per month if fuels are purchased. Due to the chimney it is also expected that indoor air pollution in the kitchen is significantly lower compared to the use of traditional cookstove.

Methodology: To verify the above-mentioned expectations and assumptions a household survey was carried out with 2,001 households. The households were selected at random from the database where all beneficiaries are registered. The questionnaire referred to the following topics: location; access and possession of different cooking systems; usage of the Bondhu Chula; care and maintenance; perceived benefit of the stove; respondent’s contact information.

Results: 81 % of the households confirmed that the cooking fuel consumption is decreasing when using the Bondhu Chula stoves. The same percentage also noticed that they needed less time for cooking and fire preparation with the new stove. More than 80% of the households experienced a decrease of the fuel expenditure as a result of using the Bondhu Chula stove. 92% of the households confirmed that the stove is not emitting any kind of smoke in the kitchen. Further 6% noticed some smoke in the kitchen but at much lower levels compared to the traditional cookstove. Households were using the Bondhu Chula stove as dominant cooking device. 80% use the stove for all cooking or 15% for most of the cooking.



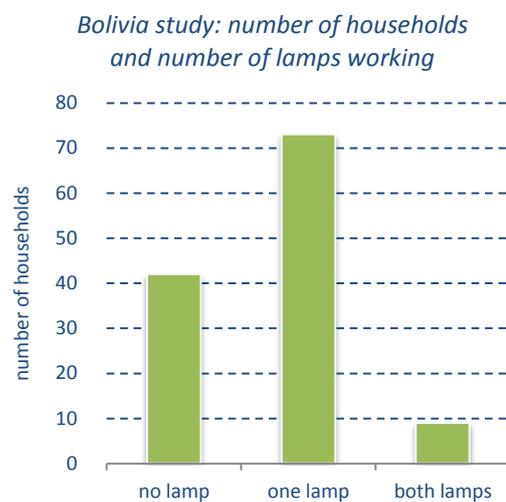
Bangladesh study: Did you notice a change regarding the amount of smoke you are exposed to when using the Bondhu Chula?



Conclusion: The client satisfaction with the Bondhu Chula stove is high. Interviewed households were not only highlighting the positive properties of the stove but also declared that they will recommend others to buy a Bondhu Chula stove. Also the price is considered affordable. EnDev will now analyse more in detail the economics of the Bondhu Chula. If a reasonable profitability of the stove production and installation could be ensured all basic factor for a sustainable market would be given.

Bolivia: Verification of the condition of picoPV systems

Background: In the second half of 2013, EnDev supported a project on the dissemination of 1,800 picoPV systems with the Vice Ministry of Electricity and Alternatives Energies (VMEEA) in the Amazon lowlands (Pando region). The systems consisted of two lamps, one solar panel of 10 Watt and all the required accessories. The beneficiaries were reported in EnDev's monitoring system over the course of 2014. Due to doubts about the sustainability of these systems – contrary to prior negotiations between EnDev and the ministry, the systems had been given away for free – a discount of 70% was applied in the EnDev reporting from the start.



Methodology: For data collection, a digital questionnaire was developed in the EnDev Surveys platform in early 2015. 124 households in two municipalities (*municipios*) and eleven communities (*comunidades*), representing a share of 6.8% of all beneficiaries, were interviewed with the help of a tablet. The questionnaire referred to the following topics: location; access and possession; usage; care and maintenance; training and information; sustainability; respondent's contact information.

Results: 248 lamps (two per household) were checked of which of 91 (37%) were found to be operating and 157 (63%) were found out of order. In 9 cases, both lamps were operational, in 73 cases one lamp was operational, and in 42 cases none of the two lamps were operational. Beneficiaries indicated that batteries lasted only about 6-12 months. Nearly two-thirds of the beneficiaries stated that they did not receive training on usage and maintenance. Despite the high number of lamps out of service, a majority of the respondents estimate monthly savings between EUR 1.50 and EUR 14.50. The perceived satisfaction with the packages is surprisingly high: more than 85% of the respondents rank them as good or very good.

Conclusion: Based on the results of the study, EnDev Bolivia developed a communication and training strategy for future projects with state actors. Training and information materials have been designed, including information on how to claim the warranty. For upcoming projects of VMEEA, EnDev will advise strongly for inclusion of market development aspects, such as training of entrepreneurs on sales of replacement batteries and spare parts.

EnDev's reaction to emergency situations in Liberia and Nepal

During the past two years, EnDev faced new challenges, when the implementation of country projects in Liberia and Nepal were hit by tragic humanitarian crises. In the first case, since early 2014, EnDev had to cope with the outbreak of the Ebola epidemic in Liberia which lasted for more than a year, while in the second scenario, a very strong earthquake affected Nepal in April 2015 followed by aftershocks. In both cases, EnDev initiated immediate response activities, mainly by providing PV products to affected households as well as to social institutions, in Liberia especially to health institutions.



Nepal: Students of the Shree Ramdevi Secondary School in Sangachowk, Sindhupalchowk are happy about their Waka waka lights.

EnDev also assisted other organisations outside of the countries to facilitate their donations on the ground. In the latter context, for instance the Dutch picoPV company "Wakawaka" donated picoPV systems both for Liberia and Nepal, but needed support when it came to import their products into the country and disseminate them among beneficiaries. EnDev also cooperated with the GIZ emergency relief project facility, for the context of above-mentioned energy related activities in both countries.

Installing a system on the roof of the Kamiendor Peripheral Health Unit, one of the eight



During times, when the GIZ risk management regulations did not approve staff movements, EnDev cooperated with other local NGOs, already based in the crises zones and thus, they managed to continue working in the field. Moreover, the local project teams in the countries were able to keep activities running, in spite of temporary absence of international project managers. In the case of Liberia, EnDev minimised infection risk for their staff by approving ample use of project vehicles, so that employees were not confronted with the risk to enter public transportation for their daily road to work.



Nepal: Ram Krishna Shrestha, a student from Irkhu, also gives positive feedback.

The speed of implementation, however, naturally slowed down, and achievement of results delayed. Since emergency relief products were often provided for free by other organisations, EnDev had to temporary lift the strict market approach mechanism (see country chapter Liberia).

Lessons learnt

Even though EnDev was fast in reacting to the changed reality, factors outside of EnDev's influence still determine the rhythm of project progress. Procurement of solar products in the sense of setting orders could quickly be dealt with, it was part of the GIZ internal mechanism. Any further step, however, follows mechanisms of outer systems: Availability of products on the market was not always given, and products had in some cases still to be produced or to be sent from production sites in Asia, before entering the next bottleneck of the shipping process.



Liberia: Vehicles used for logistic purpose had to overcome the muddy roads to the villages and towns in Sierra Leone.



Liberia: The team of EnDev installers in collaboration with Play House Foundation installers.

Customs bureaucracy had to be dealt with in lengthy procedures. The latter took longest in Nepal, where only for a short interval of time directly after the earthquake, customs restrictions for emergency support articles were lifted.

Time for dissemination or installation lasted in all cases longer compared to what had been foreseen: The Nepalese Government insisted on coordinating emergency relief activities – however, in reality was not able to cope with the challenges in due time. Hence, even one year after the earthquake, not all products have been distributed.

For EnDev Liberia, the ongoing relief measures are more complex, because they also cover the neighbouring countries Guinea and Sierra Leone. EnDev emergency response in the Ebola context focusses on installing solar equipment for health institutions. The project's team of solar technicians take care of these activities, who have to travel from site to site (see country chapter Liberia).

In consultation with partner agencies in Nepal, it had exceptionally been decided to donate funds as immediate response mechanism to affected sites because support should be immediately available instead of losing time for needs assessments. Moreover, site visits would anyway not have been possible in severely affected locations, because sites were not accessible after the earthquake. Hence, communities could estimate internally, where support was needed most, since demand was site-specific (see country chapter Nepal). From what has been evaluated so far, these support funds have all been spent immediately on rehabilitation needs. This observation leads to the conclusion that under certain circumstances financial support can be a reasonable and effective support mechanism to cope with severe emergencies – and maybe also the fastest way of efficient support.

Based on these experiences, EnDev had to learn the lesson, that **immediate response** can only be realised to a limited extend. Since EnDev can only act within existing systems – especially in terms of logistics – external factors are out of EnDev's scope of influence. Hence, for future situations of this nature, EnDev would tend to be more careful when it comes to entering commitments for immediate effect. EnDev would in future announce differentiated lines of activities with the larger part of actions implemented on a long-term perspective.

In October 2015, a total of 23 sites in Sierra Leone were provided with FOSERA solar systems, here in one of the 12 schools.

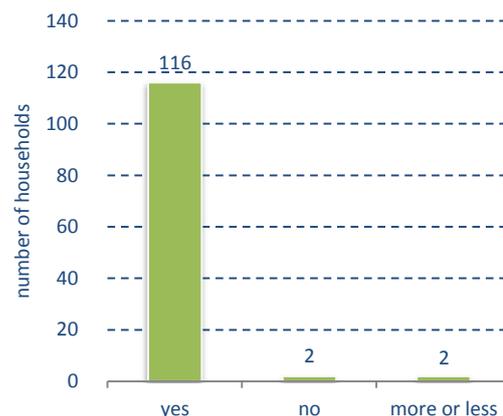


Honduras: Life span of the Justa Stove

Background: According to estimations, the Justa stove has a life span of five years. After that time the Justa is not supposed to be an improvement anymore and has to be removed from the outcome figures (*replacement*). However, the life span of five years has never been verified by field studies. In addition, anecdotes pointed to the possibility of life span extension through repairs. Therefore, a study on a sample of some of the oldest Justa stoves was conducted.



Honduras study: user satisfaction



Methodology: Due to the density of the stoves and distances between the communities, it was decided to work in western Honduras in the departments of Ocotepeque and Lempira. The sample consisted of 120 Justa stoves which had been in use for at least five years (average age was 6.5 years), representing 2% of the total Justa population. A team of five interviewers was hired. For data collection, a digital questionnaire with 94 questions was developed in the EnDev Surveys platform. The questionnaire referred to the following topics: location and general characteristics of the households; technical analysis of the stove; usage, maintenance and repairs; current fuel use; photos of the stove.

Results: 111 of the 120 stoves (92.5 %) were still in use. 105 have no exterior signs of damage, in 17 cases the entry was damaged, in 20 cases the combustion chamber had been removed or was severely damaged. 112 of the chimney were found to be in good conditions. 116 users are very satisfied with the stove. Average firewood savings were reported to be 67%. 25% of the families use a gas cooker for secondary cooking tasks. Quite a number of repairs had been performed on the cooking plates, combustion chambers and chimneys by users and stove builders.

Conclusion: After five years, the vast majority of the visited Justa stoves are still in use and still working as an improved cookstove. The Justa stove can therefore be safely assumed to have a life span of more than five years. In addition, it was found that the critical components which determine the life span had been exchanged on a number of stoves. That points to the possibility of promoting sustainability through after-sales services.

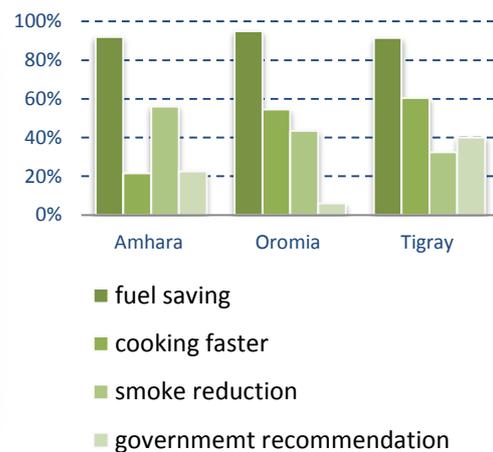
Ethiopia: sustainability trends for improved cooking

Background: Since 2005 EnDev supports the development of a commercial stove sector in Ethiopia by improving the technical and business skills of private stove producers as well as by strengthening the demand side of the market. In 2014, a study on improved stoves has been conducted in three regions (Amhara, Oromia and Tigray) to analyze project results along with sustainability trends.

Methodology: In total, 1,680 households and 58 producers and retailers have been interviewed. These were selected by random sampling. The research investigated the following topics: (1) penetration rate, (2) coverage rate, (3) usage rate, (4) maintenance rate and (5) replacement rate. Only a few selected results on Mirt stoves (used to make *injera*) are reported below.



Ethiopia study: reasons for ICS purchase



Results: Fuel savings were mentioned as an important reason to buy a stove by more than 90% of the users. (Savings were reported to be in the range of 40%-45%.) Faster cooking and smoke reduction were mentioned as important reasons by about 50% of the users.

More than 90% of the households claim that they perform routine maintenance (ash removal). At an average age of 4 years, 60% of the stoves in urban areas and 70% of the stoves in rural areas were found to be in a good condition. The majority of the households are satisfied with their stove: on a scale of 1 (not at all satisfied) to 10 (completely satisfied), average satisfaction was about 8.

Conclusion: User satisfaction and maintenance rate were high. The study also proposed certain improvements to ensure maintenance, repair and replacement of stoves in the future.



Rwanda: This shop is a retailer of a RBF company. The company receives an incentive for every certified solar lamp or solar home system sold, rented or installed to end-users.

PAPETERIE SUN KING

Rwanda: The independent verification agent visits customers to make sure the sales claimed by RBF companies are valid.



Rwanda: This single mother in Huye district bought the solar lamp through a local cooperative. She pays the cooperative through her harvest.



Rwanda: Under the solar lighting component, private sector companies keep a record of their customers' contact information. This serves to verify sales before receiving a financial incentive for selling solar systems to people in rural areas.

E. Overview about general EnDev activities in 2015

Global trends and cooperation with other organisations and initiatives

Climate change: In December 2015, **COP21** in Paris finally brought an agreement about limiting the impact of climate change to below 2 degrees Celsius. The Paris Agreement formally acknowledges the importance of upscaling and distributing renewable energy as well as the need for universal access to energy through renewable energy solutions. Various elements of the Paris agreement and the climate convention refer to energy access, i.e. the (I)NDC's, capacity development for developing countries, technology transfer and the confirmation of the Copenhagen Accord on Climate Finance for Developing Countries (USD 100 billion annually from 2020 onwards). While many issues of the Paris Agreement still need to be fleshed out before countries ratify, energy access has been added to the climate change agenda, demonstrated also in a number of side events (EnDev featuring in two) and the launch of several initiatives such as EU's ElectriFI, Bill Gates' "Mission Innovation", US Global Lighting and Energy Access Partnership under Power Africa and more. In addition energy, access is highlighted as one of the prominent themes in the **Lima to Paris Action Agenda**.

It remains to be seen whether this will have an impact on the availability of additional climate finance for rural, off-grid energy access as promoted by EnDev. Many of the INDC's have been drafted rather hastily with strong support from international consultants and development organizations and hence still need further refinement and ownership in many developing countries. Priority to off-grid energy access solutions in the final national contributions and financing plans is not a given: it will strongly depend on available funding which, from a first rough assessment, appears to be directed mainly to grid-connected options. Safeguarding the establishment and growth of inclusive energy access markets in rural areas requires governments, donors and climate investors to prioritize investments in these last mile markets.

The **Copenhagen Accord** potentially plays an important role in developing energy access markets. Developed countries have already endorsed the Copenhagen Accord, meaning their public and private investments will have to grow substantially over the coming years. Donor countries will need to explore instruments to implement the Copenhagen Accord – in particular those instruments that leverage public funding with private investments, meaning that the development of sustainable business models will be key. EnDev, with its demonstrated capabilities and extensive infrastructure, can be considered a quick and flexible instrument for channelling these investments with the assurance of measurable, reportable and verifiable results.

EnDev also has become a member of the **1 GigaTon coalition** which has been initiated by Norway and UNEP to identify gaps in measuring and reporting of mitigation achievements in developing countries in the energy sector. EnDev will continue sharing its results and calculation methods in a transparent way.

Finally, EnDev initiated a cooperation with World Bank (ESMAP) and the Global Alliance for Clean Cookstoves (GACC) on a joint multi-country proposal for comprehensive clean cooking sector development for the **Green Climate Fund** (GCF). In 2016, pending accreditation of the submitting organizations, a full proposal may be submitted. Meanwhile a draft proposal will be put forward to the GCF secretariat.

Sustainable Energy for All: At the SE4ALL forum, 4-6 June in New York, UN, EU, US, DFID, MDB's and others reported on substantial funding for SE4ALL targets committed at the launch of the initiative and announced additional efforts. Earlier, US President Obama had announced the Power Africa Initiative bringing substantial equity, guarantee and loans to the table for electrification in Africa.

Yet, despite SE4ALL's ambitions, despite country action agendas and investment prospectuses, and also despite considerable envelopes for SE4ALL funding, the results and planned activities in the segments of the markets where EnDev operates (i.e. inclusive and basic energy services in rural areas) are moderate. The majority of funds are still directed towards grid solutions and large generation units.

EnDev's contribution towards transitional and transformational changes

Societies pursue their Sustainable Development Goals (SDGs) generally in three ways:

1. Minor changes to the business as usual scenario, merely trying to make existing policies and structures more efficient and effective;
2. Transitional change: working towards a predefined outcome, via undefined pathways leading to a paradigm shift and structural changes in processes and systems;
3. Transformational change: a fundamental change of a society with completely new structures and internal processes functioning in a radical different way.

In order to create significant impact, political, economic and social changes in a society are necessary. This implies that bigger changes are required than “simply” adjusting the business as usual scenario. In other words, transitional changes are minimally needed to change the basic development paths, and thus to achieve the SDGs. This holds for the energy access sector in exactly the same way as for other sectors. Whether or not a combination of transitional changes may eventually lead to a full transformation of the sector is hard to predict and even harder to manage. EnDev tries to support transitions in the energy access sector, from three stone fires to improved cooking solutions, from kerosene and dry cell batteries to solar or grid electricity, putting both access and renewable resources at the centre of the transition. This cannot be done by EnDev alone, however. Governments play an important role in transitional changes, having to create favourable framework conditions for initiating and sustaining change processes, through changing policy schemes, sectoral focus and creating or supporting an enabling environment. Other actors, such as civil society and the private sector, play their role in realising transitional change, too. Finally, true transitions is only possible with the buy-in of the end consumer, making behavioural changes essential element in the transition process.

The eradication of extreme poverty, the stabilisation of the climate and universal access to modern energy services are among the key objectives of the Sustainable Development Goals (SDGs). In order to achieve these SDGs, EnDev contributes to several fundamental changes in its partner countries:

- from fossil fuel dominated economies towards economies that are based on renewable energy resources and energy efficiency;
- from centralised, grid based power systems towards decentralised off-grid solutions for electricity services in rural areas;
- from an economic growth concept focused on urban and industry development towards rural development strategies.

EnDev supports these fundamental changes in its partner countries by triggering **a)** structural changes; **b)** new capabilities among key actors; and **c)** a shift in mind-sets and peoples' behaviour. Below table shows how some of the results from EnDev projects support fundamental changes. These may lead over time to transitions and eventually possibly to transformational changes.

a) triggering structural changes	EnDev country
Introduction and adaptation of power purchase agreements and feed- in-tariffs	Rwanda
Creation and strengthening of private sector and civil society association and organizations	Ethiopia, Kenya, Nepal, Peru
Introduction of performance standards and benchmarks for products and services moving the market into new directions	Nepal, Peru
b) triggering of new capabilities among key actors	EnDev country
Introduction of innovative technologies	Rwanda
Capacity development of private sector and private investors in new technologies	Nepal, Peru
Creation and strengthening of public institutions for renewable energy technologies (e.g. quality inspection agencies, rural energy agencies)	Bolivia, Peru, Liberia, Senegal, Nepal
c) triggering a shift of mind-sets and peoples' behaviour	EnDev country
Creation and promotion of awareness shift among customers towards innovative renewable and clean technologies, and a change of the image of devices (modern instead of poor man's business).	Madagascar, Bolivia, Peru
Awareness shift among governmental and public institutions towards decentralized off-grid solutions and low carbon development	Nepal, Peru

Nevertheless, 2015 showed important new initiatives on the off-grid agenda. In October, DFID launched its **Energy Africa** campaign aiming to substantially boost the off-grid solar sector in Africa through addressing policy and regulatory barriers, and overcoming financial hurdles and market failures. Under the **Power Africa Initiative** the dedicated *Beyond the Grid* component was announced in partnership with practitioners and investors. Both initiatives will bring substantial funding to the sector involving international industry and financiers.

This will also have its effects on EnDev as the programme will be challenged to assess and define its particular role in the sector. EnDev is in close exchange with important sector players such as GOGLA and Lighting Global, coordinating efforts on the ground in several countries, but will seek to further strengthen this in 2016, including with Energy Africa campaign and Power Africa/Beyond the grid.

In the **clean cooking** sector similar developments based on a multitude of international initiatives cannot be observed. The successful 2014 GACC Cookstoves Future Summit resulted in close to EUR 440 million in pledges. The funds are aimed to a large extent at individual activities and programmes in the partner countries. The GACC secretariat's role is to contribute to coordination of activities in the sector, to public relations, to lobbying and to evidence, but its role is not in implementation on the ground. Individual donor countries or initiatives taking a global or regional lead in implementation are not available.

The main problem for achieving universal access to sustainable energy is serving rural energy markets. At the moment, results for pico-solar solutions are mainly achieved in urban or peri-urban areas, and in the cooking sector attention seems to focus on higher tier solutions like gas and LPG, and biomass gasifiers that also predominantly sell in urban areas and in a few more developed countries. As this is no surprise, strengthening rural energy business cases is essential. EnDev's strategy is particularly targeting rural markets, which implies a close cooperation with the local private sector as promoted by some of the global initiatives.

In some subsectors in 2015, progress on these **business cases** has been made. In particular, Pay-As-You-Go (PAYG) solutions for poor customers seem, in some markets, to provide good solutions to mitigate the need for large upfront investments by consumers. Some examples of consumer financing for cleaner cookstoves are found in a few markets too. Some of EnDev's RBF projects also pilot financing models for consumers. As a general observation, however, financing models for both consumers and distributors/suppliers are still limited, underdeveloped and under-financed. Depending on market segment and country there is a need for financing models, structures (MFI/FI), capital and guarantees. EnDev will further analyse its possibility to engage private financiers in its markets for basic and off-grid energy access.

The **SDG summit** adopted the SE4ALL targets under SDG 7. It is the first time that the world community has adopted energy as a development goal, approving of universal access to energy as a core contribution to sustainable development.

Currently the UN Statistical Commission seeks **indicators for SDG 7**. In designing the indicator on cooking energy World Bank (ESMAP), GACC and WHO lead the discourse – with EnDev contributing through its monitoring experience. The current proposal reads “the percentage of population with primary reliance on clean fuels and technology”, whereas, originally, the indicator read “non-solid fuels”, excluding all biomass options (except for biogas) and effectively banning all intermediate solutions from the discussion. The current proposal provides more opening for solid biomass solutions, depending on the definition of “clean”, which is still an on-going global discussion. EnDev principally agrees to an ambition to facilitate tier 4 and 5 access to all, as promoted by WHO and GACC. EnDev, however, strongly holds the position that this is not achievable for all within a reasonable period of time, and that intermediate solutions in tiers 1-3, and especially innovation of such solutions, should be pursued with equal vigour. EnDev will further share its position in international discussions and develop a comprehensive market development approach comprising a full menu of options to support this.

In 2015 EnDev has contributed intensively to the international debate and developments in clean cooking. It has worked closely with ESMAP on the development of the multi-tier framework for energy access for cooking, as it has contributed to the electricity multi-tier framework in support of

the Global Tracking Framework (GTF). In this cooperation, EnDev has tested the GTF household survey in Ethiopia.

EnDev contributes to the development of ISO standards for clean cookstoves and clean cooking solutions: EnDev participated in the working group which drafts a standard for harmonized laboratory testing. This standard is intended to replace the international workshop agreement on cookstove performance from 2012. Furthermore, EnDev contributed to the working groups on the conceptual framework, field testing and on impact assessment. EnDev has also entered into discussions with WHO on the guidelines for Household/Indoor Air Pollution. Finally, EnDev has contributed to the ESMAP State of Energy Access Report that will be published early 2016.

Development of a new furnace: in 2015, the production centre in Fianarantsoa started to use briquettes from Artemisia residues, Madagascar

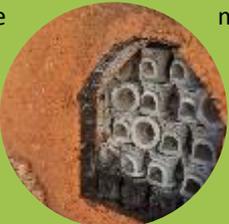


For the production of the improved cookstoves OLI that save up to 65% of fuel wood or charcoal, every year the furnaces consume around 200 t of wood. The process to burn approx. 600 stoves at once lasts around three days and it takes place in the production centre of Fianarantsoa constructed and financed by EnDev in 2014. EnDev's partner NGO in Madagascar, Association pour le Développement de l'Energie Solaire



(ADES) researched and developed with own funding how to produce briquettes out of biological waste that today fully substitute the required fuel wood for the ICS production. ADES cooperates with the local pharmaceutical company Bionex, who produces Artemisia-based ingredients for Malaria treatment. The Artemisia residues are now being processed further into large briquettes that ADES buys at the same purchase price as fuel wood.

Unfortunately, the furnaces used before were not suitable for the new fuel. The first attempt brought burned combustion chambers (see picture in the middle) due to insufficient air supply. Together with an expert from Antananarivo, large furnace was developed, which is only fuelled with those Artemisia sophisticated combustion chimney with a valve to regulate air supply on the right).



a specially designed new high efficiency fuelled with those Artemisia sophisticated combustion chimney with



First results are promising: Not only does the production need less fuel, but also the furnaces can be reloaded faster.



After this success, ADES started fundraising for a second large furnace, which allows to increase the burning temperature up to 800° C, and thus further improve the quality of the clay cores, which would then be produced with thinner outer walls and thus at reduced product weight, leading to an accelerated cooking process and reduced emissions. In addition, other new developments in the production process lead to further improvement of the quality of OLI charcoal stoves: stronger ventilation of air in the combustion chamber allows a more efficient burning process.

Bolivia: Since 2015, picoPV lamps provide light for the people living in the remote areas of the region Sena in the department of Pando.



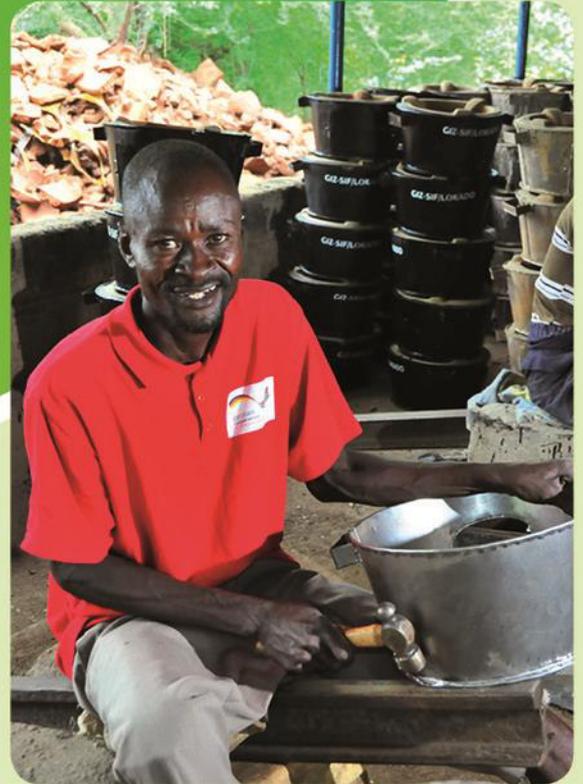
Bolivia: Around 43% of the rural population does not have access to electricity, mainly because of the cost of the connection. EnDev Bolivia provides a subsidy to lower the costs for families to get their own electric meter, like this one.



Tanzania: The metal cladded Matawi stove is manufactured as part of SNV's EnDev funded Tanzania Improved Cook Stove programme project.



Kenya: In the refugee camp Kakuma, the ICS Lokado is produced. So far, 2,100 energy saving stoves produced with EnDev support have been distributed to vulnerable refugees in the camp.



Women distributing the ICS Lokado.





Kenya: The refugee camp of Kakuma is in a remote area and therefore not connected to the national grid. Solar street lighting are installed in strategic locations such as market places, highly frequented streets and paths within the camp and in Kakuma town. Street lighting allows people to move around in the Kakuma refugee camp.



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