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13 Years of Impact in Ghana

Report on productive use of energy
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Chapter 1: Linking Energy Access and Economic Gains

1.1 Background

1.1.1 About EnDev

Energising Development (EnDev) is a multi-donor, multi-implementer energy access programme currently financed by six donor countries – the Netherlands, Germany, Norway, the United Kingdom, Switzerland and Sweden – which provide EUR 350 million. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH acts as lead agency for the implementation of the programme and cooperates closely with the Netherlands Enterprise Agency (RVO) at global level as well as other implementation partners at country level.

EnDev promotes sustainable access to modern energy services that meet the needs of the poor – long lasting, affordable, and appreciated by users. By 2019, access for minimum 20 million people worldwide shall be achieved. The bottom-up approach contributes to create positive economic, social and environmental impacts. Since its initiation in 2005, EnDev has attained a prominent position in the international energy access debate. EnDev is one of the first outcome-based and performance-based programmes in the energy sector; pioneering innovative approaches, developing new markets for pro-poor energy access and scaling up successful interventions.

Currently, EnDev is implemented in 25 developing countries, while 50% of the funds are targeted at least developed countries. A broad spectrum of technologies and a variety of project concepts and instruments are applied, corresponding to individual country situations. A thorough monitoring system measures the results on a permanent basis: by December 2017, a total of 19.2 million people, 21,900 social institutions, and 41,300 small enterprises have gained sustainable access to modern energy services.

1.1.2 Energy Access in Ghana

Ghana's status as one of the wealthiest and most stable nations in West Africa extends to having one of the continent's highest energy access rates. Access to electricity, through a state-owned distribution network, increased from 25% in 1991 to 84.3% in 2018. The country's goals are most exemplified in its Fifth Self Help Electrification Scheme which envisions universal access to electricity by 2020.

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Ghana's development objectives also focus on how energy is used. From the late 1980s, the Government of Ghana has been working to develop the Clean Cooking Sector and laid the policy foundations necessary to encourage the use of efficient technologies for cooking and heating while also recognizing its role in promoting good health, well-being, gender equality, climate action and eliminating poverty.

Despite these gains, weak rural infrastructure and high poverty levels reveal the unequal distribution of energy access in Ghana. Public investments in energy access have targeted households, while micro, small and medium-sized enterprises (MSMEs), which include farming and agro-processing activities, continue to perceive and experience access to electricity beyond their affordability. A 2014 survey of 547 farmers in five regions, revealed that 87% did not have access to grid electricity for productive use, even though most of them had electricity access at home.

These remaining barriers towards universal access to energy provided the backdrop for EnDev's engagement in Ghana which began in 2006. After 13 years of work through facilitation, capacity building, technical support and access to funding, EnDev is concluding its work in Ghana and provides an opportunity to look back on its achievements as well as towards the future of the productive use of energy across the country.

1.2 Major Lessons Learned from 13 Years in Ghana

EnDev Ghana helped foster a change of thinking among stakeholders in the utilities sector. Rather than seeing micro, small and medium enterprises (MSMEs) as a drag on the system, these important actors were now seen as interesting customers. The dialogue between district governments and business associations also helped foster more positive relationships on the district level with the private sector and helped show how they can be involved in a good medium-term development plan for the district that benefits both parties. It is these relationships that form the back bone of the major lessons learned from over a decade of implementation in Ghana.

Strong and local ownership is key

Locally grown solutions are sustainable and scalable, and they need strong private sector champions as well as public sector support. The light industrial zones that developed fastest were those that had been initiated by a strong local association. Their engagement helped smooth over the many hiccups involved in public sector infrastructure development. This development grew consistently even through changes in Government in which public officials often had to move to new districts. Similarly in the development of a market for improved cook stoves for gari processing, the market showed growth after a well-established local company began marketing an innovative model. The Burro Gari Elephant stove was a new design that is assembled in Ghana with the aluminized steel components brought in from other countries as prefabricated parts. Despite its international mix of design and production, it well met the local needs of the gari processors, could be made available quickly to customers, and was popularized through established local sales structures.

Land tenure is an important step to get activities started

Unclear land tenure hinders investment for all entrepreneurs, for farmers and even district governments. Having access to secure land tenure for small businesses was one of the intended outcomes of the LIZ intervention, but acquiring land tenure for each light industrial zone had to be negotiated individually by local actors and often involved protracted legal processes. The issue could not be resolved easily and continued to hinder the development of a light industrial zone in many districts. Many farmers also operate on land belonging to local chiefs, and are not able to invest in irrigation because the tenure can be revoked easily. The most successful irrigation systems built were those whose farmers possessed land tenure for their farming plots; thus providing confidence and ensuring that the investments they were making into their livelihoods would have long term gains.

Established companies are pioneers in using innovative technologies

Being able to use improved energy services, whether it means a dedicated electricity connection in a well-ordered industrial cluster or a PV or grid-powered irrigation system, is something that more established local entrepreneurs will be able to take advantage of first. Although EnDev explicitly targets entrepreneurs who have not used modern energy services for their business or farm before, those companies who were better established and usually having some sort of access to electricity from generators or shared electricity connections, were those that pioneered use of the new technologies. They are also better able to invest in their business and digest complex information about maintenance and use of innovations.

Trainings are needed for micro-entrepreneurs

Especially for micro to small entrepreneurs and farmers, the role of training not only on technical aspects but also on good business practices makes a crucial difference in their success. Even up to 10 years after support, entrepreneurs in the industrial zones cite the impact of the profitable environmental management and business entrepreneurship trainings as important contributions to their business.

In the case of irrigation systems, both solar and grid-based, for farmers, the high costs for fixed assets are untenable for most smallholder farmers. For farmers who are able to afford these costs, there also exists a major knowledge gap when it comes to the design, selection and maintenance of these systems. While the payback rate for these irrigation systems poses a great potential for farmers and the ecosystem of suppliers and service providers for these systems, they must also be made aware of and be trained to use them to their full potential.

User-centered incentives and subsidies are key

The introduction of new systems and ideas are often met with low demand, for practical reasons as well as a simple lack of understanding of its benefits. In addition to technical support and facilitation services to promote technologies like electrical irrigation systems, improved cookstoves or relocation of businesses to a centralized area, appropriate carrot mechanisms are required as a stimulus.

This may come in the form of viable financial incentives to help offset high fixed costs for the adoption of technologies. In the case of Light Industrial Zones, local governments and business associations may even create attractive lease arrangements to attract businesses to create a new home for themselves. These include the promotion of LIZs as having the means to ensure that supporting infrastructure is finished and maintained; or providing a relocation bonus for new start-ups. In the case of solar-irrigation, the nature of the technology makes it generally too-expensive for use by small-scale farmers, according to the experience so far. In the future, the promotion could be flanked by subsidized services and financing arrangements, which would also help make it affordable for small-holder's integrated in clustered agricultural locations.

2.1 Strategy and Objectives

From June 2006 to September 2019, the role of EnDev in Ghana has been to facilitate access to energy for productive use, as an indispensable pillar for increased productivity and economic growth. In its first phase, EnDev focused on local economic development and access for small businesses with a strong focus on job creation. The second phase of the project known as EnDev2, aligned with the Government of Ghana's 2014 SEforAll Action Plan and added the agricultural and agro-processing sectors to its energy access objectives, with an aim to increase productivity and profitability in small scale intensive agriculture. These objectives impact beyond the scope of access to energy as jobs are created, health is improved and business outputs are improved.

This new access to electricity for poverty reduction have been a cornerstone of EnDev's vision and mission in Ghana. EnDev's role as a facilitator has been implemented via awareness raising, dialogue platforms, training and capacity building, and support to businesses. Its main partners ranged from national to local level governments and business associations. Decentralization and local governance have also played a part in EnDev's work in Ghana through support for economic development at the local government level.

The valuable role which EnDev has played is most exemplified with the Government of Ghana now increasingly promoting productive use of energy in line with its own Private Sector Development Strategy.

2.2 The Evolution from Local Businesses to Agriculture and Agro-Processing

In 2005, a series of market demand studies from the GIZ supported Rural Trade and Industry Promotion project identified that a key bottleneck to private sector development among MSMEs was lack of access to energy, as well as being trapped in residential areas with little or no space to expand their businesses. This rationale informed the recommendation of Light Industrial Zones (LIZs) where MSMEs could provide enhanced services to the local economy. These would thus create a central business zone which could cluster like-minded businesses that were already organized around their Business Associations, for example metalworkers or woodworkers. In September 2005, the Energy for Productive Use project was initiated following consultations with the local divisions of the Northern Electricity Distribution Company (NEDCO), and various Municipal and District Assemblies in the Brong Ahafo Region and the Ministry of Energy.

Chapter 2: The EnDev Project in Ghana

By July 2006, EnDev Ghana was implementing its flagship project, known as EnDev1, to improve business environments for small enterprises by providing access to energy for productive use, thereby spurring local economic development and job creation. Through working through local government and business associations, the project set out to facilitate the establishment of new industrial zones, known as LIZs, and to provide the relocated enterprises with improved access to energy for productive use as well as financial and non-financial services.

Understanding of the link between energy and private sector development grew in Ghana partly due to the role of EnDev1 and led to the extension of the scope of the project to address issues of the nexus between energy and agricultural growth. In response to the core vision of the Ministry of Energy's 2014 SEfor All Ghana Country Action Plan, EnDev 2 shifted its focus to increasing efficiency and profitability in Ghana's small-scale intensive agriculture and small-scale agroprocessing sectors.

EnDev2's focus on small scale farming acknowledged the gap between urban and rural electrification in Ghana, as well as the problems faces by micro-entrepreneurs in accessing electricity. By 2011, overall electrification in Ghana had rose to 72%, but less than half of households (45%) in rural areas had access to energy. Furthermore, electrification focused on households, with subsidized tariffs, but requires farmers to pay a higher commercial tariff if they need electricity for their business. Meanwhile, growing domestic and international demand for food commodities provided an attractive economic opportunity for rural farmers. Though many of these farmers were considered smallholders, with three hectares or less, many were drawn to the growing markets. However, many of these smallholder farms were limited in their farm production due to their reliance on traditional manual irrigation techniques. The potential for improving small and medium agricultural operations via improved access to powered irrigation systems thereby formed a significant component for EnDev2.

Many processed foodstuffs in Ghana meanwhile, like palm oil, shea butter, pito beer and cassava flour, are still produced by micro-entrepreneurs using traditional energy sources – i.e. wood, charcoal and manual labor. These processes are laborious, unhealthy and use wood resources at an unsustainable rate. EnDev 2 also worked to address these needs with a component for improved energy for thermal processing that eventually focused on the improved production of gari – a dried and fermented flour from cassava that is an important staple food.

In 2014, EnDev2 was launched with four components. While it would continue to assist local governments to complete existing LIZs, EnDev2 would also facilitate access to energy for agricultural irrigation through both the extension of the existing electricity grid, and through solar (photo-voltaic) pumps sold and installed through private sector actors. As well, EnDev2 included a component to facilitate clean thermal energy for agro-processing through the use of improved cookstoves.

Chapter 3: Key Players

3.1 State Partners

3.1.1 Ministry of Energy

The Ministry of Energy (MOE) is responsible for the overall development and utilization of energy resources in Ghana. It formulates, implements and monitors power sector policies, provides technical advice to the Government of Ghana and overseas state-owned public electric utilities while also working with various energy-related agencies. MOE served as EnDev's political counterpart from the preparatory meetings leading to EnDev1 through EnDev2 and its pivot towards agriculture and agro-processing. In 2008, the project signed a Memorandum of Understanding with the Ministry of Energy to provide network materials for the extension of electricity to a Light Industrial Zone in Kenyase. From 2014, its Directorate of Renewable and Alternative Energy was an implementing partner for Grid Powered and Solar Powered Irrigation Systems and Thermal Agro-processing.

3.1.2 Ministry of Trade and Industry

EnDev worked through the Ministry of Trade and Industry (MoTI) as part of its Private Sector Development Strategy, in both first and second phases. The objective of MoTI's PSDS is to foster the development of sustainable corporate strategies for enterprise growth and job creation. These aligned with EnDev's strategy for the productive use of energy for local economic development from the implementation of LIZs, as well as the agriculture and agro-processing industries. As such, EnDev1 was implemented by GIZ's Programme for Sustainable Economic Development with MoTI to develop Light Industrial Zones. The Rural Enterprises Project, which is supported by the African Development Bank and IFAD, will continue to collaborate with local governments to develop LIZs indirectly, while also providing Rural Technology Facilities (RTFs) for technology transfer and training in completed LIZs.

3.1.3 Energy Commission

The Energy Commission was established in 1997 to provide technical advice to the MOE on regulating, managing, developing and utilizing energy resources in Ghana with view towards preparing the power sector for greater private sector participation. It acts as the coordinator for Ghana's Sustainable Energy for All (SEforALL) Action Plan is an important stakeholder affiliated with the MOE. EnDev's own objectives for productive use of energy harmonize with SEforALL action plan of the Energy Commission. For example, the Energy Commission of Ghana and other stakeholders indicated that EnDev's activity to extend electricity to communities in EnDev2 was in line with the SEforALL action plan.

3.1.4 Ghana Irrigation Development Authority

The Ghana Irrigation Development Authority (GIDA) is a subsidiary of the Ministry of Food and Agriculture (MoFA) and is another key stakeholder for the grid and solar-powered irrigation systems component of EnDev2. Through GIZ's Market-Oriented Agriculture Programme (GIZ), the EnDev irrigation components in Ghana are able to bridge the gap between energy supply and irrigation to support farmers with the assistance of GIDA. For ENDev's activities in Northern Ghana, GIDA educated farmers on solar pumping technology and supported in the procurement and installation of 2 solar powered irrigation systems for farmers in the Upper West Regions. These installed systems were used as demonstration and practical training for agricultural extension officers, farmers and agricultural officers.



3.2 Business Alliances and Trade Organizations

3.2.1 Trade Associations

Creating industrial zones with access to energy, known as Light Industrial Zones, cannot come to fruition without the buy-in of associations of businesses. EnDev, through GIZ as implementer, worked alongside associations of businesses in the same sector (example: garage associations) at the district level to increase the sustainability of industrial zones. Improved business associations that have well-defined leadership structures and systems of management allow them to work better together with utilities companies to improve access to electricity. Downstream advances in livelihoods and job creation for business association members are attractive motivators for their active participation in the development of LIZs.

3.2.2 Farmer Based Organizations

Access to farmers who are interested and motivated to apply grid powered or solar powered irrigation systems to increase their outputs could not happen without the involvement of Farmer Based Organizations (FBOs). In the inception of EnDev2, selected FBOs, and partner microfinance institutions (MFIs) were sensitized on the importance of deploying solar pumps for irrigation, and helped to identify suitable farmers to participate in the program.

FBOs have not only served as gateways to direct beneficiaries, but also are important entities for business and organizational development trainings so they are able to engage and advocate for improvements in infrastructure and services delivery from both public and private sectors involved in energy access.

Together, engagements between FBOs and energy access stakeholders, like the Electricity Company of Ghana, that have been facilitated by EnDev2 have improved trust and confidence for energy utilities and confidence for further and sustained work.

3.2.3 Ghana Alliance for Clean Cookstoves (GHACCO)

Ghana Alliance of Clean Cookstoves (GHACCO) is a local trade alliance that fosters the market and supports their members, who are small and medium sized agro-processing businesses, to work in line with Sustainable Energy Market Development Approaches. It works by implementing awareness campaigns and policy advocacy with its government partners.

Through the work of SNV, GHACCO has been restructured and will now be more influential as a sustainable guiding entity for the agro-processing sector. The association will support the commercialization of improved cookstoves (ICS) and promote the technically best products that are economically sound for their members.

3.2.4 Solar Pump Suppliers and Installers

The inception of the EnDev2 component on solar powered irrigation systems depended heavily on the involvement of suppliers and installers. Photo-voltaic (PV) pumps for irrigation had not been used much in Ghana, but rather had shown success for drinking water supply in the northern city of Tamale. This paved way for the first phase of the project in 2014-2017 to employ a market development approach to support the installation of PV irrigation pumps for small-scale farm irrigation. Through this intervention, EnDev2 was able to understand that local technical expertise in the design, installation and maintenance of solar irrigation was available for future expansion and that the suppliers themselves saw this as a huge business opportunity.

3.3 International Institutions

3.3.1 GIZ

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is a service provider in the field of international cooperation while also supporting the German Government in achieving its objectives. In 2017, the organization generated a business volume of approximately three billion euros. The German Federal Ministry of Economic Cooperation and Development is the GIZ's main commissioning party. The organization works across a variety of sectors as well as across stakeholders; from bilateral and multi-lateral institutions including the European Union and the United Nations to civil society, the private sector and national governments.

GIZ acts as lead agency for the implementation of the EnDev project in Ghana. From 2006 until 2013, EnDev in Ghana was implemented as part of the BMZ programs for local economic development and private sector development. Since 2014, the project has been implemented independently of the bilateral BMZ-portfolio, but in close cooperation with the GIZ energy and agriculture portfolio.

3.3.2 SNV Netherlands Development Cooperation

SNV Netherlands Development Cooperation (SNV) is a not-for-profit international development organization with a long-term, local presence in over 25 countries. The implementer focuses on three sectors: agriculture, energy and WASH in market-based approaches that develop the private sector while also being a trusted partner of local and national governments. SNV has worked in Ghana since 1992 in its three technical sectors.

With its expertise in delivering effective market transforming approaches, SNV partnered with GIZ to implement the "Productive Use of Thermal Energy in Agro-Processing" project in Ghana, financially supported by EnDev, from August 2014 to November 2018.

Chapter 4: EnDev Ghana's Achievements



4.1 Powering Local Development with Light Industrial Zones

With support from the GIZ Programme for Sustainable Economic Development, the EnDev1 component for light industrial zone (LIZ) development sought to extend electrification beyond households and towards productive uses, particularly for MSMEs. The major objective of the intervention was to stimulate local economic development and improve the performance of small businesses by providing, in cooperation with local partners, a service package including improved electricity supply, as well as road access, water supply and sanitary facilities. In parallel, business development and environmental management trainings from local partners would complement these infrastructure improvements to increase productivity. On one hand, access to electricity and lighting facilities extends working hours, and higher customer attraction, while business development trainings would improve product and service quality leading to increased income and growth for MSMEs.

The project initiated the development of LIZs in 8 towns in district capitals in the Brong Ahafo Region. In 2010, the geographic scope of the project expanded based on demand from metropolitan, municipal and district assemblies to the Northern, Ashanti, Eastern, Western and Central Regions.

The inception of EnDev2 from 2010 provided an opportunity to sustain this project by selecting an additional 10 districts and their local governments to facilitate the development of LIZs with road, water and sanitary facility access in addition to its connection to the grid. Furthermore, business management and development training services were enhanced through the work of local providers.

4.1.1 Key Players

As national level stakeholders, the MOE and MoTI officiated the project steering committee to provide advice and coordination. In 2008, the MEP signed a Memorandum of Understanding with the project to provide network materials at the cost of GHS 30,000 for the extension of the electricity grid to a LIZ in Kenyase. For EnDev2, MOE continued its support for the extension of the electricity grid for irrigation development in the Anloga, Ada and Gomoa areas by providing similar network materials and the commitment of the Energy Company of Ghana to pay for labour costs and installations.

Metropolitan, Municipal and District Assemblies and their Departments of Trade and Agriculture were integral for the successful implementation of activities related to the productive use of energy. They provided suitable land and infrastructure as well as paid for installation of hardware. Local Business Associations performed similar responsibilities in land acquisition and development depending on their fiscal ability, administration and organizational development.

Business Associations, particularly the Ghana National Garages Association (GNAG) have been key private partner for LIZ component in all District Capitals. They initiated the largest number of LIZs by acquiring land and beginning its development. The most successful LIZs are those that were started by the local GNAG.

Publicly owned utilities, particularly ECG and the Northern Energy Distribution Company (NEDCo) provided technical support including procurement advice, network design, selection of contractors and supervision of installations.

4.1.2 Key Achievements

- 18 Light Industrial Zones supported in the Ashanti, Brong Ahafo Western, Central and Eastern regions
- 17 of 18 districts supported a LIZ with collaboration from MMDAs, Business Associations and other private sector partners.
- 1203 MSMEs located in supported LIZs (as of Dec 2016 when regular monitoring last took place, and the supported sites do continue to be further developed so that more relocations can take place).
- 417 businesses gained sustainable access to electricity for the first time (Dec. 2016)
- 324 MSMEs founded in industrial zones (Dec. 2016)
- 3600 people employed (Dec. 2016)
- Competency-Based Economies through the Formation of Enterprise (CEFE) and Profitable Environmental Management (PREMA) training approaches were mainstreamed into the Ghana Skills Development Initiative and the National Board for Small Scale Industries (NBSSI) with a key number of senior staff possessing high awareness and appreciation of the methodologies after Training of Trainers

In addition to the achievements resulting from LIZ, a 2013 impact study* of project beneficiary MSMEs confirmed that electricity enables enterprises to perform better than those without. This is observed through longer opening hours, with high quantity and quality of lighting putting users in a favourable situation. Furthermore, the LIZ itself does not correlate to positive impacts for companies, but rather the holistic environment of both the infrastructure supporting the LIZ, and business development services that are offered to MSMEs to support their further growth.

4.1.3 Lessons Learned

Local champions, especially the concerted involvement of well-organized business associations, are required to initiate local economic development processes and their implementation were key to the success of light industrial zones. The ability of these bodies to legally acquire suitable land, develop complementary infrastructure and hardware installation for grid access all ensure the development of a successful new LIZ.

Furthermore, the strong motivation of the local garage and wood-worker associations/private sector initiative combined with the willingness of local government is needed to collaborate with local development partners to share costs and expertise. Harmonization with existing decentralization and urban zoning plans and private sector programs ultimately create a stronger and more sustainable LIZ. When local economic development support measures are integrated into LIZ development, there is broader stakeholder buy in as LIZs are seen as an integral component of the local economy.

Businesses must also be incentivized to relocate to LIZs through both carrot and stick policy tools. Business development trainings for MSMEs, especially new start-ups, that do participate in a LIZ serve as an attractive tool as participating enterprise experience improvements to their livelihoods as well as business growth as a result. Local governments may legislate their own regulations to ensure site conditions are adequate in order to motivate entrepreneurs to re-locate to LIZs. For delinquent tenants, local governments may also legislate punitive measures in agreement with business associations. For example, delinquent enterprises who commit to a LIZ but do not physically relocate may be fined or lose their right to tenancy.

4.2 Extending the Grid to Irrigate Farms

Grid Irrigation is considered the second component to EnDev's work in Ghana and continues to address the gap in access to electrification - particularly for the agriculture sector. The growth in market demand for a great diversity of vegetables that needed to be watered regularly provided the rationale for demand for grid electrified irrigation systems in small and medium sized farms. The target beneficiary groups were mostly practicing manual irrigation, while some used petrol pumps to irrigate their plots. Some were also sharing electricity tapped from domestic sources that were a distance from the farms. Those that relied on fossil fuels faced increases in their operational costs due to increasing fuel prices. There was no support mechanism to promote the productive use where the low-voltage grid is available. Farmers with the resources to develop systems encountered cumbersome process of procuring commercial meters from the utility agencies. However, the high upfront cost for fixed assets of grid irrigation systems together with widespread land tenure insecurities explained why smallholder farmers were cautious and slow to buy into these systems.

The lack of a support scheme or programme to support informal irrigation put EnDev in the right position to play a pivotal role in supporting the Government of Ghana as they made productive use of energy in agricultural value chains a priority in their SEforAll Action Plan.

In addition to supporting public utilities to extend their grids beyond households and towards systems for small and medium agriculture, the project provided a partial subsidy to reduce the upfront investment on fixed assets by small-scale farmers.

4.2.1 Key Players

In order to access beneficiary farmers, the project worked through Farmer Based Organizations (FBOs), the Ministry of Food and Agriculture (MOFA), and community leaders. Through these gateways, farmers submitted formal applications fulfilling certain criteria for assessment and selection, which were approved by a Technical Committee for the project. Beneficiary farmers invested in the irrigation system, and paid the utility for the system cost, which was subsidized until 2017 by the project. The main utility provider, the Electricity Company of Ghana (ECG) carried out technical assessments for the installation of systems and their connection, with verification completed by a certified installer of the Energy Commission. The publicly owned utility was paid directly by the beneficiary farmer before EnDev paid the subsidy directly to the utility.

The project provided subsidies to cover connection costs to farmers, following a pre-feasibility and cost estimate done for these activities. The project also continued its business development approach for farmers by providing business, irrigation and good agricultural practice training to beneficiary farmers in intervention areas.

* Peters J, Sievert M and C. Strupat (2013). Impacts of Micro-Enterprise Clustering Program on Firm Performance in Ghana. Ruhr Economic Papers #407. RWI RGS Econ. 02/2013.

Snapshot: Access to Energy for Agriculture

- 462 farmers connected to the grid in Ada, Anloga, Anyanui and Shime
- 400 farmers underwent Good Agricultural Practice Trainings that included modules for irrigation, tube well construction and electrical safety in Anloga, Shime, Anyanui and Sege.
- 400 farmers benefited from CEFE business trainings and prepared simple business plans Utility PUE awareness campaigns
- Increased demand for connections to the grid despite reports of high utility tariffs

4.2.2 Key Achievements

In the short term, EnDev was able to promote productive use of electricity among smallholder farms as well as broaden electrification to agricultural communities not yet on the grid. Intermediate impact was seen through the improvement of water supply for irrigation and the reduction of labour hours, and thereby operational costs, required to irrigate farms. In the long term, beneficiary farmers are now able to grow multiple crops, with an average of five crops that can be harvested more frequently with improved irrigation practices. Improved farm outputs have also led to improved livelihoods and poverty reduction of smallholder farms.

4.2.3 Lessons Learned

The high cost of electricity, lack of subsidies or promotional rates for farmers continue to prevent farmers uptake of powered irrigation systems. Demand for irrigation systems is unequally distributed across Ghana with high demand across the southern coastline but limited awareness in others. Land tenure, and its insecurity for many farmers also affects their willingness to invest in grid connections despite the fact they are cheaper than petrol pumps.

Farmers need training and advice on irrigation system design and maintenance. Awareness and technical advice are needed to implement systems and also efficiently use electric pumps. Nearly all farmers use a one-size-fits-all pump regardless of the size of their plot. Many require assistance to design their irrigation systems appropriately and save on energy costs. This offers business growth opportunities for irrigation equipment businesses to expand their range of services.

If investments can be made to make cost of informal irrigation through the electrical grid competitive, this intervention will have the potential to enable long term improvements of rural livelihoods through better energy infrastructure and more intensive agriculture.





4.3 Promotion of Solar Powered Irrigation Systems

In order to reach farmers located too far from the electricity grid, as well as those looking to make long-term savings in their irrigation costs, EnDev included a component to support the procurement, installation, operation and maintenance of photo-voltaic (PV) powered irrigation pumps. These activities built upon interest to roll out PV pumps for irrigation purposes based on their success as water pumps in Ghana's northern communities. In the city of Tamale, excess water originally intended for the drinking water supply was being used for agriculture and had triggered the interest of local farmers and potential suppliers. Stakeholders viewed a large market potential for PV pumps since prices of fossil fuels and grid electricity were comparatively high. Many farmers were looking for mechanised irrigation to intensify cultivation and to improve upon manual forms of irrigation. Others were seeking an alternative power supply option for their existing irrigation schemes based on diesel or petrol pumps.

The project unfolded in two phases. From 2014 to 2017, EnDev provided financial support for the installation of 35 PV irrigation pumps for small-scale farmers through a market development approach. Selected companies were provided with incentives in the form of sales-based grants of up to 40% of the PV-system cost to market and sell up to 35 systems. On the demand side, target beneficiary farmers were mobilized through equipment providers working through FBOs.

From 2017, until the completion of the project in 2019, more than 300 micro solar pump systems were purchased and utilised by small scale to medium sized farmers.

4.3.1 Key Players

This component of the EnDev project was implemented by GIZ and involved a number of private sector actors already offering solar pumping solutions or eager to enter the PV pump market. This component of EnDev focused on the lack of awareness about the benefits of the technology for small-scale irrigation, scepticism about their long-term viability and the high capital costs that makes further market introduction support necessary.

Selected FBOs and micro-finance institutions (MFIs) were sensitized by EnDev on the importance of deploying solar pumps for irrigation. The target beneficiary farmers were smallholder farmers who were not using grid electricity as well as commercial farmers seeking to reduce energy costs by deploying an energy option that offered low operation and maintenance costs over the long term.

An Operations and Maintenance Manual for SPIS was developed. Trainings conducted on the manual for promotion and planning of SPIS for solar pump installers, agriculture extension officers and MFIs.

The project also worked in collaboration with the SEforALL Secretariat to hold events to promote the productive use of energy in all 10 regions in Ghana to complement market development activities for SPIS.

4.3.2 Key Achievements

- Introduction of first SPIS FAQs in Ghana, taken up by the Ghana Energy Commission, and introduction and piloting of an operations and maintenance guide for SPIS, targeted at farmers
- Cooperation with agricultural sector actors led the way for other solar irrigation support programs in Ghana such as a project for farmers in Northern Ghana with support from UNDP
- 79 PV pumps installed nationwide providing new access to energy for more than 348 farmers
- Capacity built for 8 local installer and maintenance companies in a results-based financing approach
- 182.9 KW solar generator capacity installed nationwide
- Extended periods of green vegetation as evidence of good farming practice - land can be now cultivated 2-3 times in a year
- Increase in yield from 5 sacks to 16 sacks for cocoa production within 2 farming seasons at Roland's Farms in Jamase in the Ashanti Region
- Up to 4 hours of manual work saved per day, as well as operational costs; farmers now report it only takes a few minutes to water each plant bed

In the short run, the project was able to promote the productive use of energy while also demystifying the use of SPIS through the education of participants. These activities attracted a high interest from the cocoa sector to deploy solar irrigation systems on cocoa farms to improve yields. This awareness came as a result of promotional and marketing activities implemented by suppliers that were supported by EnDev.

For farmers using SPIS, the reliability of the power source resulted in all-year round farming of multiple crops, providing a safety net for farmers during the dry seasons and improved crop resilience. Farmers reported appreciation for systems installed, and installers received warm receptions and responses on maintenance visits. The gross revenue for both supplier and buyers of SPIS increased significantly, and farmers were able to pay back the cost of the system in two seasons or less as a result of their improved outputs. For farmers who initially used diesel or petrol pumps, solar-based irrigation eliminated the cost of fuel – insulating farmers from market fluctuations. Strong evidence that the activities of this component led to increased productivity with little requirement for additional capital compared to before.

EnDev was therefore able to play a catalytic role in the marketing of solar-powered pumps in Ghana. The proliferation, deployment OR roll-out OR launch of SPIS practices also reduced the dependence on fossil fuels, and therefore less carbon emitting potentials.

4.3.3 Lessons Learned

Small systems are not economical and special solutions need to be introduced for the very small-scale farmers. The relative high cost of the system remains because of small market size, Government-subsidized other agricultural hardware and inputs, cost of direct current solar pumps and lack of access to finance for farmers. As a result, demand for SPIS remains low among smallholder farmers who are located beyond the electrical grid while it is growing faster among commercial farmers. These smallholder farmers are slower to invest in these systems because they perceived these systems to be of high cost and no viable business models, like subsidies, exist to create an enabling environment for SPIS ownership despite the high payback rate. The larger group of beneficiaries were commercial farmers and farmer groups.

Like grid-powered irrigation systems, farmers, installers and maintenance providers also require technical advice to design appropriate powered irrigation systems. While the development of manuals and training curriculum helped to correct for the low appreciation of system maintenance, additional technical guidance and regular maintenance to all parties involved in the selling, installation, maintenance and use of the systems is needed for the solar power elements.

4.4 Productive Use of Energy for Food Processing

In Ghana, MSMEs use thermal energy based on wood fuels in combination with inefficient stoves when processing traditional agricultural products. The main agro-processing performed converts cassava to gari, a storable fermented flour. Cassava is the largest agricultural commodity produced in Ghana - 14.2 million tons in 2011 – and 25% of all cassava is processed to gari through an energy-intensive roasting process. The country produces 740,000 tons of gari per year.

However, agro-processing comes at a cost in the form of unhealthy working conditions, and negative impacts on the environment as a result of the deforestation required for biomass energy. These negative impacts are also disproportionately levied on women, as thermal agro-processing is a female-dominated trade that is conducted as a small-scale industry using traditional and inefficient stoves.

The objective of EnDev's component in this element of the Ghanaian energy economy was to demonstrate benefits of improved cook stoves, to capacitate stove-builders and to support their dissemination through a sales-based grant in domestic markets. Improved cookstoves are more sustainable for the biomass fuel market. Compared to volatile liquified petroleum gas (LPG) prices, improved cookstoves offer the opportunity to MSME agro-processors to also reduce their operational costs. The activities envisioned a market potential for up to 50,000 improved institutional Gari cookstoves; a potential to reach a large number of customers, reduce pressure on forestry stocks, and reduce the carbon density of thermal energy for agro-processing in Ghana.

This component was rolled out in two phases. From August 2014 to May 2017, 300 improved cookstoves (ICS) were installed for gari-processing in order to spark market demand and interest among agro-processors. The project utilized a combination of finance, technology, policy and legal instruments to stimulate supply and demand. Subsidies were provided to both ICS suppliers and buyers. From June 2017 to November 2018, an additional 225 ICS systems were distributed through local ICS suppliers.

4.4.1 Key Players

The Government of Ghana has had an interest in the Clean Cooking Sector since the late 1980s, beginning with a partnership between the Ministry of Energy and Petroleum and the World Bank.

This component of the EnDev's work in Ghana was Implemented by SNV who took on a facilitation role with trade organizations and marketing support. In particular, SNV was able to secure financing for agro-processors interested in acquiring improved cookstoves by collaborating with rural banks and MFIs.

The Ghana Alliance for Clean Cooking served as the gateway, or enabling environment, to reach out to beneficiaries, while also working with government stakeholders to create a regulatory and governing framework for ICS.

4.4.2 Major Achievements

- Agro-processors are aware of the benefits of improved fuelwood stoves for agro-processing
- 4 MFIs ready to provide loans and other financial services for potential users
- 540 improved cookstoves distributed for use by gari and other agro-processors nationwide
- 4 improved institutional cookstove builders strengthened in business operation and management

By building the foundations and stimulating both supply and demand for ICS for agro-processing in Ghana, the project moves towards reduced deforestation and reduced carbon emissions. The project also expects the improved health of persons, especially women, involved in agro-processing, and an increased income for agro-processors as they cut down their expenditures on fuelwood use. Information, education and advocacy materials developed also have the power to reach even more agro-processors with the nationwide reach of the project


The training aspects of the project have also exposed the beneficiaries, especially both the ICS suppliers and agro-processors, to improved business practices. Whether they were business development trainings, or marketing support, private sector stakeholders were able to learn the processes they needed to grow their businesses and further improve their earnings.

4.4.3 Lessons Learned

Supporting locally grown solutions that are scalable and can exceed the market potential prove to be sustainable. The semi-industrially manufactured gari stove was seen to be a successful option that could be used across a variety of agro-processing value chain. Burro Gari Elephant, one of the SMEs supported by this project, markets a stove that is locally assembled at scale in Ghana, with the aluminized steel components brought in from other countries as prefabricated parts. It has the potential for higher production volumes, allowing for greater market penetration.

In addition to focusing on the ICS technology itself, **it was important for the project to ensure the dedicated engagement of supply, demand, finance and an enabling policy environment** to develop a market for ICS with growth potential.



A photograph of a man wearing safety glasses and a blue protective vest, kneeling and welding a metal part of a vehicle. Sparks are flying from the welding point. The background shows an outdoor workshop setting with other vehicles and equipment.

Chapter 5: Productive Use of Energy in Action

While EnDev in Ghana has worked through its implementers, government, private sector and trade association partners, the downstream beneficiaries have been MSMEs and farmers who ultimately benefit from the economic fruits brought by productive use of energy.

5.1 Electrification as a Tool of Growth for SMEs

In Ghana's Bono East Region lies the town of Tubodom, home to 45-year-old Emmanuel Essey. He has owned and managed 'Shalom Straightening and Welding Enterprise' for 27 years. For many of those years, however, life was challenging for the father of four. Prior to 2009, Essey had no easy access to electricity and was forced to spend 160 euros each week in order to rent a generator. This arrangement made it difficult for Essey to run his welding shop effectively, resulting in low business productivity and a limited income.

Essey's introduction to EnDev's grid extension scheme significantly changed his business. Between 2006 and 2017, EnDev Ghana has facilitated and supported the creation of new light industrial zones, bringing access to energy for productive use to more than 3,000 households, small and medium enterprises in rural and peri-urban areas. With the help of local governments and industry associations, 3,500 jobs were created, while 1,200 enterprises were established or relocated to the light industrial zones. These Ghanaian enterprises can now focus on business growth for years to come. Essey is one of them and says: "My colleagues and I have benefitted immensely from the provision of electricity and we are grateful to the officials in charge." With reliable access to electricity, Essey can work effectively and generate a higher income. He has expanded his welding business and has employed five apprentices, bringing him closer to his dream of training young people.

5.2 Solar Irrigation is a Game Changer for Farmers in Ghana

Teacher Mante, a farming community in the Eastern Region of Ghana, which is an hour drive from Accra, lacked a reliable supply of water for irrigation. Moreover, they were too far from the national grid to make a grid extension and electric pumping feasible. As a result, most inhabitants of the community abandoned their farmlands.

Intending to solve this problem and while doing so, rekindle the interest of the young and unemployed in farming, a farmer named Bobby Gyesi, with support from EnDev, procured a 1500W solar powered irrigation system, which was installed by a private pump dealer. Six months later, Bobby is able to irrigate ten (10) acres of vegetables by drip irrigation from a reliable source of water, whereas he previously farmed just one acre. He has expanded his total farm to another fifty (50) acres and contracted twenty-two (22) farmers to cultivate the additional area under an out-grower scheme. With a percentage of the farm profit, he has constructed a dam to collect water for irrigation of the additional acres and hopes to expand his system to employ solar irrigation on it soon. Kwame, another farmer and member of the out-grower scheme testifies, “the solar pumping system convinced us that solar irrigation is the right technology for us.”



5.3 Getting on the Grid: Lessons from Keta


Although the land in the Keta municipality in the Volta Region of Ghana is sandy, most of the farmers engage in farming as their main source of livelihood. Michael Gawuga, a 46-year-old man who resides in the municipality has been struggling with hernia as a result of the continuous lifting of cement and other building materials he sells to customers. He decided to quit his business and focus on farming as a full-time business. With the help of the EnDev project, Michael extended the electricity grid to his 2-acre farmland which he inherited from the father. The project subsidized 70% of the cost of connection. With access to reliable electricity, Michael introduced sprinkler irrigation systems in his farm. He cultivates onions, carrots and pepper.

He also participated in good agricultural practices and business trainings organized by the EnDev project. Through these trainings, Michael learnt new techniques of farming to increase yield as well as practical business techniques. In less than a year, Michael was able to pay back his investment. He further purchased a 5-acre farmland to increase his land under cultivation. During our last meeting with Michael a month ago, with a broad smile he said; “with my deteriorating health, I had no idea that farming will be a better source of income, thank you EnDev for the trainings. The trainings did the magic for me.” He further encouraged other farmers to put into practice lessons from the various trainings to turn around their farming and improve their economic and social well-being. The EnDev project has so far trained 360 farmers in the Volta and Greater Accra regions.



5.4 Improved Gari-Processing is Healthy for Body and Business

Faustina Nakie lives in Asuboi and is one of Ghana’s many gari-producers and it has been her main livelihood for the past 15 years. She had been using a traditional pan to process the cassava into gari, but her health had been impacted as a result. The illnesses she experienced, linked to smoke produced by traditional gari-roasting techniques, meant she could only work one to two days in a week. Thanks to the Burro Gari Elephant, an improved cook stove that minimizes the health impact of gari production while also making it more efficient, Faustina is able to work through the week. She’s even roasting twice the amount of gari compared to her production in the past meaning her profits have increased.

A woman in a purple shirt is filling a blue mug from a water tap. She is standing behind a chain-link fence. The background shows lush green trees and a white vehicle. A large white circle is overlaid on the image, containing the chapter title.

Chapter 6: Gender Impacts in the Productive Use of Energy

EnDev in Ghana went beyond gender awareness to engage stakeholders from the onset to promote gender balanced access to productive use of energy interventions while also acknowledging engrained barriers faced by female beneficiaries in the Ghanaian context.

For the development of Light Industrial Zones (LIZs), the project set a goal in which 15% of businesses in LIZ developments should be owned by women and 20% of plots be dedicated to women with the acknowledgement that men were the dominant business owners in these areas. The project was able to achieve 10.5% of female owned businesses in developed LIZs, which is a success considering that business activities were dominated by men; and 20% of business development trainees were women.

In the realm of agriculture, EnDev in Ghana was able to contribute better to gender equality and women's empowerment with solar-powered irrigation systems (SPIS). Due to the land tenure system, women often rent or share small scale plots for agriculture with their husbands. Furthermore, women also perform many of the manual irrigation duties on farms and the project learned that reduced time spent on farm for manual irrigation provided women the opportunity to own farms.

Women's health and their livelihoods predominantly as agro-processors also formed a cornerstone of EnDev's component on thermal agro-processing. As a result, targeted training programs and awareness raising activities for women-owned agro-processing MSMEs were implemented.

Despite these achievements, EnDev in Ghana acknowledges that the project can still do better with gender. In particular, EnDev can learn from these experience and in the future perform needs assessments and develop strategies based on users actual needs when designing interventions targeting the constraints women face while also improving the productive use of energy.

Chapter 7: Looking Towards the Future

EnDev has been a unique energy access project targeting MSMEs and small-scale farmers in district capitals and rural areas. It leaves behind important lessons on how utilities can work together with business associations to improve access to energy and how sales-based grants as a form of results-based financing are a novel approach to subsidies for suppliers. The penetration of solar powered irrigation systems and improved cook stoves has not only been stimulated, but the right actors have been stimulated to ensure that supply and demand are sustained. Finally – private sector participation to improve the capacity of energy utilities began in March 2019 and is expected to improve access to energy by farms and to continue productive use of energy objectives that were first identified by GIZ in 2005 and subsequently pursued by EnDev throughout its presence in Ghana.

In EnDev's departure from Ghana, partners are mobilized and motivated to continue working together. Key Government counterparts include the Ministry of Food and Agriculture (MOFA) with the Ghana Irrigation Development Authority (GIDA), the Ministry of Trade and Industry, and the Rural Enterprise Project will all continue to collaborate with the Ministry of Energy for policy formulation and national-level implementation. Productive use of energy will remain the main pillar of the SEforALL Secretariat Ghana Action plan. Included in this Action Plan is the Renewable Energy Master Plan which envisions 10,000 solar irrigation systems to cover 20,000ha. of land.

Among trade partners, the Ghana Alliance for Clean Cooking and Fuels (GHACCO) will step up its advocacy role to attract financing and to champion the implementation of programmes to increase improved cookstove penetration in Ghana.

For the development of Light Industrial Zones, business associations like the Ghana National Garages Association (GNAG) will continue to serve as a key partner for Metropolitan, Municipal and District Assemblies to promote local economic development through the provision of infrastructure and other support mechanisms. The Rural Enterprise Project will also continue to support LIZ initiatives indirectly by earmarking funds for the provision of Rural Technology Facilities that can be used to improve skills and technology transfer for businesses in completed LIZs.

Finally – irrigation is crucial to achieving food security and reducing poverty, especially in poor and inadequate rainfall seasons. Government partners MOFA and GIDA will continue to pursue this course with key drivers from the private sector and microfinance institutions to continue its market-based approach. A regulatory role is expected to be fulfilled by the Energy Commission. Harmonization with other projects and donors will also help to support credit, -results-based financing and business development and capacity building that have been achieved by this component.

Energy access and economic development go hand in hand. Fostering collaborations across sectors and stakeholders has been a crucial part of EnDev's work in Ghana. Harmonization and ownership by both local government and the private sector have led to the project's successes as a result of the facilitative role of EnDev's implementing partners in Ghana. EnDev looks forward to a prosperous and energized future for the country of Ghana's economic development.

