

1. **General Project Information**

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| pROJECT NUMBER | HO-M1051 |
| Project tITLE | *Private Investment De-risking Mechanism for Rural Solar Energy in Honduras* |
| Project Objective Statement | Demonstrating that lower cost, more efficient and innovative designs for solar rural electrification can deliver an adequate level of “access to energy” to the poorest remote villages of Honduras, with particular focus on demonstrating that solar energy can power agro-processing mills, thus reducing manual labour which is typically performed by women. The project will also demonstrate that adequately designed risk mitigation instruments provided by national or international public sources can help crowd-in private capital by de-risking private investments and increasing confidence on investors’ return. |
| Executing Agency (EA) | Village Infrastructure Angels (VIA) |
| Design Team Leader(S) | Filippo Berardi (ABG), Gabriela Torrez (ATF), co-TLs |
| Supervision Team Leader | Fausto Castillo (CHO) |
| Other Team Members | Zachary Levey (ABG), Carlos Jacome (ENE, CHO), Arnaldo Viera (ENE), Emiliano Detta (CCS) |
| Beneficiary Country | HO | **Budget** |
| uNIT WITH dISBURSEMENT responsibility (udr) | CHO | MIF Grant | $280,000 |
| MIF Access Area | ABG | SEP Non reimbursable financing | SEP: $150,000SDC/SEP: $200,000 |
| MIF Agenda | Clean and Efficient Energy | MIF Equity | $0 |
| Number and type of Beneficiaries | 10,000 low-income indigenous people | Total MIF Contribution | $280,000 |
| Previous Operations with EA | N/A | Counterpart – Private INVESTORS | $1,040,000 |
| Complementary IDB Operations | N/A | Co-financing (Loans) IDB group others | $0 |
| OII’s 5 questions/afidavit |  | Co-investment (Equity) | $0 |
| World check  | Done, no issues. | Total Project Budget | $1,670,000 |

1. **Problem Diagnosis**

Honduras had one of the lowest electrification rates in the Americas region, but has been steadily improving the situation, reaching 93% of the population by September 2015[[1]](#footnote-1). However, within Honduras, access to electricity varies greatly, from over 98% in major city centres to less than 25% in the most rural departments such as *Gracias a Dios* in the east. This project focuses on the rural areas of the least-served department of Gracias a Dios, where many donor-funded projects involving rural electrification have failed to reach[[2]](#footnote-2). The vast majority of unelectrified villages are in rural areas, with higher proportions of indigenous people. Studies such as the Climate Investment Funds Investment Plan[[3]](#footnote-3) estimate that 10% of Honduran villages will not be connected to the national grid in the foreseeable furture and will require isolated power system solutions such as mini-grids or solar home systems (SHS). This represents a market of 80,000 households (400,000 people)[[4]](#footnote-4). Of these, approximately 14,000 households already have access to solar home systems.

The department of Gracias a Dios has approximately 15,000 households[[5]](#footnote-5) (75,000 people, mostly indigenous). Half of these are in the main town of Puerto Lempira, which as an isolated diesel mini-grid, and the other half are scattered at low density across the department in villages of generally 20-200 households. Thus, approximately 7,500 off-grid households need to be reached if Gracias a Dios is to deliver *Sustainable Energy for All* by 2030, one of the new UN-backed sustainable development goals.

***Figure 1 - Access to electricity across Honduras***

The investment plan of the national utility ENEE does not include off-grid isolated systems, so there is a need to mobilize alternative funds to build such infrastructure. The target beneficiaries of the initial stage of this project will be approximately 2,000 rural households in Gracias a Dios. The main problem addressed will be to increase access to electricity, but to a level higher than traditional solar home systems delivers, so that community-scale agro-processing facilities can be included, to reduce manual labour - especially of local women - by up to 1 hour per day. The cause of the lack of electricity for rural indigenous villages over the past 20 years seems to be a lack of prioritization from the central government for social reasons, a lack of funds to reach all households and an understandable focus on bringing access to areas of highest population density before those in areas of low population density. A lack of ability to design cost-effective village power systems that do not need to depend on subsidies may also be an underlying cause. Access to electricity can particularly benefit women, as it can mean an end to dangerous kerosene lamps within the house and the hard manual labour that is required each day to process staple crops into edible food.

1. **Intervention model**

The project will consist in selecting, purchasing, installing and ensuring correct operation & maintenance of mini-grids and solar home systems (SHS) to provide access to lighting, phone charging and shared agro-processing mills to off-grid 2-3 communities in Gracias a Dios. The SHS will be leased to the individual households with 3-year contracts, after which - in the absence of default - the property will be transferred to the users. The private operator of the mini-grids for the agro-processing will retain the ownership of the agro-processing mills, and charge a fee-for-use to the households that use the facility.

The Executing Agency will source the private capital needed to purchase and install the technology from family and angel investors. The MIF TC will provide technical assistance to cover the project’s soft components (households mapping, trainings, knowledge management). The SEP funding will be used to guarantee a minimum return to the investors. The SEP funding will act as a new kind of partial guarantee for the invested capital, mitigating the risk of investing in an innovative technology with a new financing scheme for the end-users (households) in a very difficult environment (Gracias a Dios), with limited data on loan default available to date. The percentage of guaranteed revenues for the investors will decrease as more information on default rates become available, other project variables are understood and the model’s viability is proven. After the second or third iteration, investors will have more solid bases to make assumption relative to actual default rates, costs and risk mitigation measures hence the investment risk for private investors will have been significantly reduced.

The project will go through these stages:

STAGE I – Community A

* + - 1. Construction investors/lenders provide construction capital to build the project: 1000 households, expected timeframe: 12 months.
			2. Geo-referencing of the targeted households is completed with satellite imagery (cheaper than with handheld GPS devices), to support decision making on interconnections and most efficient placement of community agro-processing mills.
			3. Project is build and SHS leases are signed with each household for a period of 4 years.
			4. Project operates for 3 months, gather default rates data, and is subsequently placed on a crowdfunding platform (e.g. Kiva) for refinancing at a lower interest rate: (a) If refinancing is obtained, this constitutes the exit strategy for construction investors so that capital can be reused to move to Stage II; (b) If refinancing is not obtained, construction investors/lenders will remain in the deal until the end of the lease.
			5. During operation, if actual revenues are lower than the expected threshold ($2.5/household/month), the SEP non reimbursable financing will kick-in and cover the gap in the expected investors’ returns up to 40% of the expected gross revenues.
			6. After the refinancing has taken place (or at the end of year two of operation, in case of no refinancing), the available resources of SEP funding will be reinvested in Stage II on the next community.
			7. At the end of the equipment lease period, the property of the equipment is transferred to the beneficiary households.

STAGE II – Community B

Assuming a default rate of household repayments equivalent 40% of the expected gross revenues in Stage I, the financial model estimates that the SEP funding will have a remaining balance of US$100,000. In this second iteration, then it will only cover up to 20% of the expected gross revenues (instead of 40% in Stage I).

The default rate assumed in Stage II will be lower than in Stage I, due to the learnings and adjustments from Stage I (better technology, better contracts, better awareness campaigns, etc). This will mean that the leverage ratio of the guarantee fund will be higher, thus allowing for a similar number of households to be included in Stage II even though the guarantee fund is smaller

STAGE III – Community C

1. Successive iterations will follow the same process as for Stage II, until the SEP funding is fully utilised. It is estimated that at least two iterations could occur during the execution phase of the project.

**Expected impacts** include at least 2000 households (10,000 people) with improved living conditions (CRF: 310401) in the first two iterations, with a minimum of lighting, phone charging and solar agro-processing services delivered to every household. This will lift access to energy in Gracias a Dios by approximately 13% from current levels (approx. 15% or population have access to reliable electricity). **Expected results** include at least 10,000 people having adopted new technologies (CRF: 210400) and having access to new basic services (CRF: 210600). Additional results will include reduction in time spent in manual labour of smallholder farmers from a baseline of approximately 200 hours/year to less than 50 by using the agro-processing facilities. Time saved in processing crops will benefit mostly women.

1. **INNOVATIon AND SCALE**

 *FINANCIAL INNOVATIONS:*

* Increasing investor certainty through a private capital de-risking mechanism: Private investors interested in investing in high social impact rural energy projects are prepared to accept higher levels of risk. However, considering this is the first project of this kind and scale in the area, there is no consolidated data on household default rates, which increases investors’ risk significantly. The project will provide a partial guarantee on recovering the capital they have invested: once the project is built, SEP resources will be used as partial risk guarantee to cover up to 40% of the potential gap between expected and actual revenues (e.g. in case the default rates on repayments were higher than expected), thus ensuring that the required Debt Service Coverage Ratio (DSCR) can be maintained. The MIF/SEP will not be exposed to construction or equipment performance risks, which will be borne by Village Infrastructure (VIA) instead.
* Pay-as-you-go technology (PAYG), embedded in the SHS provided and connected remotely with the data centre to provide live-performance data from the villages to help field staff monitor the projects and use this data for billing and control purposes. Also, this PAYG will be used to shut down the systems in households in default (>90 days of arrears) as a countermeasure to contain default rates.
* Refinancing through crowdfunding platforms. Platforms like [www.Kiva.org](http://www.Kiva.org) can mobilize 0% interest loans from crowds of investors. The first crowdfunded project launched by the Executing Agency in this way took only 4 hours to be fully funded, considerably faster than any other source of lending funds available in the market, and at a lower interest rate. This would provide an early exit strategy for construction investors and increase the economic profile of the project itself by lowering the interest rate during operation.

 *TECHNICAL INNOVATIONS:*

* More efficient appliances. The project model will embed in the design a strong promotion of more efficient end-use technologies (lights, phone charging stations and agro-processing mills). A typical rural electrification design does not encourage energy efficiency for the appliances connected, but simply allows households to connect anything that is available from the local market. In contrast, a parallel design is proposed that aggressively controls the energy efficiency of the connected loads, such as only allowing white LED lamps. This design change is one element of the theory of change that this project seeks to deliver - to raise awareness of planners and engineers of modern rural electrification design options via practical field implementation of such designs.
* AC to DC voltages. Another key element of the design is a move away from high-voltage 110-240V AC power system towards 12-60V DC voltage that is consistent with solar energy systems. By placing power generation very near to where loads exist rather than distributing power over long distances, the need for higher voltage AC power is reduced. This means that there is no need for expensive and complicated inverters (that convert DC solar power to AC). Such inverters tend to fail within 3-5 years of installation, and technical expertise to repair them is often so far from rural villages as to be impractical. Also, high-voltage AC power requires trained, licensed electricians to install the system, whereas low voltage DC systems are safer and can be installed by unlicensed workers, more easily available locally.
* Inclusion of productive uses. A growing argument used against solar, with some justification, is that solar can only power low power consumer devices such as telephones and LED lights, and cannot power high power productive end uses that can make more serious reductions in energy poverty. Solar irrigation pumps have made some dent in this notion, but motive energy for electric motors that drive tools, mills and machines are yet to be demonstrated as a viable use of solar energy. This project would directly address this misconception as well, by delivering a range of locally appropriate solar agro-processing mills such as corn shellers, flour grinders and vegetable graters that can process the dominant staple crops of maize/corn and cassava. Currently in many remote villages, women spend up to 1 hour per day manually processing staple crops, and these small mills can reduce this to a 5 minute job. The same changes that have been seen in other countries of implementation of these mills can be expected in Honduras, whereby villagers no longer transport 25-50 kg bags of crop to a distant market in a larger village 2-20km away where a diesel or electric mill processes it, but instead can bring 5-15 kg at a time to the local mill located less than 500m from their house, saving the cost of transport and making manual transportation of the crop more possible due to the decreased weight.

To **scale** this cost-effective model of rural electrification, there are more households within Gracias a Dios that could also be reached. The benefits could extend to 5,000-10,000 households locally in successive iterations of the model without the same level of grant-support. Within Honduras, the project model could also be implemented in Lempira (the department with the second lowest energy access rate after Gracias a Dios) and other departments with low energy access rates, potentially including neighbouring regions of Colon and Roatan Island, which have even higher capacity to pay for such services than the indigenous villages of Gracias a Dios.

1. **KnoWLEDGE VALUE**

Rural electrification and value-adding sustainably to the crops of smallholder farmers is not an issue that is relevant only for Gracias a Dios or Honduras, but has wide application through the Americas and many other developing countries. Lessons learned from previous solar projects indicate that solar technology is an appropriate option for bringing electricity to remote regions, but has had limited applications to date in terms of end uses. This project would prove up the feasibility of applying solar power to higher power community-scale end uses such as agro-processing mills, and transfer best practice lessons learned for DC mini-grids from Africa and Asia to Central America. Beyond technical effectiveness and price competitiveness, the development effectiveness of the intervention could be measured by the theoretical payback periods that the project expects to achieve (which should be markedly lower than when using traditional designs), and the practical acceptance of the technologies by community households and thus the actual payback periods (and corresponding default rates by non-payers). The impact of PAYG technology on the default rate can also be evaluated.

The project will contribute to several key knowledge gaps:

1. very few, if any, methods exist at a cost-effective rate to map the location of a large quantity of households using satellite imagery, rather than visiting households with a GPS unit or other surveying equipment
2. very few if any methods exist at a cost-effective rate to optimally design a large number of minigrid layouts to connect household locations with the least length of wire, rather than manually designing each grid
3. demonstrating how solar can be used to drive DC motorized machinery such as mills without an inverter
4. demonstrating how crowdfunding can accelerate private sector funding and spread risks in a unique way
5. **executing agency and STRATEGIC Partners**

The executing agency that would lead this project is Village Infrastructure Angels (VIA), a UK-based for-profit company limited by shares, established in 2012 with specific expertise in delivering access to energy. The staff of VIA have helped 2 million people gain access to electricity in the past 15 years, with technologies including micro hydropower, solar, wind and efficient end uses such as LED lights. The core objective of VIA is to provide poverty-alleviating infrastructure, so this project is fully aligned to the core mission of the company. VIA’s current size includes 10 key personnel with a variety of skills to help undertake tasks such as mapping, planning, engineering, sourcing, manufacture, shipping and logistics, installation of renewable energy equipment, training and capacity building, financial product design, capital raising, legal issues, and software development, amongst others.

The company has two major spheres of work - Consulting and Project Development. The services and expertise of VIA are made available to any organization interested in poverty alleviation, and repeat clients such as the World Bank, ADB, IRENA, Hivos, Rotary and others have used the Consulting services to plan and execute rural energy projects in various countries. This exposure to the projects of others allows VIA to explore new models and ideas without requiring equity investment as other startups might use. In parallel, VIA develops its own projects, lending infrastructure such as solar power generation systems to villages via 3-5 lease-purchase agreements. VIA connects investors to rural villages that show demand for improved infrastructure and the ability to pay for them. The staff of VIA have demonstrated capacity in delivering innovation and scaling renewable energy businesses, having grown off grid market leader Barefoot Power from an idea to a $5 million revenue business that reached 1-2 million people, and gained awards for innovation from the G20, Ashden Awards, EU-GEEREF, ADF and many others.

A key strategic partner is the technical engineering company VIA uses to for supply of the solar agro-processing mills - Project Support Services (PSS), who has 15 years of experience in the procurement and manufacture of diesel, electric and manual small-scale processing machinery for small-scale farmers. VIA and PSS have teamed up to demonstrate that the development of solar powered mills using DC motors on mature processing mills is practical and affordable. That said, VIA retains its independence and constantly investigates alternative supply sources for all parts of the infrastructure systems that VIA installs. Other key partners in Honduras are (i) **Pies Bonito**, a private company which will be in charge of importing equipment and local project management; (ii) **Rotary clubs** of Roatan Island and Arlington, Texas, and (iii) the **Norma Love Foundation[[6]](#footnote-6)**, a local NGO based in Mocoron, Gracias a Dios, who have been instrumental in delivering clean water solutions with Rotary assistance for a number of years.

VIA has obtained funding from GSMA which resulted in US$300,000 of micro infrastructure projects currently under management across in Vanuatu, Papua New Guinea, Indonesia, Honduras and Ghana. Additional funding are secured from USAID for a further ~$1.7 million in projects to be built during 2016-17, to benefit around 10,000 households. Further pipeline is available for projects for India, Philippines, and Tanzania. Clients from 5-10 other countries have also used VIA’s consulting services. VIA’s headquarters is in the United Kingdom, and has an operational office in Sydney Australia to oversee Asia-Pacific field projects, and works through partnerships in the Americas and Africa.

Current experience in Honduras: a 150 household pilot project (focused on lighting and phone charging only) has been executed by the VIA project team in Gracias a Dios, mostly around the major town of Mocoron where Norma Love Foundation is based. Rotary Arlington (Texas) and Pies Bonito have helped to train entrepreneurs in villages along with Norma Love Foundation, and these entrepreneurs have been collecting payments from villagers since March 2015. Villagers report that no-one has ever tried microfinance in their area before, so they are grateful for the opportunity, particularly women. Side agreements have been signed with crowdfunding platform *Kiva.org* for every product leased, allowing future refinancing of the systems, which can help repay the loans made by Rotary Arlington angel investors (about $30,000). Technical performance has been satisfactory, with a few minor issues solvable locally. Many households selected have some form of income (such as members of farm and forestry co-operatives, fishermen, lobster divers and those with sons in the military who send up to $200/month to their families), which is used to pay the $2/month tariff. However, some payment delays from the military is contributing to significant payment defaults, which currently stand at about 30-40%, demonstrating the high risk of lending to the poorest, most remote villages in Honduras. Refinancing on Kiva.org will help mitigate this risk for the Rotary angel investors, and potentially pass this to a crowd of Kiva lenders, but part of the solution is also increasing the scale of the pilot so full time staff can be devoted to it, and bringing pay-as-you-go technology to the region. Interest from Rotary Arlington has been secured to invest again in the project, despite these initial challenges.

1. **Country Office Comments**

The department of Gracias a Dios is located in an area of ​​Honduras with major limitations in terms of basic services, including energy supply for both household consumption and productive uses. The IDB Country Strategy 2015-2018 indicates that MIF initiatives should explore models to promote decentralized power generation. As the proposed intervention aims provide communities with lighting, cell phones charging stations, and agro-processing electric mills, it is in line with the IDB country strategy. Finally, the proposed project supports the Government of Honduras in achieving its energy access goals for off-grid communities.

1. Data from ENEE - Empresa Nacional Energia Electrica [↑](#footnote-ref-1)
2. Examples include EnDev (<http://endev.info/content/Honduras>), UNDP-GEF and the GAUREE Project (*Generación Autónoma y Uso Racional de Energía Eléctrica*) financed by EU + ENEE. [↑](#footnote-ref-2)
3. <http://www.sefin.gob.hn/wp-content/uploads/2012/06/Plan%20de%20Inversiones%20SREP%20%28Version%20en%20Ingles%29.pdf> [↑](#footnote-ref-3)
4. Out of a total of over 200,000 that lack electricity now in Honduras, approximately 120,000 are expected to be connected by grid extensions over the next few years. For the remaining 80,000 households, off-grid systems will be needed. [↑](#footnote-ref-4)
5. <http://www.citypopulation.de/php/honduras-admin.php?adm1id=09> [↑](#footnote-ref-5)
6. <http://www.normalove.org/> [↑](#footnote-ref-6)