Partnerships for Productive Use for Mini Grids

BUILDING STRONGER PARTNERSHIPS WITH APPLIANCE AND COLD CHAIN COMPANIES

PowerGen, photo courtesy of CLASP

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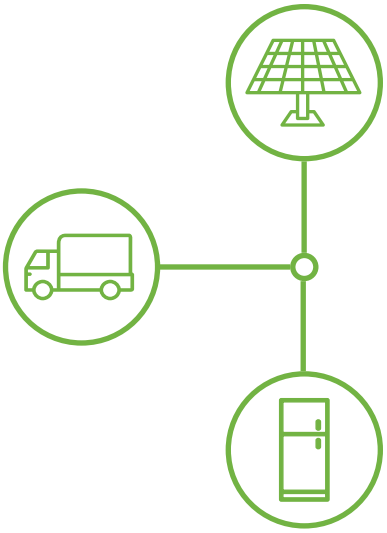
An overview of different partnership models between mini grid developers and appliance/equipment distributers. How Powerhive, Equatorial Power, and PowerGen have broken out roles and responsibilities for the sale of equipment to their mini grid customers.



Models for Productive Use of Energy and Appliance Integration

Pilots abound that demonstrate the ability of appliances and productive use equipment to increase the economic activity and the electricity consumption of mini-grid customers. However, achieving higher productivity and mutually beneficial electricity consumption is not as simple as plugging in a mill or chest freezer.

This case study looks at mini grid developer partnerships with appliance, PUE and cold chain companies and seeks to provide guidance to all parties in how to set appropriate expectations and define roles and responsibilities.

GREEN MINI GRID FACILITY | KENYA

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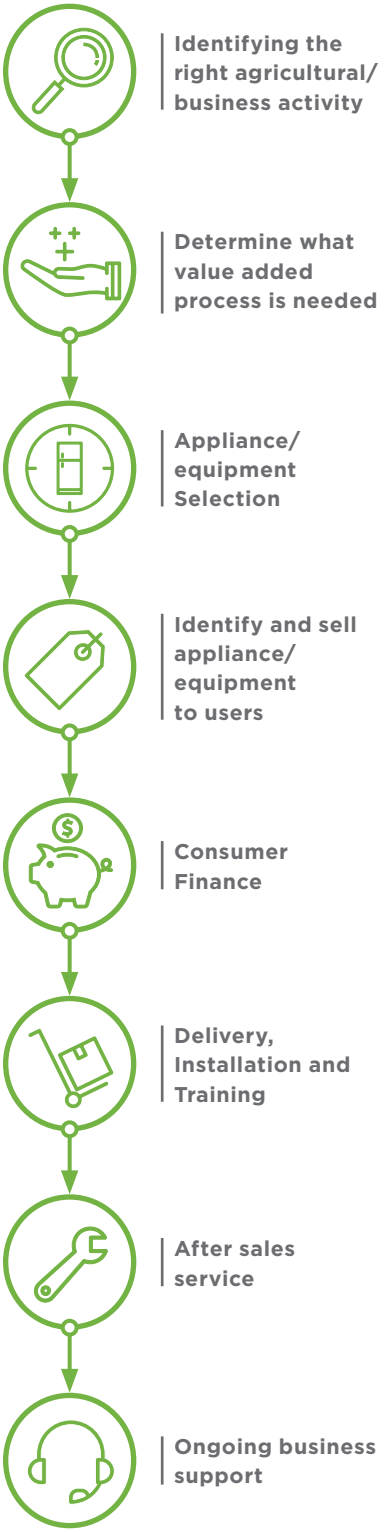
UKaid from the British people



The chart to the left lays out some of the key roles and decision points that are needed to effectively deploy appliances and equipment on a mini grid. The mini grid developer may choose to fulfill these roles but in many instances a variety of actors are needed to make the equipment useful and economically sustainable.

The following provides a closer look at three examples of mini grid developers deploying productive use equipment.

Wearing Many Hats: A Closer Look at the Partnership between Agsol and Powerhive [Example 1]

Agsol, a milling design company focused on small holder farmers, has partnered with Powerhive to test 10 maize mills for Powerhive customers in Western Kenya. Milling provides an important potential load for Powerhive's mini grids. Currently milling services are performed in the area with diesel powered mills that start at 10 HP or the central grid where reliability is a constraint. 7.5kW electric versions of these mills are overcapacity for Powerhive's inverters and therefore converting diesel mills to electric mills is not an option. Meanwhile there is a complete lack of smaller power efficient mills in the local market.

Agsol's newest mills are 40% more efficient than their closest alternative available on the international market and offer a potential cost advantage to diesel mills in terms of profit per kilogram milled. For the pilot, roles and responsibilities are collaboratively shared between Agsol and Powerhive. This includes opportunity mapping (location of current diesel mills relative to population densities), identifying mill customers, providing those customers technical and business training, supporting other complimentary agro-enterprises (e.g. animal rearing), building out pricing and payment terms, loan origination and collection, and ongoing after sales service. In an ideal world, Agsol would focus on mill design, manufacturing and delivery to a third-party retailer. Powerhive would focus on providing reliable electricity.

The goal of this work is to better understand the key elements that make the business case for milling work on a mini grid. Ideally Agsol and Powerhive hope to develop a set of 'golden rules of thumb' that can be applied throughout the sector to help developers understand what circumstances are essential to see the business case work. Based on what is known at this stage, simply putting mills onto grids without consideration will see a high rate of failure.

The key ingredients for a successful mill deployment ascertained so far are:

— **Customer selection**—the mill owner/operator needs to pass a rigorous credit assessment, have a sufficient level of business acumen and the correct entrepreneurial attitude to 'hustle' for business.

— **Mill Location**—the mill should have a customer base of 100 households or more that are in closer proximity than another competing mill.

— **Optimize and Diversify Use Case**—the mills will support maize production for human consumption and will also produce maize for chicken feed to support Powerhive's poultry supply chain.

Agsol Maize Mill, photo courtesy of CLASP

Neither Powerhive nor Agsol want to carry the financing risk from the mill loans, but have not been able to identify an alternative third party willing to finance an untested product in a new market. Matt Carr from Agsol states:

"Powerhive is doing all the financing work at the moment. No one in the financial sector has worked out how to evaluate risk for a mill loan yet. Powerhive has a productive relationship with COOP Bank but the bank is unwilling to extend asset loans to Powerhive's mini grid customers directly without collateral as security. Neither Agsol nor Powerhive want to provide aftersales service for the mills in the long term. Both want to work through local agents who will perform sales, installation, training and after sales service, along with up-sell opportunities for other complimentary appliances or accessories—e.g. shellers, dehullers, grain handling equipment. Ideally we would provide the business and technical training to these future agents."

The milling pilot will help Agsol build out technical and business training manuals. It will also begin to build the foundation for competing with poor quality products. At the moment there is no way to distinguish quality.

Working Across Multiple Partners: Equatorial Power's Build Out of Cold Chains on Idjwi Island [Example 2]

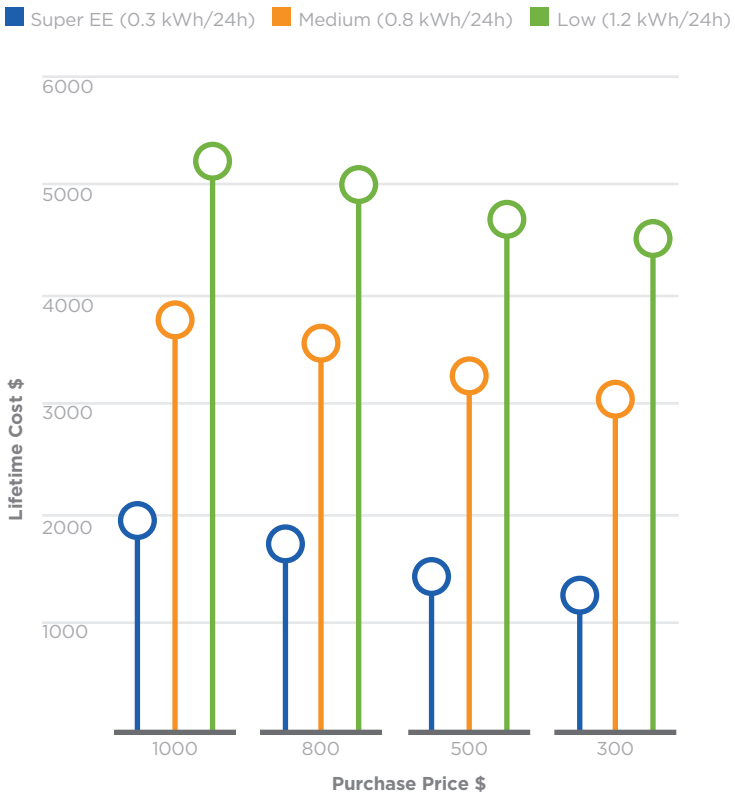
Equatorial Power (EP) has created a large consortium of partners to pilot the development of a cold chain on Idjwi Island in the DRC to supplement demand on EP's 30kW/300 connection PV mini grid and a 30kW existing Industrial Park run by Maranatha Enterprises. EP plans to install a "hub + spoke" cold chain system on the island, where a 5 ton ice maker is installed and powered at the industrial park for the preservation of poultry, dairy, and farmed tilapia intended for export to mainland markets in a boat outfitted for iced storage. The ice maker also allows ice distribution to two other locations on the island where chest freezers hold and sell the ice. The purchase of a combination of Global LEAP certified refrigerator/freezing appliances, as well as ice boxes for fishermen and smallholder dairy producers enable greater demand for EP's ice maker and increase the economic benefits of the cold chain. EP is working with a local women's cooperative to identify and train local entrepreneurs to engage in the newly equipped agricultural value chains.

To select an appropriate ice maker, EP partnered with China Impact Ventures. CIV took technical specifications and performance parameters from EP's CTO and visited 5 suppliers in China. The top three products were shortlisted and tested by CIV. The best performing ice maker was selected after testing and shipped to the mini grid site. CIV handled all shipping logistics and charged a fee based on their direct costs, number of ice makers tested and days of work.

EP used Global LEAP testing data and the Global LEAP test method to guide their selection of freezers that are appropriately designed for an off-grid environment and have a low lifetime cost. LEAP testing evaluates energy efficiency alongside service delivery, durability and price. A chest freezer if treated properly can operate for 10 plus years. The two graphs below show that over a 10-year time horizon, operating costs matter.

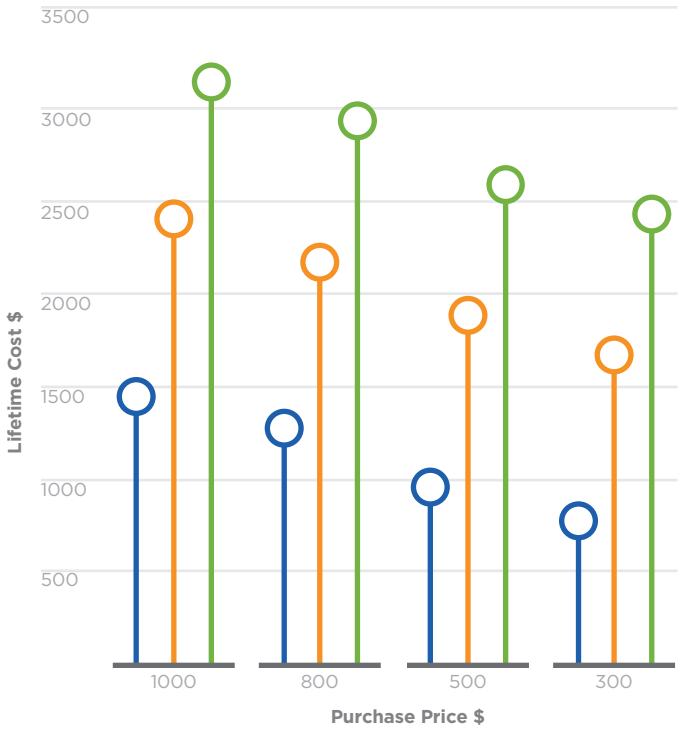
Fridge Lifetime Cost

10 yrs/1$ Tariff



Lifetime cost difference between High cost/ High EE and Low cost/Low EE **$2,585**

10 yrs/0.5$ Tariff



Lifetime cost difference between High cost/ High EE and Low cost/Low EE **$943**

The charts above are based on 70 refrigerators found on the VeraSol product database. Given the large variance in purchase price and operating cost, the lifetime cost of a freezer can have a significant financial impact on the end user. Selling low cost freezers with high energy consumption can be tempting given these types of models are usually available locally. EP opted to market more expensive freezers with better performance financed over a longer period of time as a means of improving the long-term viability of the businesses and value chains operating from their mini grid. Another key selection in EPs fridge selection was availability. Working on a remote island in Lake Kivu significantly limited the availability of high-quality efficient refrigerators and dramatically increased transportation logistics costs. EP creatively overcame this challenge by working with their strategic partner, SustainSolar, who is based in South Africa and was able to ship power generation equipment and high-quality fridges together in a container.

EP sees partnerships as critical in scaling PUE across their mini grids in Uganda, Rwanda and the DRC. A lot of work is required for each new appliance to define power specifications and quality, source suppliers, negotiate prices, transportation logistics, financing and after care service. EP hopes a third party will take on these roles for many mini grids across East Africa, creating greater economies of scale and lowering prices. EP is currently working with EnVenture, an energy business incubator in

TaTEDO EPCs, photo courtesy of CLASP

Uganda that focuses on support to last mile energy distribution models. EnVenture was selected to provide inventory management and distribution, appliance sales, finance and after sales service. They are a new actor to offer this type of service, yet assessed as well positioned to take on these elements of the value chain. EP have not yet identified suitable partners in Rwanda or the DRC, and would ideally find a partner that can scale with them to all markets and in doing so, create economies of scale in centralized purchasing of appliances.

This EP partnership is an example of how integration of energy-efficient appliances will create greater value for target communities, and yet such products will require a longer repayment scheme to ensure consumer purchase of the products at a viable pay-go rate, with the benefit of lower energy usage costs over the life of use. Furthermore, the example highlights a demand and need to strengthen regional and industry-wide distribution partners so that all actors involved will benefit from economies of scale.

PowerGen and TaTEDO Sell Electric Cookers to Mini Grid Customers in Tanzania [Example 3]

PowerGen, like many mini grid developers, see electric cooking as a potential opportunity to sustainably increase load. To pilot the appetite and uptake of electric cooking, PowerGen partnered with a local Tanzania company, TaTEDO, which has been selling sustainable energy technologies in Tanzania for 20 years. TATEDO selected an electric pressure cooker for the pilot. PowerGen used SMS notifications to gage interest in electric cooking and notify customers that a sales team would be conducting demos. An SMS survey was used to better understand cooking behavior and fuel expenditure. TaTEDO staff carried out all marketing, sales, and delivery to customers.

Over a two-day period, cooking demonstrations and trainings were conducted during which 25 sales were made. In the following weeks, sales doubled through word of mouth. 86% of these customers were selected to finance the electric pressure cooker through a 9-month loan offered by PowerGen. In follow up surveys, users noted the main benefit of the electric pressure cookers was having more time to attend to their gardens and small businesses. PowerGen saw on average a 19.5% or 2.6 kWh/month increase in electricity consumption.

TaTEDO provided a valuable partnership to PowerGen that allowed PowerGen to continue to primarily focus on its core expertise of operating an off-grid utility, while TaTEDO provided expertise in last mile distribution, marketing and sales. PowerGen absorbed the consumer lending functions, allowing it to maintain transparency of data and credit risk management.

Key Considerations in Developing Productive Use Partnerships

Roles and Responsibilities	Key considerations	Example 1	Example 2	Example 3
Identify the right agricultural/ business activity	— Identify income generating crops for local or international markets i.e. coffee, tea, sisal, horticulture, fish, poultry. — Off-takers need to be identified which involves value chain mapping.	Powerhive	Maranatha Enterprises	PowerGen
Determine what value-added process is needed	— Increase Productivity: chicken incubator, drip irrigation, chaff cutter — Decentralized Pre-Processing: milling, packaging — Reducing waste: ice machine, cold room, chest freezer — Value addition: oil pressing, yogurt production	Powerhive	Maranatha Enterprises	N/A
Appliance/ equipment selection	— In many rural communities, appliance/ equipment selection is limited. — Lack of appliance energy consumption or testing data to accurately predict the number of appliances that can be supported on a mini-grid; performance data from suppliers must often still be tested on-site for site-specific performance metrics — Uncertainty of the tariff needed to make appliances viable and encourage consistent use by end consumers makes precise optimization planning challenging — Need to define product specifications to align with power system size and anticipated load use and timing and also align with consumer demand?	Powerhive	China Impact Ventures and Global LEAP	TaTEDO

Key Considerations in Developing Productive Use Partnerships

Roles and Responsibilities	Key considerations	Example 1	Example 2	Example 3
Identify and Sell appliance/ equipment to User	— Some mini grid developers have staff on site that have an understanding of who might be interested in purchasing appliance/equipment — Mobile phone surveying tools can be used to identify interested customers — Mini grid developers often have detailed electricity usage data which can be used to identify customers with a higher ability to pay for new equipment — Local women's or other community groups help collect additional community-level data, and facilitate trusted sales — Map incumbent technology users to identify what can be replaced and unlock economic value.	Powerhive	IFINE (Local Women's Cooperative)	TaTEDO and Powergen
Supply Chain and Consumer Finance	Often asset finance is not available from banks or MFIs. This requires either the equipment provider or mini grid developer to provide financing in-house (covered in detail in consumer finance case study).	Powerhive	China Impact Ventures	PowerGen
Delivery, Installation and Training	Many mini grids are located in remote locations with poor road infrastructure, driving up logistics timing and costs Equipment delivery, storage and installation often requires specialized skills not available in remote locations, driving up costs and limiting after sales services. PUE typically requires training and calibration that must be relayed by the equipment manufacturer, distributors and sales agents	Agsol	Sustain Solar and IFINE	TaTEDO
Aftersales Service	Equipment repair and servicing in remote communities is costly, yet important for consumers and willingness-to-pay Sensors and IoT are used to provide predictive maintenance and guide remote support	Agsol	Equatorial Power	TATEDO

Photo courtesy of CLASP

Appliance/Equipment Partnership Best Practices

Key Lessons Learned

- Paying a third party to select, vet and ship equipment can be worthwhile for higher value items.
- Selecting energy efficient equipment can dramatically reduce the lifetime cost of equipment, making a stronger sales value proposition to consumers; this savings case must be well-explained.
- Working with local NGOs and cooperatives can reduce the cost of customer selection, training and after-sale service.
- Thinking about equipment needs at the beginning of mini grid design can open up the opportunity to ship power system equipment and appliances/machinery together, reducing costs and improving quality.
- Financial institutions are reticent to extend loans for appliances and PUE to mini grid customers, where the loan structure and repayment risk are unknown. As such, consumer finance must typically be provided in-house through the appliances provider, mini grid developer, or a specialized third-party asset lender until better commercial lending models are developed.

Conclusion

Building and running a utility is a hard, complex business. Adding additional business lines can detract from a mini grid developer's core business and comparative advantage, stretching management's focus too thin. Finding the right partnerships to drive productive energy use can help ensure adequate electricity consumption. These partnerships should be put in place as early as possible and if possible, and ideally be part planning process before the mini grid is built. Mini grid developers with multiple sites and longer duration of operations at a given site can increasingly optimize and reduce their costs, and so will be true as PUE partnerships mature to realize efficiencies and economies of scale.

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