DEVELOPMENT INNOVATION VENTURES' INVESTMENT IN MERA GAO POWER

FINAL REPORT

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Summary

Mera Gao Power (MGP) was founded in July of 2010 with a basic design for a low cost solar powered micro grid design to serve off-grid villages of Uttar Pradesh with priority energy services. MGP's first pilot was commissioned in August 2010. Over the course of the next 15 months, MGP refined its technical design, learned more about its customer base, and expanded its offerings to include both lighting and mobile phone charging. MGP was founder-financed from its inception until the end of 2011.

In October 2011, the United States Agency for International Development (USAID) through its Development Innovation Ventures (DIV) office, made a seed investment in MGP of $300,000 in the form of a fixed obligation grant (FOG). The objective of this grant was to serve 4,000 households across 40 villages with lighting and phone charging services. The average village was assumed to have 100 households and it was assumed that all households would sign up for service.

In February 2013, MGP finalized an equity investment with Insitor Seed Fund, an impact investor managed out of Cambodia. Funds from this investment arrived in India in early March 2013 just as MGP ran out of its DIV funding. Most of the equipment procured with DIV funding was deployed into villages at the end of March 2013.

As of the end of February 2013, MGP had 4,480 customer households across approximately 180 villages; by the end of March 2013, when DIV funded equipment was nearly exhausted and Insitor-funded equipment was being added to MGP's warehouses, MGP had 5,443 customers across 222 villages. A number of the initial assumptions turned out to be wrong; a typical village MGP serves is only 50 households with some villages as small as 20 households. The subscription rate is approximately 60% instead of 100% as initially assumed; while MGP's service is better and cheaper for most households, customers without mobile phones find MGP's services to be more expensive than kerosene alone. Other households have invested in batteries which they take to town to get recharged once a week. With these batteries, they not only get light and phone service, they can also watch television.

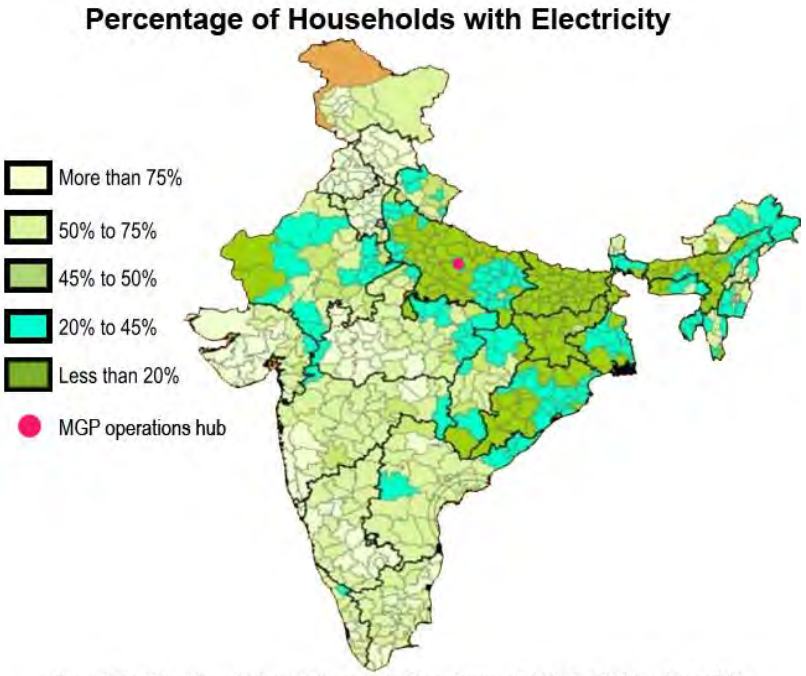
Since installing its facility in Kaharanpurva, MGP has improved its payment collection process, reduced construction time from one week per village to one day per village, and brought the per (50 household) village cost down to under $1,000 through purchasing efficiencies and improved design. As MGP's micro grids are solar powered, they also have no input supply chain to manage. As a result of this DIV grant, MGP has been able to demonstrate its model to investors, scale up, and secure investment for further growth; by the end of 2013, MGP aims to reach 150,000 people in 26,000 households across 1,000 villages.

Pain Point

In India, the limited power generation, transmission, and distribution infrastructure has left many villages, and sometimes entire regions, without electric power. Data

varies by source, but the trends are consistent. As of 2010, it is estimate that 48% of rural households are unelectrified nationally; Bihar, Jharkand, and Orissa have electrified fewer than 35% of rural households[1]. Ministry of Power data put the percentage of electrified villages in Uttar Pradesh at less than 42% in 2006 (and therefore household electrification likely even lower). In 2010, the total number of unelectrified households stood at 61 million. Off-grid demand continues to be unmet by modern power services; and communities resort to low quality sources of energy such as kerosene, wood, diesel, candles, and disposable batteries.

Nighttime lighting is a fundamental human need often poorly provided by kerosene wick lamps which provide between one and six lumens of light (MGP's current lights provide above 70 lumens and a new light being piloted provides nearly 100 lumens; a 60 watt incandescent light bulb generates 750 lumens). These 61 million off-grid households in India consume on average between six and seven liters of kerosene per month[2] for lighting; this amounts to 4.4 billion liters of kerosene per year (this does not represent the total consumption of kerosene for light as many families with grid access also burn kerosene for light during periods when power is not available[3]). The combustion of this kerosene in wick lamps would produce 11 million tons of carbon emissions per year. Worldwide it is estimated that kerosene lighting represents the largest share of the 260 million tons of carbon dioxide emissions which are produced each year from fuel-based lighting[4].



Source: "Sustainable and Renewable Energy Environment Scan / Demand Assessment, India", Grow Wellington, February 2009.

[1] "Rural electricity to speed up inclusion", Economic Times, May 27, 2010.

[2] In North India, this figure is significantly lower; most of MGP's customers state they only consumed 3 liters of kerosene per month prior to receiving service.

[3] "Trends in Consumption and Production: Household Energy Consumption", DESA Discussion Paper No. 6, April 1999.

[4] "Technical and Economic Performance Analysis of Kerosene Lamps and Alternative Approaches to Illumination in Developing Countries", Evan Mills, Lawrence Berkeley National Laboratory, June 2003, http://evanmills.lbl.gov/pubs/pdf/offgrid-lighting.pdf).

Solar lanterns and solar home systems have emerged as one potential solution to off-grid lighting. Low quality solar lanterns which last only a few months can be purchased for a few dollars, but longer lasting products cost between $12 and $70; solar home systems can go for hundreds of dollars. The lower end products provide only a single source of light for four hours a day on a full charge while the more robust system requires the consumer to have significant cash on hand to purchase. Many of the solar lantern companies have concluded that the prevalence of low quality lanterns has eroded the market and consumers are unwilling to make an initial investment on a product of which they cannot immediately assess the quality.

Solution

Solar lanterns require consumers to make large up-front payments and burden the risk of poor performance. Kerosene is priced affordably with small, frequent payments instead of large up-front payments, but the quality of light is very poor. MGP designed its business to provide off-grid households with a high quality lighting and phone charging solution with the affordability of kerosene.

Each of MGP's customers gets two LED lights (which MGP owns and thus the customer does not have to purchase) and one phone charger. Each micro grid turns on at dusk and remains on for 7 hours each night. Customers are not responsible for paying for replacement parts or taking any operational responsibility; they simply walk into their homes in the evening and turn their lights on.

To subscribe to the system, customers pay a Rs. 25 ($0.27) connection fee plus Rs. 25 ($0.27) for their first week of service. Each customer is provided a customer card which acts as their receipt for payment. MGP's service is pre-paid and each week an MGP staff member arrives at a pre-arranged time and place to collect customer payments in cash. As a customer makes his or her payment, MGP's collector records the payment both on the customer card as well as in the collector's register. Customers may pay multiple weeks in advance for convenience.

MGP's Micro Grid Design

In 2010, MGP custom designed a solar powered micro grid to provide priority power services to off-grid villages in India. The aim was to design a low cost system for generating and distributing electricity within a village to provide customers with indoor lighting. Initially, MGP's working assumption was that lighting was the priority demand of off-grid villages, but through its first two installations, it became clear that mobile phone charging was essential to this customer base. The reason? While most customers had very little credit on their phone and rarely made calls, mobile phones are the lowest cost multimedia devices available in rural India. Farmers wanting to listen to music during the day while working or to watch movies at night purchase

multimedia phones for as little as $15 and load them up with music and movies once every few weeks for $0.25 to $0.50.

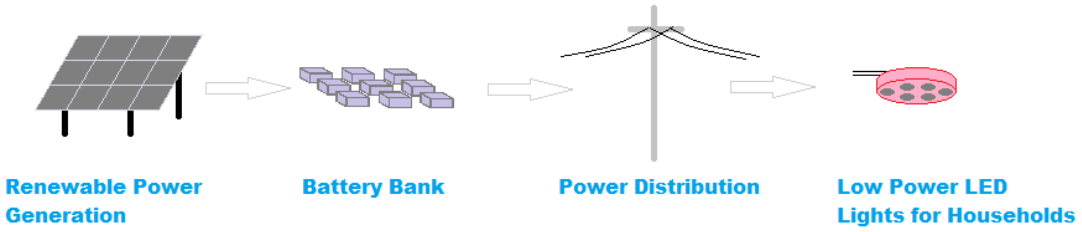
In 2011, MGP modified its design to reduce the cost, improve performance, and add mobile phone charging services alongside lighting. These improvements helped make MGP's design more commercially viable while also reducing power theft (as most power theft was to charge mobile phones, adding it in as part of the service was essential for this).

With USAID/DIV funds, MGP was then able to take this low cost design and its improved understanding on how to work with rural clients and to establish its first commercial micro grids. Throughout 2012, MGP began commercial operations and was serving 2,391 customer households over 120 villages and hamlets by the end of the year.

MGP's solar powered lighting utilities provide customers with 7 hours of priority power services through 2 lights and a mobile phone charger. The simplicity of the system results in a number of benefits:

- Low capital cost: through the implementation of the USAID/DIV grant, MGP was able to improve efficiencies of its design bringing the cost of a 50 home system down from $3,000 to under $1,000. This cost includes equipment, transport, and labor.
- Easy to install: over the course of the implementation of this grant, construction time was reduced from one week per village to one day per village. A three-person team can construct the system backbone within a few hours and by the end of the day is able to connect those customers who have paid their connection fees.
- Low operational cost: the system is fully automated, low maintenance, and does not require an input supply system to manage.

MGP's technical design for a 50 house hamlet (which is anticipated to lead to 30 customers) is summarized below:



Panels: Two panels are mounted on the roof of a willing host's household within the village. The sizing of these panels as well as the tilt angle have been calculated using a custom-build model based on region-specific solar data.

Batteries: Two deep cycle gel tubular batteries create a 3 day battery backup allowing the system to weather consecutive cloudy days. These batteries are stored in a small wooden cabinet which is placed within the hosting family's house. The small footprint allows the cabinet to be tucked away in an unused corner of the house.

Charge controller: MPPT 24v 10A charge controller not only conditions the power from the panels for recharging the batteries, it also has timing functionality to control the distribution of power based on time of day. The photo above

Distribution lines: Three to four cables, are run in different directions across a village. Households electing for service are then connected to the distribution line running closest to their house.

LEDs: Each house is installed with two LED modules connected in series. The hours of operation are flexible, allowing villages to decide what hours of the night and early morning they prefer to receive service. Over the course of implementing the USAID/DIV grant, MGP has increased the luminosity (brightness) of its lights from 60 lumens to 75 lumens and is now piloting a new 100 lumen light.

Mobile phone charger: A mobile phone charger for charging mobile phones is also installed in each customer's house.

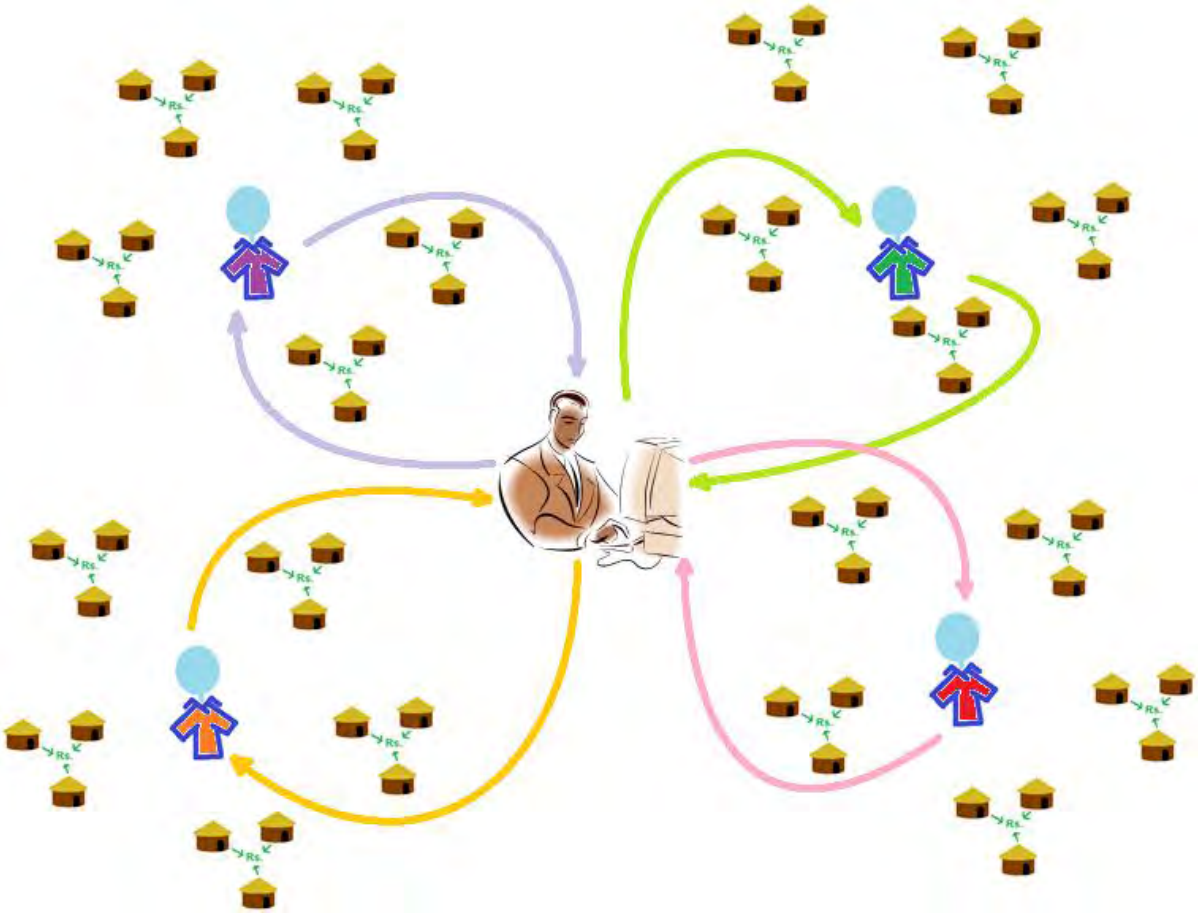
Collections

MGP builds off of the expertise developed in the micro finance sector. While MGP's service may make it seem like an energy company, operationally MGP closely resembles a micro finance institution.

Each village is given a collection time and place. Customers know that at that time and day each week, MGP's collector will arrive to collect payments. Customers congregate at the meeting place to make cash payments to the collector for their next week's service.

Each collector collects from up to five villages a day and 25 villages a week. A single branch can cover up to 300 villages employing a team of 12 collectors. Collectors leave in the morning with a schedule of villages and a list of customers in each

village. After visiting each village, the collectors return to the branch office to deposit the day's collections. Each customer's payment is then entered into a field level database and their balances are updated.



Each branch also manages a customer care number which customers can call to report a problem. Problems reported overnight are dealt with first thing the next morning by the branch's team of maintenance electricians. After reported problems are dealt with, the maintenance electricians travel to villages within their catchment to inspect the systems, wash the panels, and search for signs of system abuse.

Cost and Unit Economics

MGP's lighting utilities are the lowest cost micro grids in operation as measured both by upfront capital costs and recurring operational costs. This results in a short projected repayment period.

CAPEX	**Rs. 50,000 ($926)**
Annual Revenue	Rs. 35,000 ($648)
Annual Operating and Maintenance Costs	Rs. 10,000 ($185)

Annual Earnings	**Rs. 25,000 ($463)**
Repayment Period	**Approximately 2 years**

Through the experience implementing the USAID/DIV grant, MGP has been able to bring its CAPEX down, strengthen its revenue collection processes so that customers pay on time, and develop cost effective operating processes which limit OPEX to 30% of revenue. MGP will be focusing in 2013 on further reducing both its CAPEX and OPEX.

Project Implementation

Initial Setup

In October 2011, MGP identified an NGO partner, the Sarathi Development Foundation (SDF), which would do a baseline survey, quarterly surveys, and new village engagement. The baseline was completed in November 2011. The villages of Kaharanpurva and Lodhenpurva were the first two villages to be completed as per the construction plan. SDF conducted baseline assessments in both villages. It was the working assumption that SDF as an NGO with experience in the district would be more effective at communicating to villages about the value of MGP's services. SDF conducted 5-day assessments in each village; MGP expressed to SDF that this level of engagement was too lengthy for village engagement moving forward.

In December 2011, MGP staff visited Kaharanpurva to begin installation of the village level micro grid. Local leadership was invited to a group meeting the night before to ensure the village wanted service. The leader, or *pradhan*, was now overwhelmingly in favor of the project though other villages seemed very interested. In MGP's past experiences, pradhans often seek bribes to allow public work projects to be completed. An additional challenge was that the service itself had been poorly described by the SDF staff. Residents had been told that MGP would provide 24 hour power for lighting, television, fans, and refrigerators for a monthly fee of Rs. 40. When MGP staff then clarified the nature of the service, many residents believed that MGP was trying to trick them into paying more than the official price and would be pocketing the additional money. However, despite this, a very effective engagement meeting was conducted, the service was well described, and the lights were demonstrated through a demo light attached to a battery.

MGP proceeded despite the initial concerns from village residents and commissioned its first commercial micro grid in Kaharanpurwa with funds from USAID DIV. In January 2012, MGP completed its second micro grid in Lodhenpurva. It was this second micro grid that demonstrated the need for MGP to focus geographically. As the crow flies, Lodhenpurva was only 10 kilometers away from Kaharanpurwa, but due to the nature of rural roads and the placement of a body of water, it was nearly 30 kilometers by road from Kaharanpurva. As MGP still had not formalized its processes, a strong presence was required in the villages each day which was difficult to do with a small staff and a long travel distance. Problems arose in Lodhenpurva which arose from the miscommunication from SDF. After additional investigation, it also appeared that SDF may have been encouraging residents to

cause problems in order to demonstrate to MGP the need for SDF's community engagement services. MGP immediately cut ties with SDF, opting to do onward village engagement on its own and working with a new NGO to conduct quarterly assessments.

Collections and Collection Recording

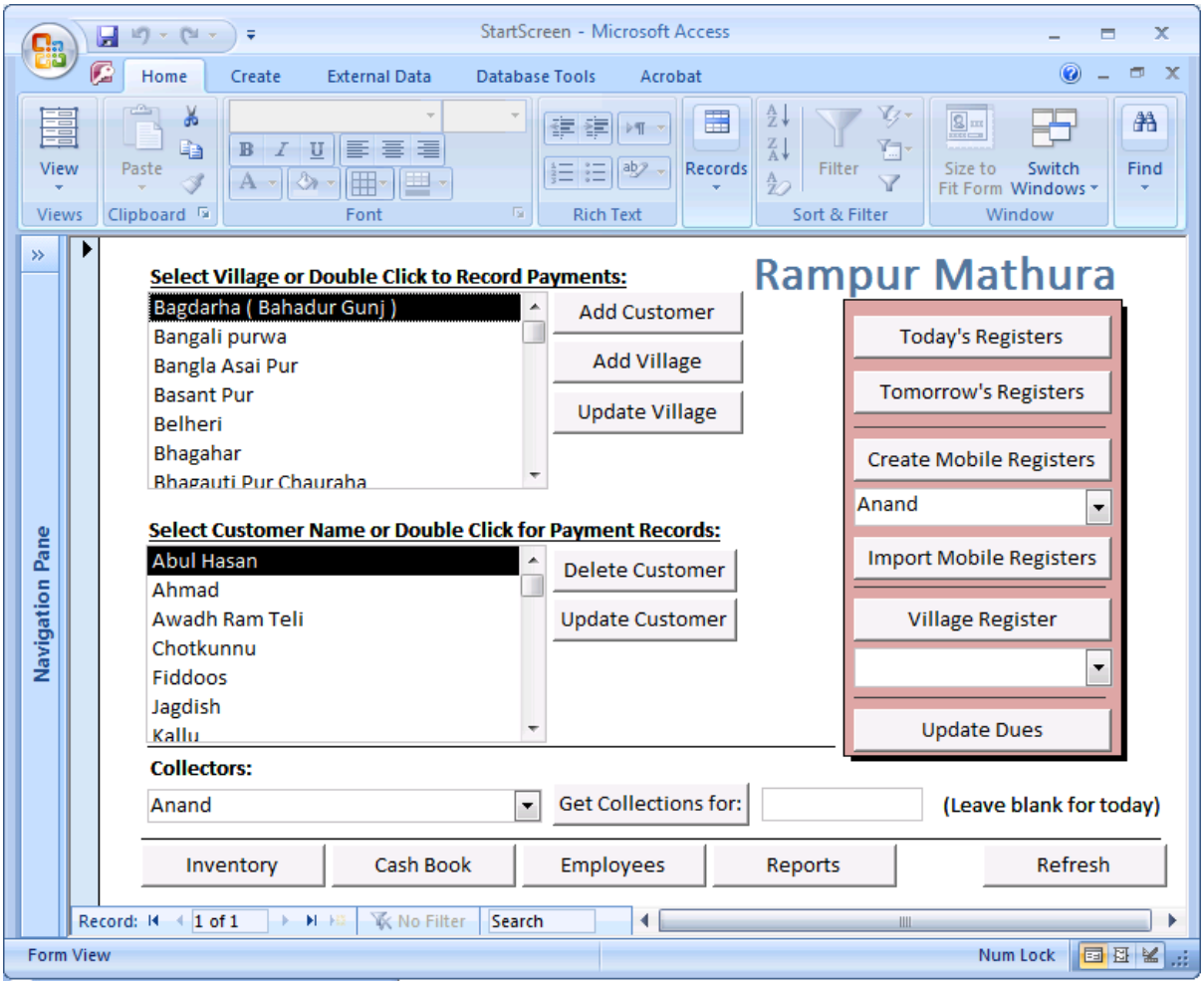
Initially, payment collections were being done house to house. However, this proved to be a time intensive process, with each village taking up to 3 hours to complete collections. Customers would not be at home when the collector came by requiring the collector to have a neighbor call the resident from the fields to make payment. A single payment collection could take as long as half an hour.

The process was modified in March 2012; instead of house to house collections, customers were informed they would need to report to a collection point within the village. MGP's initial goal was to create women's groups that would handle payment, but the evidence, including consistent advice from many organizations operating in Uttar Pradesh, was that women's groups are very difficult to organize in Uttar Pradesh. Group payments significantly reduced collection times. Instead of a few hours per village, most collectors are able to complete collections within a single village in 20 minutes. This then allows a single collector to collect fees from customers in 5 villages a day. With this modification, MGP's operating costs reduced dramatically, leading to a commercially viable return on its micro grid investments.

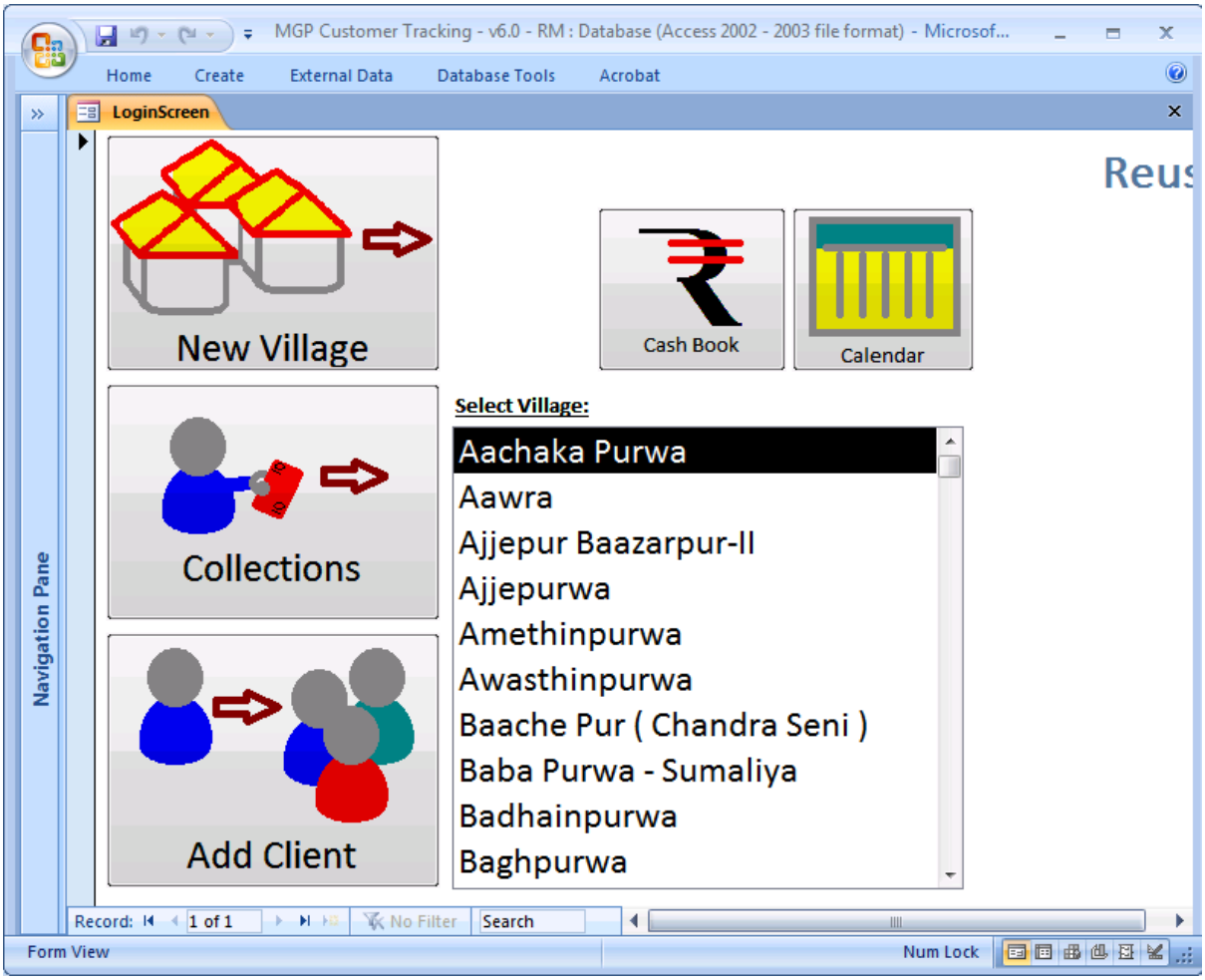
Group collections in a typical village.

An individual customer makes his payment of Rs. 25
and has his payment marked on his customer card.

As MGP approached 1,000 customers, the excel sheets our branch manager was using for tracking payments become unwieldy. The assumption was that a single branch manager would be able to verse a customer network of 6,000 to 8,000, yet with fewer than 1,000 clients the branch manager was working until midnight each night recording all of the payments. In response, a branch level MIS system was developed to track villages, customers, payments, bills, inventory, and employees.



This database has significantly improved availability of data and reduced branch level operations. Additional functionality continues to be added to the database as per branch manager requests. However, many of MGP's new branch managers are recruited right out of MGP's villages. These branch managers have no experience with computers and find the robust database overwhelming. A modified interface has been created to allow computer illiterate staff to do basic activities such as record payments and add customers. New branch managers are being trained on this database interface as of April 2013 with the intention of having local hire branch managers completely overseeing operations within their branch by May 2013.



In addition to the database, an android app has been developed to allow collection agents to record customer payments in the field and sync them automatically with the database. However, due to the perception of staff having expensive phones or tablets in the field, this has not yet been rolled out to collectors. However, a pilot demonstration found the process to save significant time in entering payments into the database. Instead, collectors may be asked to make entries into a tablet upon returning to the branch office each night removing the branch manager from having to work with each collector to manually enter each payment.

Human Resources

MGP hired Mr. Sandeep Pandey in November 2011 to develop its cash collection processes. Mr. Pandey has spent his career designing **and** practicing efficient, low-cost techniques for collecting small quantities of cash from a dispersed base of rural customers. Mr. Pandey is an expert in developing field level processes for organizations that demand to control their operating costs, particularly around payment collection, in order to keep cost of service and price to consumers low. Mr.

Pandey has been involved in every level of payment collection, from practicing to process development, in organizations such as SKS Microfinance and Bharti Micro Credit, the later in which he acted as Chief Operating Officer. Mr. Pandey is a key staff who MGP believes can grow into the role of COO.

Mr. Sushil Gupta was hired in December 2011 to be MGP's first branch manager. He began by doing all cash collections from MGP's first 5 villages. At the point where the network began growing more rapidly, Mr. Gupta and Mr. Pandey began hiring cluster operators whose job it was to collect fees from a set of villages each week. Mr. Gupta is now positioned to become MGP's first hub manager overseeing the operations of up to 6 branches.

Initially, MGP hired Kalyan Kumar Rai to manage constructions. However, Mr. Rai in mid 2012 for personal reasons. His replacement only lasted two months.

All of the above listed personnel were hired from outside of Sitapur District. It was assumed that branch manager and construction manager positions would require skill sets that would require recruitment from Lucknow (the capital of Uttar Pradesh) or other parts of India. However, over time, MGP staff hired from the same rural villages in which MGP operates have proven to be hard working and reliable. Once processes are firmed up, local staff are more than able to do the work and are comfortable working in rural conditions.

Evaluation of Project

DIV invests in scalable models of providing the world's poor with basic services. Each award, then, is an opportunity to prove the effectiveness of a new model, both in providing a necessary service as well as in its ability to scale up to reach a large number of beneficiaries. In addition, each award comes with its own project-specific milestones.

20,000 beneficiaries in 4,000 customer households across 40 villages by May 2013: MGP's end-of-project targets were all exceeded. By the end of February, MGP had crossed the 4,000 customer with just under 200 villages under service and still had equipment funded through the USAID/DIV grant. By the end of March, MGP had crossed the 5,000 customer mark.

Validity of technical model: MGP's first commercial facility has now been operational for over one year. Most of the component of the system has been tested individually either in lab tests or in the field. Customers are satisfied with the lights and charging services and continue to pay week after week, strong evidence that the systems are working adequately.

As MGP's systems are solar powered, the monsoon period in the summer and the foggy season in the winter are the most challenging time for system performance. MGP custom built two proprietary data models to size its facilities and project periods of non-performance. It was a result of these models that MGP settled on its current design. However, field experience was necessary to fully test the design. During the

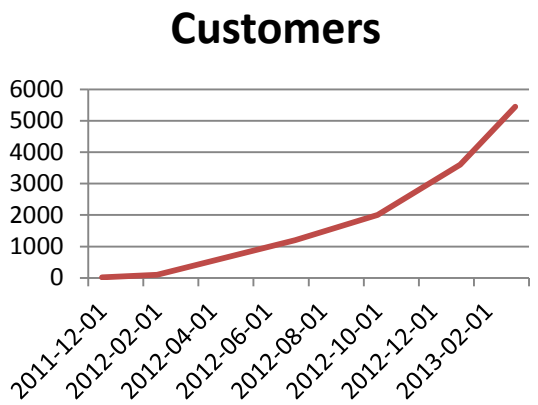
monsoon period in 2012, there was a two week period during which performance was imperfect, with some villages reporting only a few hours of light a night; however, service continued smoothly in most villages. However, it was the winter months of January and February of 2013 that were problematic. In a 23 day period, there was not a single day of sun as the fog was very thick. The fog came and went through the end of January and into mid February. As MGP's system is solar powered, this foggy period led to poor performance and non-payment.

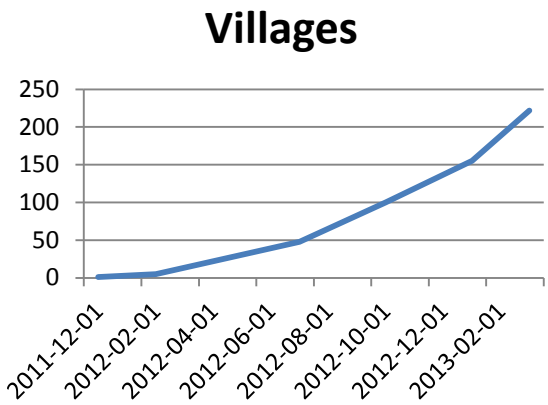
MGP has begun refining its technical model in response to the fog problems. A new panel wiring configuration is being used which should help generate more power even in the fog. In addition, a higher voltage panel is being ordered for future installations. Finally, MGP will be designing a meter which will display the number of hours of service over the past 7 days. This will help collectors confirm the actual performance rather than having to rely on customer feedback to determine actual performance. MGP aims to pilot this meter in a number of villages before the monsoon.

Investment: The ability to raise additional funding from outside of USAID/DIV, in particular private financing, is critical to taking a proven technical model to scale. MGP was able to secure $1 million investment from the Insitor Fund in February 2013. These funds were invested into Micro Grid Power Global Pte Ltd, a Singapore registered company which wholly owns Mera Gao Micro Grid Power Pvt Ltd, the Indian company. The Singapore entity will allow MGP to raise debt from abroad and on-lend / invest it to India in compliance with Government of India regulations. The Singapore entity will also be a useful entity through which new country operations can be invested.

Scalability: Scalability is dependent on two different qualities: 1) the ability to use financial resources to reach more beneficiaries quickly and 2) the ability to raise financial resources. MGP's growth rate accelerated throughout 2012. Projected growth rates for 2013 are even higher as MGP aims to expand from 5,000 customers in March 2013 to 25,000 customers by December 2013.

Funding, however, for social initiatives has always been a challenge. In the four years it has been operational, MGP has applied for many grants but only received one – its grant from DIV. Donor funding is subject to shifts in priorities as well as amounts making a donor-dependent initiative vulnerable and difficult to scale. It is for this very reason that MGP was founded as a for-profit business rather than a non-profit. By demonstrating the potential to generate a return on investment, MGP is able to access much larger pots of funding to fuel its growth, namely equity and debt. MGP secured a $1 million investment from Insitor Seed Fund in 2013 and aims to raise $3 million in debt to fuel its growth in 2014 and 2015.





Impact

As a first step, MGP preidentified 10 villages in which to conduct a baseline and quarterly assessments. The initial idea was to install micro grids in two of these then villages each quarter, allowing MGP to compare social indicators between customer and non customer households and between electrified and unelectrified villages. However, as a young company with week processes, MGP had a lot to learn about building and managing this infrastructure. A preidentified list of villages to electrify, representing what MGP expected to be 25% of its total village projects and the majority of its projects each of the first two quarters, created complexities; MGP realized it needed to be able to choose its customer villages based on demand and social factors such as internal politics and alcohol abuse. In addition, geographic focus was very important for efficient collections and maintenance, but the 10 randomly selected villages were dispersed across a large area. Thus, MGP, with permission from DIV, deviated from the preidentified build schedule though quarterly assessments were conducted through 2012.

MGP initially contracted the Sarathi Development Foundation (SDF) to conduct a baseline survey and quarterly surveys. However, MGP's troubling experience with SDF led to a cutting of ties. A new group, Rising Sun Consultants, was then hired to conduct surveys instead. However, data quality was still an issue as some of the data seemed to be repeated while other data appeared randomly generated. The final data was collected by MGP staff to ensure the data collectors actually went to villages and spoke directly to customers to gather the data.

Beyond the collection techniques, the design of the survey was not particularly well done. Neither SDF nor Rising Sun Consultants provided feedback on the survey design. However, an academic group from Columbia University reviewed it and gave feedback in 2013 that the survey was not well structured to gather accurate information on income and expenditures in particular. This could have explained a lot of the data questions that led MGP to question the data from Rising Sun Consultants.

In the end, poor data did not create a significant burden on MGP's operations. While better data would have helped MGP link customers with programs that could help them better utilize the lighting services for greater income generation, customers clearly see value in the service they have and many have begun working later into the evenings to earn more money without outside support. However, even with better data, there is a lack of potential of partner NGOs and government agencies that could be trusted to add value to MGP's operations. Experience with two NGOs was not encouraging; the first NGO was hands off and did not actively participate in MGP's communities while the second appeared to be intentionally creating problems which they could then come in and solve for MGP.

The lack of detailed data was not a hindrance to raising investment. MGP passed the sniff test most impact investors conducted to ensure MGP is truly a social enterprise; the customer base, the service being provided, and the pricing were sufficient to convince impact investors that MGP's business model has strong social value.

Demographics

MGP works in off-grid, unelectrified, rural villages. The correlation between poverty and these qualities is very strong. The average household across all surveys conducted during the entirety of the award had 5.34 households and a monthly reported income of Rs. 4,778 ($88). That is a per capita income of Rs.30 ($0.55) per day. A USAID India representative, upon seeing where MGP operates, was surprised that its customer base was so poor and clearly bottom of the pyramid.

Most of MGP's customers earn their primary income through agriculture either as farmers or farm laborers. Some households earn their primary income as wage earners in nearby towns and industries such as brick making or agricultural processing.

Homes are either made of mud bricks or proper bricks. Houses made of proper bricks also tended to have cement roofs while mud brick homes had thatched roofs. Aside from electricity, these villages do not have running water, proper sewage systems, toilets, cooking gas, or paved roads. Occasionally, a road in the village will be made of bricks sometimes with an uncovered sewage drain running aside it. Most villages have at least one well and water pump provided by the government. The wells are used more often to feed livestock and bathe while the water pumps are more commonly used for drinking and cooking. Some village are located alongside paved roads connecting them to larger roads and towns while other villages are connected to the paved road network by dirt roads and walking paths.

Rural banks operate in the area but usually on public funding. These banks make it difficult for customers to start bank accounts, a task already challenging because of poor documentation, proof of identification, and title of property. Micro finance institutions are not active, most siting the extreme poverty as evidence that micro finance is not viable in these areas. Credit is available through local money laundering and earnings are saved through livestock and incremental household upgrades.

While many people believe solar lanterns and home systems may be a threat to MGP's business, it is this same poverty that keeps MFIs out that has also limited the

operations and success of the country's largest sellers of solar products. Though Uttar Pradesh has an enormous population (approximately 250 million), these companies prefer to work in the South where households are better off and can afford to pay for products more easily.

Education

The first assumed impact of MGP's lighting service was on education. It was assumed that with improved lighting, children would have an improved environment in which to study. Using regression analysis, MGP measured the impact of lighting service on number of hours children spent studying.

Across all of the surveys, the average number of hours parents reported their children spent studying was pretty consistent, varying from 0.85 hours per day to 1.03 hours per day. The correlation between MGP service and hours children spent studying was consistently positive statistically significant in all four surveys.

Increase in Number of Hours Children Spent Studying		
-2 SD	Coefficient	+2 SD
0.3204	0.7644	1.2084
0.1364	0.419	0.7016
0.3434	0.5305	0.7176
0.054	0.216	0.378

Of those surveyed, many customers without MGP service identified poor quality lighting and the biggest constraint to children studying at night while none of MGP's customers identified any constraints to children studying.

> *"I am Brij Kishore Awsathi, resident of the village of Dalpatpur. I am the connection holder of MGP. We are getting very good service in our village. When light gets turned on in the evening, you will find smiles on the face of the entire village. Kids are studying more with this light. We are charging our mobile phones in less time. With MGP's light, we are getting clean and bright light. Again we all are requesting that in near future we need that same quality of service."*

<u>Evening Income Generation</u>

As mentioned above, MGP works in very poor communities with few opportunities for income generation. One of the working assumptions behind MGP's proposal to DIV was that improved lighting would enable customers to work later into the day and that at least a portion of the customers would take advantage of this opportunity to earn more money. Over the course of implementation, MGP staff witnessed women's groups that embroidered saris (traditional women's dress) at night, a baker that cooked samosas for sale in the local market, a man who made eyeglasses, a man who made table clothes out of reused plastic bags, a number of shop owners who were able to keep their businesses open later into the evening, and farmers who could prepare their produce for sale in the market the next day. Harder to quantify are the many people who were seen doing chores at night that they could not otherwise have done, perhaps freeing up time for children to study.

Regression analysis shows a fairly modest increase in nighttime income associated with MGP service. However, despite the small increase in earnings, the increased earnings are greater than the cost of MGP's service and are still significant given the very low incomes in these communities.

Increase in Evening Earned Income With MGP Service		
-2 SD	Coefficient	+2 SD
-12.6	147	306.6

Again, though the data quality is not great, the quantitative and qualitative evidence together suggest that customers are able to earn more money and get more done due to MGP's service.

> *"I am Prem Kumar Rastogi, the resident of the village of Dalpatpur. I am the connection holder of MGP. We are getting very good service in our village. When lights turned on in the evening, everyone in the village including kids become so happy saying ''Light aa gayi'' (Lights are turned on) and everyone gets busy in their work due to good and bright light. With the light definitely we are saving our environment and there is no pollution. I am requesting that in near future also we need same quality of good service."*

Expenses

MGP's assumption was that with improved lighting, customers would stop purchasing kerosene as they no longer needed it for nighttime lighting. However, experience showed that customers had good reason to continue buying kerosene even after receiving service. Subsidized kerosene, which MGP's customers are entitled to, sells for less than half the free market price of kerosene. Customers could easily buy a liter for Rs. 18 and sell it for double to a trader right across the street. Further, kerosene is a perfect substitute for diesel. Farmers rely on diesel generators to irrigate their fields. Thus, kerosene was also diverted to other uses, as Jalil Ahmad explains:

> *"I am Jalil Ahmad, resident of the village of Kalepurwa. I was consuming fifteen litres of kerosene oil per month in five kerosene lamps. Now I am saving my kerosene oil and using that oil in different purpose such as irrigation. My kids are studying more hours in MGP's Light. Kerosene oil is harmful for our environment and now we are saving our environment too."*

Though there was a measured decline in kerosene purchases with MGP service, it was far less than anticipated for the above reasons. However, phone charging expenses dropped more significantly. Still, the numbers show a far lower reported monthly expense on mobile phone charging, and thus a lower monthly savings, than MGP initially anticipated. This could be in part explained by a selection bias; customers with the largest phone charging needs would likely to switch to MGP's service. Thus, unconnected customers would have a relatively low monthly expenditure on phone charging, leading to a smaller gap between what customers and non-customers spend on phone charging each month.

Reduction in Expenditures on Kerosene with MGP Service		
-2 SD	Coefficient	+2 SD
-5.7	-18.7	-31.7

Reduction in Expenditures on Phone Charging with MGP Service		
-2 SD	Coefficient	+2 SD
-36.8	-46.4	-56

As kerosene produces soot and pollutes indoor air, MGP believed there may be a long-term impact on health expenditures associated with improved lighting services. There was a statistically significant decline in expenditures on respiratory illnesses associated with MGP service in one of the data sets but it was not consistent across all of the surveys.

clinic visits		
-2 SD	Coefficient	+2 SD
-0.316	-0.63	-0.944
-0.0124	0.0126	0.0376

The fact that customers are paying for service is further evidence that they are saving money. However, due to the quality of data, it is hard to estimate a reasonable value of savings associated with service.

> *"I am Hanuman Prasad and I live in the village of Tamolipurwa. Mera Gao Power's has installed a facility in our Village and I am a customer. We used to consume 75 gram of kerosene oil for one lamp each day. I was using 2 lamps and getting only 3-4 hours of light per day. The market rate is 40 Rs. per litre and the government rate is 18 Rs. per litre. It's not very easy to get kerosene oil from the government store. We have to purchase this from the black market. It means I was spending 6 Rs. per day for Kerosene oil and 5 Rs. for mobile charging every alternate day. Our daily expense in mobile charging and kerosene oil was Rs. 8.5 day.(Around 60 Rs. week) Now we are paying only 25 Rs. week to MGP and getting brighter lights and mobile charging facility in our homes. If MGP will give us good service then we have no issue because with this good light of MGP we all are benefitting. We are getting better light than kerosene lantern. Our Houses looks clean due to MGP's Light. Previously our houses were getting black due to that kerosene lamp. Children are studying more hours, there is no pollution in the environment, we are not having any respiratory health issues, we can charge our phones faster and at our homes, we are saving a lot of money in mobile charging, and now we are not purchasing kerosene oil."*

<u>Fires</u>

Kerosene lanterns are open fires which are lit indoors, burning for hours each night. This presents a fire hazard in off-grid households. Cooking fires, too, represent a fire risk in these households, thus eliminating kerosene usage would not eliminate the entire threat of household fires.

Reduction in Fires Per Household Per Month With MGP Service		
-2 SD	Coefficient	+2 SD
0.0332	-0.02	-0.0732
0.007	-0.151	-0.309
-0.0125	-0.1265	-0.2405

Challenges Moving Forward

Growth

In late 2011 / early 2012, in an interview with someone from The Ministry of New and Renewable Energies, one of MGP's promoters stated he expected MGP to be operating in 15 villages by the end of 2012. Instead, MGP crossed the 150 village mark in December 2012. The unfortunate reality of running a start-up, however, is that "once you've achieved a goal, it's no longer the goal"[5].

With its investment from Insitor Seed Fund, MGP has the resources to reach 25,000 households which it aims to complete by December 2013. MGP is seeking $1 million in debt financing to expand service to 60,000 households in 2014 and an additional $1.5 million in debt by the end of 2014 to fuel its growth to 100,000 households by the end of 2015.

To achieve its 2013 goals, MGP will need to add 2,000 customers a month from May through August and 3,000 customers a month from September through December. As it has taken over a year to connect under 6,000 customers, this represents a significant ramp up in pace and effort.

Fortunately, the experience implementing the USAID/DIV grant has provided MGP with the processes and tools it feels are necessary to achieve these numbers. Still, MGP added fewer than 1,000 customers in March and is on pace only for 1,500 customers in April. There is significant work to speed up new construction and new customer acquisition.

Geographically, MGP's expansion will be rooted in Uttar Pradesh India; however, in 2014, MGP aims to test its model in a new country. This will help prove the viability of the model in a new market while also spreading the company's political risk. MGP's target customer base will not change in India, but the income level of customers in a second country would depend on that particular market.

Debt

MGP's equity round will last it only through 2013. Beyond 2013, MGP will need to raise debt to fuel its growth. There are two types of debt: corporate finance debt (also known as balance sheet finance) and project finance debt (also known as non-recourse finance). In corporate finance debt, a company takes their balance sheet which shows a track record of cash flow over a few year period as well as the assets it has on the ground and uses this to secure a loan. The bank is willing to lend to the company if the loan value is below the company's existing assets and if the historical earnings is in excess of the loan repayments. In this case, the bank cares very little what the loan is being used for and thus does not need sector specific experts to assess the strength of the proposed activities.

[5] As one of MGP's directors expressed in frustration to a colleague.

Project finance debt is more important to start-ups and to rapidly scaling enterprises. In the case of project finance, a company is applying for a loan not based on the track record of earnings and assets but on the future projected earnings and assets. The company is saying “lend me $X and by deploying that capital we will generate earnings of $Y which is in excess of our loan payments”. In this case, the business model is critical and banks need to have the capacity to understand actual risks associated with a specific sector and specific business model to a greater degree. Unfortunately, developing country banks often lack project finance capacity and are usually heavy on the corporate finance skills.

MGP’s growth objectives for 2014 are to more than double from 25,000 customers to 60,000 customers. The capital required to grow at this pace will be far in excess of what MGP’s balance sheet will be able to justify. Thus, one large challenge ahead is to secure project finance from abroad to cover MGP’s 2014 growth needs.

Regulation

India’s regulatory environment for off-grid energy has been the topic of a number of discussions over the past year. A number of NGOs including Prayas and the Shakti Foundation have been advocating for off-grid distributed energy regulations to transition private companies into extensions of the public sector. These companies could continue providing energy to off-grid villages but could only charge the same rate as the public sector distribution companies and would be provided with public revenue streams to compliment the limited collection fees. As such, off-grid distributed energy companies would be forced to follow the same model as public sector distribution companies. A consultant by the name of ABPS was hired to develop the framework and then proposed the framework to the Forum of Regulators which is comprised of the state electricity regulators.

MGP put together a significant outreach campaign to vocalize its disagreement with the proposed structure. A loosely organized Renewable Energy Working Group also spoke out against the regulations. In the end, the draft guidelines were altered to make participation in the proposed structure optional for the project developer. While the draft guidelines proposed by ABPS have changed, the idea of regulating the off-grid sector has gained profile and stricter regulatory environments could still be imposed in the future.

How MGP Sizes Up

Comparing itself to its competition is a difficult thing for a company to do without bias. However, it is also necessary for the company to do so in order to improve and grow. MGP’s closest competitors in India are Husk Power Systems (HPS) and Gram Power (GP). HPS is by far the largest and most mature micro grid operator in the country if not the world. It serves 250,000 people in India and has started operations in at least one country in Africa. HPS began operations in 2007. GP, like MGP, was

founded in 2010. By the end of 2012, they were operating plants in two villages[6]. In Indonesia, IBEKA owns and operates micro hydro power facilities for village electrification. MGP is not aware of other micro grid operators.

While HPS is largely responsible for demonstrating that poor villagers are willing to pay for power and that power can be generated and distributed in a low cost manner in a village setting. However, HPS's model is biomass based; this means that for every facility it operates, farmers must be organized into a biomass supply chain delivering biomass to the facility each day in order to produce the gas required to generate power for customers. In addition to the operational expense required to purchase this biomass, HPS must also pay staff for each facility it operates. In addition, a typical HPS facility costs $30,000 for 400 households making HPS dependent on government subsidies for expansion. MGP's model, alternately, uses solar to generate power; this means there is no input supply chain to manage. Thus MGP does not have to hire and manage dedicated staff to operate each of its facilities. This gives MGP a great advantage in scaling up. HPS still maintains an advantage in being able to provide its customers with more power if they are willing to pay for it.

Like MGP's model, GP uses solar panels to generate power for delivery to its customers. However, GP uses a smart grid system to ensure customers are not able to steal power. This added advantage also comes at a significant cost; GP's systems, as per a presentation in December 2011, cost $25,000 for a village of 100 households. This is 12 times the cost of an equivalent sized MGP system. As a result, GP is dependent on government subsidies. This is likely a reason for GP's slower scale-up.

IBEKA's systems are powered by hydro, perhaps the cheapest source of renewable energy. However, like HPS and GP, IBEKA's plants are not commercially viable without grants and subsidies. While IBEKA has achieved impressive numbers, future growth is more constrained because of this dependence on non-commercial finance.

In general, MGP's model is unique in that it is the only commercially viable micro grid operator that does not depend on subsidies; the cost of this feat is that MGP is not yet able to supply customers with higher quantities of power for which customers are willing to pay less to receive.

Lessons for Social Entrepreneurs

When MGP received its DIV award, it was a pre-revenue startup with experience from a number of pilots but no experience managing a network of customers and

[6] Gram Power's Facebook page: https://www.facebook.com/GramPowerOfficial

nothing to show investors; investors repeatedly said “please contact us when you have more traction”. Had MGP not received this grant from DIV, the company may never have been able to secure a functioning team and put enough infrastructure on the ground to demonstrate its model adequately to raise equity funding. The DIV grant was an essential piece in MGP’s ability to scale and secure investment, but it was not the only piece; MGP’s founders learned, often the hard way, a number of lessons which may be able to help other social entrepreneurs succeed.

There is a growing “incubation” movement; incubators offer companies guidance, advice, services (legal, accounting, etc), often a place to work, and sometimes even funding. In principal, this is a great idea; social entrepreneurs often come from the social side with very little business experience. Guidance from an experienced entrepreneur can help the social entrepreneur focus, exercise patience, test variations of their model before scaling up, and prepare documentation to pitch to investors.

In MGP’s experience, incubators have not been particularly helpful. MGP is listed as an incubatee of the Hatch, a Gurgaon based incubator. MGP has also been connected to a mentor through TIE (The Indus Entrepreneur). Neither of these has resulted in any tangible benefit to the company. However, another incubator, Villgro, held a 2 day workshop on how to pitch to investors. Not only did this strengthen MGP’s elevator pitch and 5 minute presentation (which it made at a number of events thereafter), but MGP also met its potential first round investor at the event. Though most incubators have not added value, they have had little cost and the one that did have a positive impact was invaluable (even if it was at least partially for unanticipated reasons).

MGP has had discussions with a number of potential investors over the past 12 months. However, the introduction to the investor which MGP has negotiated a term sheet with was made at an incubation event at which there was no expectation to meet potential investors. The best press that MGP has received was through a contact made while shopping at a thrift shop. MGP’s low cost design was the result of hearing a presentation at a conference which MGP attended mainly to avoid the appearance of not being serious about its presence in the field. The greatest connections and breakthroughs have come at the least anticipated times and places.

It is important for young enterprises not to turn down meetings or conference opportunities no matter how trivial they seem. These meetings are much like jobs in sales; 95% of them may not come of anything but the 5% that do can make or break a company.

Social and impact investors are becoming more common. In India, Intellecap, an investment banking group, has started the Intellecap Impact Investment Network which aims to raise smaller rounds of funds for social enterprises. The Ennovent

Impact Circle is also an informal group of social investors. New Ventures India does due diligence on emerging companies and organizes events them to pitch to impact investors. Villgro has also helped companies meet potential investors. All of these groups allow social enterprises to pitch to a large audience of potential investors, facilitating introductions and maximizing the potential of raising funds. Sankalp and the Khemka Forum are also important events for entrepreneurs.

There is no one way to meet investors; to be successful, an entrepreneur needs to put themselves in the most situations to meet potential investors and be ready with a solid, polished, practiced 30 second pitch or 5 minute presentation.

Phase 2 and Phase 3 grantees should begin seeking investment immediately. A first round investment is more the development of a relationship than the relaying of a business model. Early investors are not investing in the business model, they are investing in the entrepreneurs. They will spend a lot of time getting to know the core team and the entrepreneur should be prepared for up to 1 year from making an introduction investment to closing a deal (though some investors can be faster). By talking to investors early, this also gives the entrepreneur an advantage; they are not desperate for funds. This is an important leverage point that investors often have over investees.

The process of closing a round will vary, but in MGP's experience it began with an introduction, sending a business plan and basic financial model, a number of phone calls, and a site visit. After that, MGP spent 3 months developing a very robust financial model (it is important to have a financial model along with your business plan but you may very well end up starting from scratch with an interested investor that has a template or methodology they prefer). This proved the potential for growth and helped identify key assumptions that needed to be proven and operational areas to focus on. Someone on the entrepreneur team should be well versed in financial models and excel; this model should not be developed by the investor alone. A short course and some books will give a good start, but there is nothing like practice. Entrepreneurs should have gone through three versions of their financial model from scratch with various levels of detail. This will help significantly if an entrepreneur develops a new model with an investor. Entrepreneurs will want to be able to identify when the model is incorrectly structured or when assumptions are overly pessimistic. This financial model will heavily impact pre-money valuation; the entrepreneur will obviously want to ensure it paints a picture that is similar to the entrepreneur's vision of how the company will expand, how customers will respond, how much revenue will be generated, and how much it will cost to run the business.

Finally, term sheets are mine fields for first time entrepreneurs. There is a famous story about an investor who said "You tell me the valuation, Ill tell you the terms.". Most points in the term sheet offered by an investor will be investor friendly and some of them are more important than the valuation. The book "Venture Deals" is a

must read for any entrepreneur raising funds and should be read prior to receiving a term sheet. While an entrepreneur and investor may not choose to have negotiations led by lawyers (this is a good sign for entrepreneurs), it is important to get a lawyer to review a term sheet so that each point and its significance can be explained to the entrepreneur. This will allow the entrepreneur to create a list of priorities for the term sheet negotiation (the phase that follows the receipt of the initial term sheet).

The period between receiving the term sheet and finalizing the investment (money in the corporate bank account) is stressful, unpleasant, paperwork intensive, and full of discussions with accountants, lawyers, and bankers. A full due diligence is often required and can take weeks of gathering papers and documents. A shareholder agreement based on the term sheet will be drafted and could reach 100 pages, all of which will need to be read. None of this is fun. It also will distract the entrepreneur from running the business and can often result in operational hiccups. Founders who can tag team will be better able to manage this process with one focused on the investment and another focused on keeping the business moving forward. Having an investor willing to pay for some of these expenses and service providers willing to delay invoicing is very helpful, particularly for small companies which are often cash constrained. Raising investment can cost tens of thousands of dollars in legal, accounting, and incorporation fees. MGP's founders are independently funding this process for MGP's Series A raise.

Lessons for DIV

The experience as a DIV grantee has been far more pleasant than anticipated. The generally intense reporting requirements for USAID awards caused MGP to pause before applying. Because of the unobtrusive nature of the FOG mechanism, the award has been very effective in supporting the development of MGP's business and demonstration of the business model without creating a significant documentation or reporting burden. This has been critical to allowing MGP to use the funds for the project rather than to hire a full time staff to generate reports and manage the USAID relationship. If the ceiling for FOGs can be increased to $1 million, applicants being awarded larger grants will appreciate the same benefits.

The DIV team has been incredibly responsive and very efficient. Upon completion of milestones, payments have been received very quickly and our ATOR has helped us structure payments to be consistent with our funding needs while still operating within the structure of the award. In a recent discussion with potential investors, we informed them that we had coordinated with our ATOR and had agreed on a path forward to help MGP receive its next tranche of funds earlier than anticipated. Upon completion of an implementation report, MGP could potentially receive funds within 2

weeks. One member of the investment team looked at another and said, “How is it that USAID is faster than us?”

We believe the milestone approach to funding tranches is the best way to structure grants to start-up organizations. This provides USAID the ability to identify poor performers while continuing to support strong performers. In fact, an achievement-oriented list of milestones would have been better for MGP under this grant as well. Because the grant has been structured to make payments approximately 3 months apart, MGP ran out of funds and had to cease work in April, August, and November despite having achieved the associated milestones. Not only did this represent time lost, it also has impacted MGP’s operations as staff were often paid without doing work, a precedence which is difficult to undue later. Instead of linking payments to time, linking payments to number of customers and villages would have helped MGP avoid these hiccups.

In contrast, a number of other donors and donor projects have not had the same flexibility and thus are unlikely to achieve significant results. The Rockefeller Foundation funded project SPEED is built on a firm premise that willing off-grid renewable energy entrepreneurs are out there but are not active because an ecosystem does not exist to link developers with NGOs, villages, projects, base load customers, and financing. However, it is uncertain what sources of information they used to come to this conclusion. Further, it is not the Rockefeller Foundation’s core strength to design intimate details of a project; as funders, they have an expertise in evaluating ideas proposed to them, identifying those that are likely to succeed and are aligned with their goals. In their decision to fund the SPEED project, they have deviated from their core strength of proposal evaluation and ventured into project design.

USAID has for a long time championed the idea that better projects come from allowing other organizations propose new and interesting ideas; many ideas are bad, but a few outstanding ideas will emerge, ideas that are better than what USAID could have come up with on its own. The DIV mechanisms follows this philosophy, relying on the breadth of external experiences to develop and propose ideas (many of them crazy), relying on USAID’s unique capacity to challenge and evaluate these ideas, sifting through them to find those that stand out from the others. Prescriptive design may be a natural tendency within donor organizations, but it can also lead to poorer achievement as the pool of ideas becomes artificially limited.

MGP’s experience with evidence was mixed. The most important indicators that MGP used to measure progress were customers connected, village level micro grids installed, and payments received. These indicators passed the sniff test investors use to ensure enterprises are truly social. However, MGP’s objectives are to provide services which fundamentally impact the lives of those at the bottom of the pyramid. The data collected was neither an accurate measure of impact nor did it lead to

action on MGP's part to help customers maximize the value of the service they were receiving.

A well-structured survey that was easy to conduct could provide MGP with more accurate data and relevant data upon which MGP could act. This data could help MGP identify partners that could help customers maximize the benefit of the service they were paying for; this could include educational programs to encourage children to study more and business linkages and training programs to help adults earn more money. USAID's M&E expertise could help DIV grantees structure their surveys according to best practices while also ensuring they are focusing on indicators with which the grantee could alter their strategy and devise better ways of providing value added services. While health indicators would be interesting for MGP to understand, it is difficult to foresee how MGP would have changed its operations based on the measurement of those indicators. Even understanding income impacts would not offer anything more than proof that MGP is creating value; instead, MGP needs to understand how customers who are earning more money are able to do so and what constraints those who are not earning more money are standing in there way of doing so. Informative data collection was a weakness of this project.

An additional way DIV can add value to its investees would be in taking more active role in the organizations. A condition for a DIV grant would be for a DIV (or USAID or even broader USG) representative to be an observer on the board of directors. The DIV representative should then be invited to attend board meetings which would occur no less frequently than every 6 weeks. In the board meeting, the DIV representative would get a much better sense of what challenges are being faced by the organization and what is being done to resolve the challenges. The board observer should be tasked by DIV to challenge the organization on its thinking and ensure the organization is testing assumptions and adequately testing multiple potential solutions simultaneously; companies are best suited to test different approaches at the startup phase rather than after significant funding has been spent pursuing a single approach. Phase 1 and Phase 2 grantees could even be encouraged to budget funds to test a few alternative approaches to solving the targeted development challenge before scaling up with a Phase 3 grant.

In addition, the board could assign board members and observers with tasks to help propel the organization forward. This would allow the DIV representative to take a more active role in both determining how they could help the organization and following through on those opportunities. These could include linking the organization with other parts of the United States government; as a company, particular sections of interest would be EXIM Bank and OPIC, but could also include sections of United States embassies that can provide country-specific information. DIV's representative may be better suited for making such introductions. However, other larger opportunities to add value will likely uncover themselves by more rigorous engagement in the board meetings. By acting as a board observer, DIV

continues to allow the organization to lead the way forward (as opposed to many incubators and donor funded projects MGP has worked with) but can offer new contacts and form of support than the organization would have otherwise.

Appendix A: Regression Results from First Implementation Report – April 2012

```
-------------------------------------------------------------------------------
      log:  D:\DATA\div.log
 log type:  text
opened on:  20 Mar 2012, 12:40:59

.
. correl mgp_cost hours_studying
(obs=1057)

             | mgp_cost hours_~g
-------------+------------------
    mgp_cost |   1.0000
hours_stud~g |   0.1133   1.0000


. correl mgp_cost fires
(obs=1050)

             | mgp_cost    fires
-------------+------------------
    mgp_cost |   1.0000
       fires |   0.1240   1.0000
```

```
. correl mgp_cost total_energy ker_cost mob_cost non_mgp_cost
(obs=1050)

             | mgp_cost total_~y ker_cost mob_cost non_mg~t
-------------+---------------------------------------------
    mgp_cost |   1.0000
total_energy |   0.0008   1.0000
    ker_cost |  -0.1745   0.8077   1.0000
    mob_cost |  -0.0531   0.5650   0.3770   1.0000
non_mgp_cost |  -0.1539   0.9880   0.8250   0.5665   1.0000


.
. regress evening_income income mgp_cost ker_cost fam_size

      Source |       SS       df       MS              Number of obs =    1040
-------------+------------------------------           F(  4,  1035) =   52.77
       Model |   574225440     4   143556360           Prob > F      =  0.0000
    Residual |  2.8155e+09  1035  2720270.57           R-squared     =  0.1694
-------------+------------------------------           Adj R-squared =  0.1662
       Total |  3.3897e+09  1039  3262469.18           Root MSE      =  1649.3
```

```
------------------------------------------------------------------------------
evening_in~e |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |    .136057   .0113656    11.97   0.000     .1137547    .1583592
    mgp_cost |   1.149668   4.468656     0.26   0.797    -7.618992    9.918327
    ker_cost |   6.014691   1.451145     4.14   0.000     3.167168    8.862213
    fam_size |  -6.109798   21.61828    -0.28   0.778    -48.53046    36.31086
       _cons |   79.51947   128.4054     0.62   0.536    -172.4452    331.4841
------------------------------------------------------------------------------

. regress evening_income income mgp_cost ker_cost males females children

      Source |       SS       df       MS              Number of obs =    1040
-------------+------------------------------           F(  6,  1033) =   36.65
       Model |   594895347     6  99149224.6           Prob > F      =  0.0000
    Residual |  2.7948e+09  1033  2705527.72           R-squared     =  0.1755
-------------+------------------------------           Adj R-squared =  0.1707
       Total |  3.3897e+09  1039  3262469.18           Root MSE      =  1644.8

------------------------------------------------------------------------------
evening_in~e |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .1347821   .0113456    11.88   0.000     .1125191    .1570452
    mgp_cost |  -.2635668   4.487274    -0.06   0.953    -9.068779    8.541646
```

```
    ker_cost |   6.575081   1.473143     4.46   0.000     3.684387    9.465774
       males |   66.19021   57.38197     1.15   0.249     -46.4083    178.7887
     females |   43.03617   71.89418     0.60   0.550    -98.03914    184.1115
    children |  -64.00775   30.62849    -2.09   0.037    -124.1089     -3.9066
       _cons |  -1.928993   131.9167    -0.01   0.988    -260.7843    256.9263
------------------------------------------------------------------------------

.
. regress hours_studying income mgp_cost ker_cost fam_size

      Source |       SS       df       MS              Number of obs =    1042
-------------+------------------------------           F(  4,  1037) =   57.95
       Model |  440.165228     4  110.041307           Prob > F      =  0.0000
    Residual |  1969.23976  1037  1.89897759           R-squared     =  0.1827
-------------+------------------------------           Adj R-squared =  0.1795
       Total |  2409.40499  1041  2.31451008           Root MSE      =   1.378

------------------------------------------------------------------------------
hours_stud~g |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .0000173   9.50e-06     1.82   0.069    -1.34e-06    .0000359
    mgp_cost |   .0099426   .0037334     2.66   0.008     .0026168    .0172684
    ker_cost |   .0058368   .0012111     4.82   0.000     .0034604    .0082133
    fam_size |   .1835408   .0180437    10.17   0.000     .1481344    .2189472
```

```
       _cons |  -.4054917   .1070147    -3.79   0.000    -.6154818   -.1955016
------------------------------------------------------------------------------

. regress hours_studying income mgp_cost ker_cost males females children

      Source |       SS       df       MS              Number of obs =    1042
-------------+------------------------------           F(  6,  1035) =   47.22
       Model |  517.833535     6  86.3055892           Prob > F      =  0.0000
    Residual |  1891.57146  1035  1.82760527           R-squared     =  0.2149
-------------+------------------------------           Adj R-squared =  0.2104
       Total |  2409.40499  1041  2.31451008           Root MSE      =  1.3519

------------------------------------------------------------------------------
hours_stud~g |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .0000196   9.32e-06     2.10   0.036     1.31e-06    .0000379
    mgp_cost |   .0127395   .0036878     3.45   0.001     .0055031     .019976
    ker_cost |   .0046319   .0012094     3.83   0.000     .0022587    .0070051
       males |   .0764114   .0471518     1.62   0.105    -.0161126    .1689354
     females |   .0432909   .0590885     0.73   0.464     -.072656    .1592377
    children |   .2987534    .025144    11.88   0.000     .2494143    .3480925
       _cons |  -.2401222    .108196    -2.22   0.027    -.4524307   -.0278137
------------------------------------------------------------------------------
```

```
.
. regress healthexp income mgp_cost ker_cost wood_cost total_energy fam_size

      Source |       SS       df       MS              Number of obs =    1036
-------------+------------------------------           F(  6,  1029) =    6.62
       Model |  82143602.2     6  13690600.4           Prob > F      =  0.0000
    Residual |  2.1278e+09  1029  2067875.19           R-squared     =  0.0372
-------------+------------------------------           Adj R-squared =  0.0316
       Total |  2.2100e+09  1035   2135253.3           Root MSE      =    1438

------------------------------------------------------------------------------
   healthexp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   -.008743   .0104021    -0.84   0.401    -.0291548    .0116687
    mgp_cost |   22.96959    4.24887     5.41   0.000     14.63216    31.30703
    ker_cost |   1.910905   2.460557     0.78   0.438    -2.917377    6.739187
   wood_cost |   3.018721   2.192559     1.38   0.169    -1.283677    7.321118
total_energy |  -1.969955   1.648803    -1.19   0.232    -5.205354    1.265444
    fam_size |   33.04509   19.09404     1.73   0.084    -4.422606     70.5128
       _cons |  -84.20584   111.9061    -0.75   0.452    -303.7961    135.3844
------------------------------------------------------------------------------

. regress healthexp evening_income mgp_cost ker_cost wood_cost total_energy male
> s females children
```

```
      Source |       SS       df       MS              Number of obs =    1037
-------------+------------------------------           F(  8,  1028) =    5.20
       Model |  85990385.9     8  10748798.2           Prob > F      =  0.0000
    Residual |  2.1240e+09  1028  2066149.38           R-squared     =  0.0389
-------------+------------------------------           Adj R-squared =  0.0314
       Total |  2.2100e+09  1036  2133196.86           Root MSE      =  1437.4

------------------------------------------------------------------------------
   healthexp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
evening_in~e |  -.0067679    .026019    -0.26   0.795    -.0578243    .0442885
    mgp_cost |   22.10344   4.250411     5.20   0.000     13.76297    30.44391
    ker_cost |   2.283839   2.480338     0.92   0.357    -2.583264    7.150942
   wood_cost |   2.955543   2.173406     1.36   0.174    -1.309276    7.220363
total_energy |  -2.119875    1.65279    -1.28   0.200    -5.363101    1.123351
       males |   61.14586    50.4759     1.21   0.226    -37.90171    160.1934
     females |   64.77339   62.86357     1.03   0.303    -58.58218     188.129
    children |   .5745766   26.81738     0.02   0.983    -52.04847    53.19763
       _cons |  -135.5658   115.0403    -1.18   0.239    -361.3065    90.17478
------------------------------------------------------------------------------

.
. regress fires income mgp_cost ker_cost children
```

```
      Source |       SS       df       MS              Number of obs =    1044
-------------+------------------------------           F(  4,  1039) =    4.29
       Model |  91.5282742     4  22.8820685           Prob > F      =  0.0019
    Residual |  5541.42479  1039  5.33342136           R-squared     =  0.0162
-------------+------------------------------           Adj R-squared =  0.0125
       Total |  5632.95307  1043  5.40072202           Root MSE      =  2.3094

------------------------------------------------------------------------------
       fires |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   2.72e-06   .0000135     0.20   0.840    -.0000238    .0000293
    mgp_cost |   .0249646   .0060872     4.10   0.000       .01302    .0369092
    ker_cost |    .001814   .0020139     0.90   0.368    -.0021378    .0057659
    children |  -.0195627   .0423965    -0.46   0.645    -.1027552    .0636297
       _cons |   .3519807   .1557672     2.26   0.024     .0463266    .6576347
------------------------------------------------------------------------------

. regress fires evening_income mgp_cost ker_cost wood_cost total_energy

      Source |       SS       df       MS              Number of obs =    1040
-------------+------------------------------           F(  5,  1034) =    7.07
       Model |  185.031734     5  37.0063468           Prob > F      =  0.0000
    Residual |   5414.9673  1034  5.23691229           R-squared     =  0.0330
```

```
-------------+----------------------------------           Adj R-squared =  0.0284
       Total |  5599.99904  1039  5.38979696                Root MSE      =  2.2884

------------------------------------------------------------------------------
       fires |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
evening_in~e |  -.0000571   .0000412    -1.39   0.166    -.0001379    .0000237
    mgp_cost |   .0239487   .0066429     3.61   0.000     .0109137    .0369837
    ker_cost |  -.0037521   .0039245    -0.96   0.339     -.011453    .0039487
   wood_cost |   .0063967   .0034505     1.85   0.064    -.0003742    .0131675
total_energy |   .0025185   .0026092     0.97   0.335    -.0026015    .0076386
       _cons |   .3012953   .1472702     2.05   0.041     .0123127    .5902779
------------------------------------------------------------------------------

.
. regress mgp_cost income evening_income fam_size non_mgp_cost females

      Source |       SS       df       MS              Number of obs =    1040
-------------+----------------------------------       F(  5,  1034) =   23.30
       Model |  15333.9245     5   3066.7849           Prob > F      =  0.0000
    Residual |   136109.61  1034  131.634052           R-squared     =  0.1013
-------------+----------------------------------       Adj R-squared =  0.0969
       Total |  151443.535  1039  145.758936           Root MSE      =  11.473
```

```
------------------------------------------------------------------------------
    mgp_cost |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      income |   .0002443   .0000856     2.85   0.004     .0000762    .0004124
evening_in~e |   .0000375   .0002173     0.17   0.863    -.0003888    .0004639
    fam_size |    .662325   .1918041     3.45   0.001     .2859553    1.038695
non_mgp_cost |  -.0386173   .0052259    -7.39   0.000    -.0488719   -.0283628
     females |   1.891872   .5519926     3.43   0.001     .8087181    2.975025
       _cons |  -.0248268   .8790502    -0.03   0.977    -1.749753    1.700099
------------------------------------------------------------------------------

. regress total_energy mgp_cost income evening_income fam_size

      Source |       SS       df       MS              Number of obs =    1034
-------------+------------------------------           F(  4,  1029) =   77.82
       Model |  1412263.91     4  353065.977           Prob > F      =  0.0000
    Residual |   4668444.5  1029  4536.87512           R-squared     =  0.2323
-------------+------------------------------           Adj R-squared =  0.2293
       Total |   6080708.4  1033  5886.45538           Root MSE      =  67.356

------------------------------------------------------------------------------
total_energy |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    mgp_cost |  -.4351219   .1760427    -2.47   0.014    -.7805656   -.0896783
```

```
      income |   .0040313   .0004892     8.24   0.000     .0030714    .0049912
evening_in~e |   .0061965     .00126     4.92   0.000      .003724     .008669
    fam_size |   8.189226   .8356071     9.80   0.000     6.549538    9.828914
       _cons |   54.62624   4.779886    11.43   0.000      45.2468    64.00568
------------------------------------------------------------------------------

. regress total_energy mgp_cost income evening_income males females children

      Source |       SS       df       MS              Number of obs =    1034
-------------+------------------------------           F(  6,  1027) =   57.70
       Model |  1532994.97     6  255499.162           Prob > F      =  0.0000
    Residual |  4547713.43  1027  4428.15329           R-squared     =  0.2521
-------------+------------------------------           Adj R-squared =  0.2477
       Total |   6080708.4  1033  5886.45538           Root MSE      =  66.544

------------------------------------------------------------------------------
total_energy |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    mgp_cost |  -.2933623   .1763736    -1.66   0.097    -.6394561    .0527315
      income |   .0039424   .0004836     8.15   0.000     .0029933    .0048914
evening_in~e |   .0064392   .0012478     5.16   0.000     .0039907    .0088876
       males |   10.44692   2.297754     4.55   0.000     5.938089    14.95575
     females |  -4.168044   2.909103    -1.43   0.152    -9.876508    1.540419
    children |   11.93258   1.165313    10.24   0.000     9.645918    14.21925
```

```
       _cons |   58.59229   4.802907    12.20   0.000     49.16766    68.01692
------------------------------------------------------------------------------
.
. log close
      log:  D:\DATA\div.log
 log type:  text
closed on:  20 Mar 2012, 12:41:00
------------------------------------------------------------------------------
```

Appendix B: Regression Results from First Implementation Report – July 2012

Descriptive statistics are a useful introduction to the data but are not able to dissect the impacts of multiple independent variables (family size, expenditures on fuel) on relevant dependent variables (hours children spend studying, health, income). Admittedly, not all of the "independent" variables are truly independent, but further analysis can still uncover useful trends. Using Stata, a number of regressions were conducted to identify the marginal impacts of MGP's service on these indicators. The regressions were:

regress evening_income income mgp_service fam_size

[To test the assumption that evening income is linearly related to total income, MGP service, and family size]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.661e+02  5.941e+01  -2.796  0.00534 **
income       3.388e-01  6.082e-03  55.699  < 2e-16 ***
mgp_service  1.621e+02  7.435e+01   2.181  0.02960 *
fam_size     1.123e+01  9.209e+00   1.219  0.22328
```

regress evening_income income mgp_service kero males females children

[To test the assumption that evening income is linearly related to total income, MGP service, kerosene expenditures, number of males, number of females, and number of children in the family]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.601e+02  6.508e+01  -2.460   0.0142 *
income       3.380e-01  6.139e-03  55.051   <2e-16 ***
mgp_service  1.470e+02  7.979e+01   1.843   0.0659 .
kero        -4.737e-01  7.789e-01  -0.608   0.5433
males        5.753e+01  2.267e+01   2.537   0.0114 *
females     -2.060e+01  3.878e+01  -0.531   0.5954
children    -2.973e-01  1.470e+01  -0.020   0.9839
```

regress evening_income income mgp_service mgp_village males females children

[To test the assumption that evening income is linearly related to total income, MGP service, living in an MGP village, number of males, number of females, and number of children in the family]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -171.01048   61.56434  -2.778  0.00565 **
income         0.33742    0.00612  55.131  < 2e-16 ***
mgp_service  194.78608  122.57394   1.589  0.11259
mgp_village  -32.38912  104.40025  -0.310  0.75649
males         57.79741   22.65759   2.551  0.01101 *
females      -23.46955   38.84088  -0.604  0.54592
children      -1.29710   14.57738  -0.089  0.92913
```

regress hours_studying income mgp_service fam_size

[To test the assumption that the number of hours children spend studying is linearly related to total income, MGP service, and family size]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.360e-01  1.107e-01  -2.131   0.0335 *
income       4.598e-05  1.134e-05   4.055 5.71e-05 ***
mgp_service  2.306e-01  1.386e-01   1.664   0.0966 .
fam_size     2.253e-01  1.717e-02  13.125  < 2e-16 ***
```

regress hours_studying income mgp_service kero males females children

[To test the assumption that the number of hours children spend studying is linearly related to total income, MGP service, kerosene expenditures, number of males, number of females, and number of children in the family]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.929e-01  1.152e-01  -2.541  0.01131 *
income       4.996e-05  1.087e-05   4.595 5.33e-06 ***
mgp_service  4.196e-01  1.413e-01   2.970  0.00310 **
kero         4.375e-03  1.379e-03   3.172  0.00159 **
```

```
males        1.184e-01  4.015e-02   2.950  0.00331 **
females     -1.697e-02  6.867e-02  -0.247  0.80494
children     3.638e-01  2.602e-02  13.979  < 2e-16 ***
```

regress hours_studying income mgp_service mgp_village males females children

[To test the assumption that the number of hours children spend studying is linearly related to total income, MGP service, living in an MGP village, number of males, number of females, and number of children in the family]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.369e-01  1.102e-01  -1.242  0.21469
income       5.354e-05  1.095e-05   4.887 1.33e-06 ***
mgp_service  3.415e-01  2.194e-01   1.557  0.12011
mgp_village -8.861e-02  1.869e-01  -0.474  0.63555
males        1.177e-01  4.055e-02   2.902  0.00385 **
females     -3.300e-03  6.952e-02  -0.047  0.96216
children     3.699e-01  2.609e-02  14.175  < 2e-16 ***
```

regress med_expense income kero wood_cost fam_size

[To test the assumption that health expenditures are linearly related to total income, kerosene expenditures, expenditures on firewood, and family size]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept) -28.738866  70.183724  -0.409   0.6823
income        0.004615   0.006602   0.699   0.4848
kero          2.030898   0.797809   2.546   0.0112 *
wood         -0.035419   0.104227  -0.340   0.7341
fam_size     10.262625  10.356086   0.991   0.3221
```

regress med_expense evening_income mgp_service wood_cost males females children

[To test the assumption that health expenditures are linearly related to total income, MGP service, expenditures on firewood, number of males, number of females, and number of children in the family]

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   40.556613  66.376134   0.611    0.541
night_income   0.010270   0.018562   0.553    0.580
mgp_service  -67.259757  84.781524  -0.793    0.428
wood          -0.004053   0.108115  -0.037    0.970
males         24.551762  25.235032   0.973    0.331
females       -0.183360  42.880373  -0.004    0.997
children      12.249915  16.506003   0.742    0.458
```

regress fires income mgp_village kero wood fam_size

[To test the assumption that the number of incidents of fire is linearly related to income, living in an MGP service village, kerosene expenditures, expenditures on firewood, and number of family members]

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  7.404e-02  6.866e-02   1.078   0.2814
income      -1.076e-05  6.200e-06  -1.735   0.0833 .
mgp_village -1.151e-01  7.206e-02  -1.598   0.1106
kero         1.484e-03  7.884e-04   1.882   0.0604 .
wood         2.790e-05  1.024e-04   0.272   0.7854
fam_size     1.448e-02  9.712e-03   1.491   0.1364
```

regress fires evening_income mgp_service wood_cost children

[To test the assumption that the number of incidents of fire is linearly related to evening income, MGP service, expenditures on firewood, and number of children]

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.356e-01  5.009e-02   2.707   0.0070 **
night_income -2.051e-05  1.706e-05  -1.202   0.2299
mgp_service  -1.510e-01  7.890e-02  -1.914   0.0561 .
wood          1.658e-05  1.008e-04   0.165   0.8694
children      2.426e-02  1.453e-02   1.670   0.0954 .
```

regress kero mgp_service income evening_income fam_size

[To test the assumption that total expenditures on energy are linearly related to MGP service, income, income earned at night, and family size.]

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.267e+01  3.223e+00  10.136  < 2e-16 ***
income        1.381e-03  8.313e-04   1.661 0.097293 .
night_income -1.785e-03  2.255e-03  -0.791 0.429013
mgp_service  -3.682e+01  4.023e+00  -9.152  < 2e-16 ***
fam_size      1.658e+00  4.970e-01   3.337 0.000904 ***
```

regress kero mgp_village income evening_income males females children

[To test the assumption that total expenditures on energy are linearly related to MGP service village, income, income earned at night, number of males, number of females, and number of children.]

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.375e+01  3.345e+00  10.090  < 2e-16 ***
income        1.277e-03  8.323e-04   1.534  0.12551
night_income -1.399e-03  2.264e-03  -0.618  0.53677
mgp_service  -3.290e+01  6.628e+00  -4.964 9.16e-07 ***
mgp_village  -4.404e+00  5.634e+00  -0.782  0.43472
males        -3.480e-01  1.230e+00  -0.283  0.77727
females       3.192e+00  2.097e+00   1.523  0.12844
children      2.080e+00  7.879e-01   2.640  0.00852 **
```

Appendix C: Regression Results from First Implementation Report – December 2012

(Though an implementation report was submitted in October, regression analysis was not conducted on the collected survey data)

Kerosene Consumption (rs.)

(*Using reported kerosene bill*) Coefficients:

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   5.583e+01  1.988e+00  28.082  < 2e-16 ***
income        6.665e-04  1.822e-04   3.658 0.000279 ***
cust         -1.248e+01  3.142e+00  -3.971 8.15e-05 ***
income_night  2.448e-03  1.473e-02   0.166 0.868027
```

(estimated actual bill based on liters of consumption times Rs. 18 for the first two liters and Rs. 40 for all additional liters) Coefficients:

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   8.437e+01  4.105e+00  20.551  < 2e-16 ***
income        1.365e-03  3.762e-04   3.628 0.000313 ***
cust         -1.869e+01  6.489e+00  -2.880 0.004135 **
income_night -5.136e-04  3.041e-02  -0.017 0.986530
```

Mobile Phone Charging Costs

Coefficients:

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.889e+01  3.073e+00  15.910   <2e-16 ***
income       5.881e-04  2.816e-04   2.088   0.0372 *
cust        -4.642e+01  4.838e+00  -9.595   <2e-16 ***
```

Study Hours

1) Coefficients:

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   6.267e-01  5.895e-02  10.632  < 2e-16 ***
income        1.920e-05  5.402e-06   3.554 0.000414 ***
cust          4.888e-01  9.317e-02   5.246 2.25e-07 ***
income_night -1.091e-06  4.366e-04  -0.002 0.998007
```

2) Coefficients:

```
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 4.393e-01  9.207e-02   4.771 2.37e-06 ***
income      1.696e-05  5.434e-06   3.121  0.00190 **
kero        3.357e-03  1.272e-03   2.638  0.00858 **
cust        5.305e-01  9.355e-02   5.670 2.33e-08 ***
```

Clinic Visits

1) Coefficients:

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.213e+00  9.854e-02  12.306  < 2e-16 ***
income        2.139e-05  9.031e-06   2.369   0.0182 *
cust         -6.406e-01  1.558e-01  -4.113 4.52e-05 ***
income_night  1.988e-04  7.299e-04   0.272   0.7854
```

2) Coefficients:

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.187e+00  1.549e-01   7.665 8.45e-14 ***
income       2.110e-05  9.143e-06   2.308   0.0214 *
cust        -6.311e-01  1.574e-01  -4.009 6.95e-05 ***
```

```
kero         4.587e-04  2.141e-03   0.214   0.8304
```

Clinic Expenses

```
Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)  -35.687533  14.073391  -2.536   0.0115 *
income         0.002432   0.001145   2.124   0.0341 *
cust          54.505790  19.949971   2.732   0.0065 **
income_night  -0.018797   0.092057  -0.204   0.8383
clinic       125.959201   5.446953  23.125   <2e-16 ***
```

Fires

1) Coefficients:

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0475568  0.0251791   1.889   0.0595 .
cust        -0.0302780  0.0258544  -1.171   0.2421
kero        -0.0003550  0.0003514  -1.010   0.3128
```

2) Coefficients:

```
               Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.340e-02  1.806e-02   1.850   0.0649 .
income        1.070e-07  1.521e-06   0.070   0.9439
cust         -2.104e-02  2.659e-02  -0.791   0.4292
income_night -4.855e-06  1.215e-04  -0.040   0.9682
study        -1.034e-02  1.202e-02  -0.860   0.3903
```

Income

```
Coefficients:
```

```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   5701.1      401.1  14.215  < 2e-16 ***
cust          2198.3      734.5   2.993  0.00289 **
```

Night Income

```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 8.607e-01  9.167e+00   0.094   0.9252
income      5.914e-05  5.410e-04   0.109   0.9130
kero        2.106e-02  1.267e-01   0.166   0.8680
cust        1.939e+01  9.314
```