



A New Ventures India Briefing Note: Micro Grids in Uttar Pradesh & Bihar

SMALL POWER PLANTS BRING LIGHT IN A SEA OF DARKNESS. PITY THERE ARE SO FEW OF THEM.

It is 11 PM on January 25 2013, a day before India's 64th Republic Day, and Mr. Bharath Kumar Madhesia of Tamkuha, West Champaran district, Bihar is an angry man. He is a customer of Husk Power Systems, one of India's micro grid companies and he had just started making boondi (a popular Indian sweet) when the power went off an hour before schedule. (The Husk plant had a breakdown of the generator). When we met him he was working in the faint glow of a battery-operated emergency light. He had planned to caramelize the sugar in preparation and now his plans had come to naught. He circled his thumb and forefinger in a rude gesture and uttered an unprintable phrase to demonstrate his frustration at the unscheduled power cut. He swore that he would, henceforth, keep a record of the service timings and show it to Gyanesh Pandey (one of the founders of Husk Power Systems).

Mr. Madhesia lives in one of about 200 villages in India that get its electricity from a micro grid. Unlike other villagers in the densely populated states of Uttar Pradesh and Bihar, Mr. Madhesia knew he could complain directly to the founder of the company of whom he was a customer. Millions of other people would have only this to say: "This is dehat (the country side), the power comes and goes, if it is there at all and there is no knowing about its timing".

In the last week of January, [David Ferris](#) (Cleantech journalist for New York Times and Forbes) and myself undertook a grueling road trip across Uttar Pradesh and Bihar to see the micro grid operations of Husk Power

Systems, Minda NextGen Tech, Mera Gao Power, Naturetech Infra, Gram Oorja and the solar pumps of Claro Ventures. We covered more than 2,000 kilometers (of often non-existent roads) over 7 days, meeting employees, managers and customers of these companies.

Our journey took us to Bihar Sharif, Siwan and West Champaran districts of Bihar and the districts of Gonda, Sitapur, Hardoi and Unnao in Uttar Pradesh. With the help of Pande, our driver, we braved the dense fog to drive in the dark and see for ourselves the impact that rural micro grid electrification has on the lives of villagers.



An Indian Village. Image Courtesy: David Ferris

Every night, the country side of Uttar Pradesh and Bihar plunges into near-complete darkness. India has many definitions of electrification but we saw only darkness in the districts we visited till, of course, we came to the capital city of Uttar Pradesh, Lucknow, brilliantly decked up in the lights of the tri-colour to celebrate the Republic Day. Homes in the villages served by these companies are the only ones that do have lights when evening descends. We understood Mr. Madhesia's rant (even though he was angry, he insisted that we sample his delicious sweets and drink *chai*) but it was also obvious that the companies we visited cared deeply about customer service.

JUGAAD INNOVATION

Micro grids, as they operate in these parts of India, are a perfect example of low-cost, stripped-down innovation. They are what is called *Jugaad Innovation*, a term made popular by a UK-based management guru of Indian origin Jaideep Prabhu, a frugal and flexible approach to innovation. The term has been made popular by: The small capacity non-fancy plants provide basic lighting services only: two lights and one mobile charger per household for a monthly subscription of about Rs. 100 per month (numbers vary between operators). The timings are rigid: from 6 PM in the evening to 10 PM/11 PM at night. The Rs. 100 (or about USD 2) per month is an important figure: Study after study has shown that is what the average Indian rural household pays for kerosene and mobile charging. Typical cell phone charging costs are as high as Rs. 5 per charge (that does not include the cost of travelling to a near- by town where charging is available).

Companies stay in business by driving down system costs. They all use renewable sources of power which brings operating costs down. Husk Power Systems uses biomass gasification, but other companies covered in this briefing note use solar. Husk Power is also developing solar systems. Husk's gasification technology relies on the availability of rice husk, a waste from the rice milling process. As more gasification plants are built, the price of this waste tends to go up. Solar systems, on the other hand, often

do not work in the winter and rainy season. The biomass gasification system that Husk uses is a 32 kW system that can electrify larger villages (about 500-700 households). These systems offer some flexibility in fixing television sets or mechanical devices (about 10% of the 500 households can have a basic television set). The solar systems are of even smaller capacity as low as 240 W going down to 100 W. They can electrify small hamlets of 40 households to 10 households. To ensure that the system capacity is not overloaded, the households cannot run other devices like radios, televisions or refrigerators. They can, however, buy additional light points.



*A customer switches on the light for the first time.
Image Courtesy: David Ferris*

Almost all micro grid companies have experimented with higher system capacities and whittled them down to suit the market demand. "We initially built systems for larger villages of about 150 to 200 households. We discovered that they took a lot more money to build as about 60% of the costs are towards drawing the distribution lines. This high capital cost made the project unviable." said Mr. Praveen Bhasin of Minda.

Every item of the system, from the generating system to the light, is subject to experimentation. The lights are all LED (for the biomass systems the lights can be CFLs), ranging from 0.8W to 2.5W. The thickness of the electricity lines, the battery backup, the charge controller and the structurals are all variables in this enormous laboratory of low cost innovation. Most solar operators run DC systems but Nature Infratech is experimenting with AC systems. (Biomass gasification based plants by default produce AC power). Every small innovation is celebrated. Mr. Bhasin proudly points out the diffuser that softens the LED light. Mr. Manish Kumar, embedded system engineer of Husk Power System, proudly shows a prototype of a meter he uses that is a child's tiffin box casing.

The meter – if produced at low costs – could help in a business model innovation. It would allow customers to buy small quantities of pre-paid electricity and consume those units at times most convenient to them.

RUN BY JUNOON

Junoon (passion) is a word we heard often: not just from the companies but the customers they serve.

The founders and managers of these micro grid companies are working in the most difficult circumstances and have made transitions from very different lives. Gyanesh Pandey used to work in the semiconductors business with International Rectifier.

He mentions his beachfront home in LA once while we sat across a bonfire in Patna. Brian Shaad, co-founder of Mera Gao Power, who now lives in Sitapur district, used to be an USAID contractor and an organic farmer in California. Shyam Patra used to work for larger infrastructure companies in India and stated Naturetech Infra because “large infrastructure projects never start.” He saw micro grids as one

way to get infrastructure to start impacting lives. Praveen Bhasin, the rural electrification manager of Minda, spends days travelling in remote areas and takes pride in designing the LED lamps that his customers can use. Minda is also the only medium sized Indian company involved in this business (the others are all social entrepreneurs). (SunEdison, a subsidiary of MEMC Electronic Materials, is a large multinational and has a micro grid business in India).

The entrepreneurs are passionately involved. In the 100 kilometer drive from Siwan to West Champaran, the cell phone of Ratnesh Yadav, the co-founder of Husk Power, rang twelve times as kids from the Tamkuha village called up making sure that he was on his way. Husk Power Systems was sponsoring a cycle race the next day and would hoist the national flag in its premises. Ratnesh points out that only a bamboo fence protects the Husk plant which is manned at night by just a few operators. There has never been any incident of theft.



*Husk franchisee plant hypothecated to Central Bank
Image Courtesy: David Ferris*

CHALLENGES OF RUNNING A MICRO GRID BUSINESS

Running a micro grid business is no job for the faint hearted. Mr. Brajesh Kumar, the manager for the Uttar Pradesh business of Minda, identified collections as his top challenge. He listed the various excuses that collection agents, who travel from Lucknow to villages in Firozabad district (about 280 kilometers away), are confronted with every month. In one month, the family would have spent all its disposable income on a wedding and in another month the man of the house may simply not be at home. After a few months, when the debts have accumulated, the customer requests a discount. Once the discount is given, the lower figure becomes the norm.

The politics of Indian villages can also be complicated. Most medium to large villages have people of various castes and communities living within the same village but somewhat separated. Customers often refuse to purchase power if the system has been installed in the “other” community’s area. Mera Gao power had to set up two systems in the same village to serve the Hindu and the Muslim parts. Even in small villages with more homogenous caste or community demographics, there are often two to three groups divided around inter-generational disputes.

Load management is another challenge. The micro grid players provide restricted electricity to the households they serve. Hooking up an additional light or a mobile charger overloads the system and brings the whole village to darkness. Companies consider this stealing, and have responded by setting up circuit breakers along the distribution lines that help them identify the house that is overdrawing the current. Reprimands by a peer group often seem to fix the problem.

MULTI-TIERED ENTREPRENEURIAL MODEL

The local challenges of running the micro grid are so complex that some companies are beginning to pursue what is called the Village Level Entrepreneur (VLE) model. In this approach, the company sells its systems to a village entrepreneur who installs and operates the plant in the village.

Mr. Vikash Chand Kushwaha, 31 years old, runs the Minda micro grid in the Attadhani village in the Unnao district of Uttar Pradesh. He is a poster boy of the solar generation. Mr. Vikash trained as a solar electrician and started maintaining the solar systems of TERI's Light a Billion Lives program and that of another company called Solid Solar. When he learnt he could purchase the Rs. 70,000 (USD 1400, after subsidy) Minda system, he roped in a few friends to buy it. "I remember the time in my village when there were just 2 cell phones and each handset would cost Rs. 10,000. Now everyone has a cell phone and prices have fallen. I know solar is going to have a wide market."

The day after he installed the 100 W solar micro grid system, Vikash had 14 customers who paid Rs. 500 as security deposit and signed up to pay Rs. 100 per month. He then quickly changed his model and asked his customers to pay him Rs. 2000 (about USD 40) as upfront money for a 3 year contract. He paid back Minda with his collections within about 6 months

But it is hard for Minda to find entrepreneurs like him. Bank loans would help in providing these local entrepreneurs with the capital to start up these small plants. But banks are slow and hesitant to lend. Mr. Abhay Yadav, 25 years old, set up a Husk franchisee plant in Jamalpur, near the town of Anderbazar in the Siwan district of Bihar. The Husk plants typically priced at USD 40,000. . It took him 6 months to procure the 85% of the system cost (Rs. 17 lacs) as loan. He has installed the plant in a plot of land owned by his family and the land has been mortgaged for the Central Bank of India loan. Mr. Yadav, additionally, had connections. His mother and father both have held elected "mukhiya" (headperson) positions in the local village.

ONCE SET UP MOST PEOPLE TEND TO SWITCH ON

Mr. Vikash, in the village of Attadhani, Uttar Pradesh, had reached his solar system's capacity of 40



This humble set will light up 40 home. Image Courtesy: David Ferris

connections in a month, and Mr. Yadav of Jamalpur, Bihar has reached the halfway mark of 500 maximum connections with his biomass system, in one month of operations. Both are from already deemed "electrified" villages by the Indian Government. But Mr. Yadav's village was electrified for only six months before the transformers caught fire. The distribution lines of the micro grid hang below the dead utility lines.

The Matiyari Jugrajpur village near Reusa of Sitapur district is technically classified as an "un-electrified village". January 27, 2013 is a very big day -- it the first time that seventeen households in the 40-household village would get to switch on the lights. It is about 5 PM and Mr. Sadhuram, the Mera Gao electrician, is jumping from roof to roof and stringing lines

while ticking off names on a sheet that he has in hands. Mera Gao Power personnel are confident that at least 30 households would want to get lights within a week. "They need to see it working," they say. Caution is easily understood. Very few things work as promised in this part of India.

BUT VERY FEW KNOW ABOUT IT IN THE FIRST PLACE

In the vast hinterland of UP and Bihar very few people know about micro grids or even solar products. We asked villagers in Bihar Sharif where Claro Ventures runs its solar water pumps whether they have heard about micro grids for lighting. Nobody knew what that was about. We asked villagers in the micro grid villages what they used for running their agricultural pumps. They said they used diesel. In Sonari, near Biswan, Sitapur district Gram Oorja solar powers a rural BPO (business processing organization) called Rural Shores. None of the forty employees who worked in the rural customer service center had ever heard about Mera Gao Power whose headquarters is in Reusa, just forty kilometers away. In their homes they used kerosene.

LIFE IS A LITTLE EASIER

People interested in rural electrification often wonder whether it stimulates additional income. The companies themselves like to make this claim. We asked this question often and never got an unequivocal answer. Most of the people that we met used lights for their homes and shops, yet it is difficult to link the availability of electricity with higher income. It is more convenient though: there is no soot, no need to clean, no need to store kerosene and, of course, it is safer. Life is a little easier.

In the village of Chairpurwa, Sandeep, who is studying for his Class X board examinations, has had electricity in his house for about nine weeks. He studies and manages a small grocery kiosk outside his home. He now studies for 4 hours a day, compared to his previous 2 hours, and now his teacher does not reprimand him for unfinished homework. Not all his friends have electricity in their houses but their parents are slowly signing up.



Image Courtesy: David Ferris

In the village of Sirpurva, in the Gonda district, where Naturetech Infra operates, Shivram Yadav, aged 37 years, is both the local doctor and the village teacher. He says that those households who have the micro grid light do not use kerosene and have less respiratory diseases. In his government primary school, about 50 of 230 students have lights in their houses. He says that the kids who do not have lights struggle to finish their

homework. Their parents harass them to get their studies finished before the kerosene is used up.

Some tasks that can be done at night might provide extra money. Parveen introduces us to her three sisters, Shaima, Nasreen and Shabnam, who work with her in making exquisite zari (embroidery with metals) sarees in the village of Muglinkuwaha, in the Sitapur district. They start working early in the morning and can now continue till late at night. Do they earn more? Ms. Anwar, their mother, does not answer yes. It may be that she is demurring in order to avoid the evil eye.

PRIVATE ENTERPRISE ITSELF IS A CHANGE AGENT

The entrepreneurial practices of these organizations can be a powerful impact. These companies recruit only local employees. Husk Power system has a company policy that employees need to address each other as Ji (representing respect). The plant operator – a Brahmin – took 6 months to address the electrician – a low caste employee – in the required manner. He took a step at a time: first calling him “brother” before he could overcome the centuries old dogma. Two of the Husk plants are run by women. Victor from Uganda is living in various Bihar villages to train under Husk and be a plant operator. The Rural Shores BPO powered by Gram Oorja allows young men and women to work in a professional organization right in the middle of their village.

WHY SHOULD OTHERS CARE?

In a period when economic growth is slowing, the un-electrified countryside provides a vast untapped opportunity. India should encourage private businesses in rural micro grids.

This is an industry that requires enormous commitment and organizations that work in these areas do so under the most challenging circumstances. There are many things India and Indians can do to make things easier for them. The Indian government could carve out territories where micro grid players could operate and spend public money to promote awareness and encourage research and development. Successful Indians can get together and crowd fund the moneys required to power up individual villages and hamlets. India has recently passed a law that requires large corporations to spend 2% of their net profit in CSR activities. These large corporations can “adopt” larger villages.

Low cost money raised from individuals and corporations has the potential to lower the monthly charges paid by customers. The fact that micro grid companies ask for monthly subscriptions of about Rs. 100 for two LED lights and one mobile charger has raised some concerns that this is too high a unit cost of power (Rupees/kWhr).

Rural consumers, of course, are willing to pay this amount because it is a saving by way of kerosene and mobile phone charging. India has many millions of potential customers who like, Mr. Madhesia the angry man we met on the night of January 25th, would loudly demand the services once they are available. Increasing the number of players who provide these services should be India's top priority.

The United Nations General Assembly unanimously declared the decade 2014-2024 as the Decade of

Sustainable Energy for All. This is following 2012 being the International Year of Sustainable Energy for All. Universal access to energy services can be India's enduring contribution to human development. The brave people running India's micro grids can make this contribution. They need all the support that the world can give them and more.

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