

# Solar Mini-grids

Emerging trends and business models

**Anjali Garg and Pepukaye Bardouille, Senior Energy Specialists, International Finance Corporation; and Richa Goyal, Senior Energy Analyst, Schatz Energy Research Center, Humboldt State University**

According to the 2011 Census of India, 81 million households rely on energy sources other than grid electricity for lighting and other basic energy needs. Of these, almost 94 per cent reside in rural areas. Renewable energy-based mini-grids are increasingly being seen by energy access proponents as a tool that could help bridge this gap. However, the sector is still in its infancy and faces a range of challenges related to lack of clarity on standard operating procedures, quality, and health and safety standards for installation. Moreover, the components for setting up systems are not easily accessible, long-term capital investment is hard to secure, and kerosene subsidies affect competitiveness, particularly for systems providing lighting.

Recently, growing interest in mini-grids has prompted key stakeholders to launch substantive efforts to address these issues and stir up innovation which, in

turn, could lead to big results in the roll-out of these solutions.

In this article, the authors highlight four emerging trends related to the mini-grid sector (specifically those using solar photovoltaic [PV] technology), observed during the course of their work over the past three years:

- Focus on asset-light systems in the past and promise of larger systems in the future.
- Outsourced operating models and leveraging rural social entrepreneurs as delivery agents.
- Dependence of ventures on corporate social responsibility (CSR) funding.
- Use of mobile technology for remote monitoring and revenue collection.

## Focus on asset-light systems in the past and promise of larger systems in the future

Some of the earliest players in India were local start-ups, led by entrepreneurs wanting to foster inclusive rural develop-

ment by creating “self-sustaining ecosystems”. Most were kilowatt-scale plants using biomass and domestically manufactured gasifiers (Husk Power Systems and DESI Power, being the first movers in Bihar). These plants were of 25-50 kWp capacity and used low-cost distribution infrastructure to connect to households and small businesses. While some were successful at a handful of sites, the majority were unable to upscale activities. The key issues faced were high capital costs, problems with revenue recovery, lack of trained staff to roll out operations beyond a certain scale, challenges in securing fuel supply, lack of clarity in coordination and interconnection with the central grid, and lack of a clearly defined exit strategy.

These issues led to a new wave of mini-grids emerging in the past few years, leveraging solar PV technology. Most of the entrepreneurs behind such schemes (Mera Gao Power, Naturetech Infrastructure, Gram Oorja, for example) selected microgrids – typically 200 Wp to 15 kWp DC systems, offering lighting and cell-phone charging for six to eight hours per day, and serving clusters of 30-50 households. Owing to their relatively small size, capex was relatively low and the systems could be moved from one location to another fairly easily in case of central grid encroachment or non-payment by customers.

There was also increasing interest from corporates. Pilot systems were set up by several domestic conglomerates and multinational companies, including SunEdison (14 kWp mini-grid in Meerwada, Madhya Pradesh) and Minda NexGenTech Limited (1.2 kW mini-grid in Nagla Dhuli, Uttar Pradesh).



However, building grid-quality mini-grids at scale and on commercial terms has seen limited success in India. Unless capital costs are covered by other parties, companies experimenting with larger systems struggle to collect sufficient revenue to cover investments, let alone provide a risk-appropriate return.

The absence of policies clarifying grid connectivity and tariff in the past led to uncertainty in the life of a plant's operation. The recent policy announcement of utility grid purchasing power from mini-grids and appropriate actions taken by related commissions are likely to incentivise investment in better quality infrastructure and larger mini-grids in the future. There is also a renewed interest in the business-to-business, anchor load model where a mini-grid company enters into a long-term agreement with companies operating in rural areas to ensure "baseload" for the mini-grid, and sells any surplus electricity generated to nearby households. For example, Smart Power for Rural Development, a Rockefeller Foundation initiative, relies on telecom towers and other rural businesses as baseload, and serves households in parallel. The success of such models could help set a precedent for large-sized systems being able to achieve commercial sustainability.

#### **Outsourced operating models, leveraging rural entrepreneurs**

Despite the increasing popularity of mini-grids, very few players actually want to either own or operate these systems. The business model has typically been to develop, sell and install technology, while using rural entrepreneurs as investors or, where capital costs can be covered by a third party, as operating partners. As an example, Minda NexGenTech Limited's rural entrepreneur-based model identifies a local person to invest in the system and take responsibility for supplying electricity to villagers. The revenue collected is used for maintenance, to service monthly payments on loans, and to generate a return on investment. However, this is not an easy model to implement as financing



continues to be a challenge. There are several cases of entrepreneurs struggling to access financing as they are not seen as "investment grade". Others are simply not keen to enter into agreements with formal banking entities, perhaps due to uncertainty about its broader implications. Further, some potential local entrepreneurs have asked why a large corporate would not want to provide the capital to begin with, questioning either the technology dependability or the overall financial viability of the business.

One reason for interest in this is that rural electrification is generally not a core competency of large corporates, most of which are essentially dipping a toe in the market with the goal of exploring to see if and how it aligns with their main business and the promise of a massive untapped market opportunity. Since universal energy access continues to be a challenge, the private sector has a key role to play. Private players can either leverage opportunities for vertical integration, or manufacture system components or be turnkey project implementers for urban solar rooftop projects. However, the extent to which the market opportunity in off-grid regions fits with their core strengths remains unclear.

#### **Dependence of ventures on CSR funding**

Initially, venture investors were the key funding sources of businesses, but

emerging models are increasingly relying on CSR and grant funding. This does not mean that concessionary or "free" money is undesirable. It is critical to support companies in a nascent sector as they climb the learning curve and help cover the prohibitive costs of project development. However, the trend of energy access projects being reliant on grants is getting stronger even though significant time has elapsed since the very first mini-grid projects were set up. CSR funds should be used to bridge the financing gap in order to achieve business sustainability during the initial teething period. As a sector matures, the catalytic role of soft money should wane rather than gain prominence.

So why is this still the case? It appears that companies are resorting to such models because of a mismatch between the choice of customer base and the nature of technology used to serve the market. Technology costs are too high and revenues from customers are low, making the business unsustainable on commercial capital. Another reason is that entrepreneurs often lack the skills to operate effectively in difficult rural markets and the costs associated with training staff or building partnerships to complement the sponsors' skills are high.

Finally, CSR-funded mini-grids projects may emerge where there may be a fun-

damental misalignment between the sponsoring company's core business and the business of running mini-grids.

This need not mean that there is no rationale for working in the mini-grid space. On the contrary, it could make a case for a non-commercial approach to such a venture. For instance, in the case of the government issuing a tender for, say, the installation of a centrally located solar PV power plant, an infrastructure company could offer to build a mini-grid in the adjoining villages as part of its wider value proposition. Here, the value addition of a mini-grid venture to the company's core business could be incredibly high. At the same time, it is important to not label mini-grids as a business and leave it to run itself. In such cases, the mini-grid is a project for which the sponsoring company is responsible. The systems must be maintained, lest they run into disrepair and fail to provide end-customers with promised energy services.

This issue really arises where CSR funds are deployed to build a system and, because there is no need for recovery of the investment, the sponsoring company simply "exits" once the system is in place. Basically, it has not thought carefully about the operation or long-term management of the system, leaving this entirely up to the community. However, this is a little different from instances where government schemes are set up and the onus of running them is on communities who have neither been trained nor have proper incentive structures for long-term operation. Many such systems lie unused or fall rapidly into a state of disrepair, defeating their initial purpose. Noteworthy is an experiment by Minda NexGenTech in Uttar Pradesh where self-help groups were set up to collect a token amount every month to cover the cost of battery replacement and other maintenance once the CSR-funded contract is over.

#### Use of mobile technologies for remote monitoring and revenue collection

This is perhaps the most evident trend

across emerging markets. Energy flow and consumption management, and efficient billing processes require expensive technological components and human footprint. Deploying personnel in remote regions, often with poor infrastructure, can significantly increase both capital and operating costs. Hence, off-grid energy companies experiment with low-cost methods for payment collection and monitoring. An emerging trend is leveraging cloud technology and the ubiquity of mobile telephony and mobile networks for remote management. There is an increasing use of prepaid energy "credit cards" and/or smart meters that use GSM networks to reduce human interaction. In many African countries where mobile money payments have flourished, the off-grid energy sector has embraced mobile money-led pay-as-you-go model. Kenya was an early adopter of mobile banking through its M-PESA service, which is used by two-thirds of its adult population. It is currently in the next phase of penetration of digital financial services, wherein the Commercial Bank of Africa and Safaricom, its largest telecom operator, came together to launch M-Shwari, a bank account that taps into the telecommunications data of unbanked Kenyans to make credit scoring decisions. The lack of availability of credit history has been a big roadblock in unlocking consumer finance for energy access services, and banking products like M-Shwari have a huge potential to bridge this information gap between bankers and consumers.

In India, on the other hand, the lack of enabling regulation has hindered mobile money-led pay-as-you-go models in the past. Most pay-as-you-go models req-



uire customers to use cash to buy prepaid energy credits from agents appointed by manufacturers. Regulation plays a critical role in the development of mobile money markets. The November 2014 guidelines by the Reserve Bank of India, which allows firms with significant experience in distribution (including mobile operators) to offer deposit accounts and payments as a business service, can be a game changer. This was accompanied by a relaxation in the proof of address requirements, and the abolishing of the rule that banks' agent networks should be within a 30 km radius of the nearest branch. The Telecom Regulatory Authority of India had already mandated telecom companies to let banks access the unstructured supplementary service data channel, which is a simple interactive messaging system that allows debit and credit card transactions for basic mobile banking services. These policy events are important achievements and have created an enabling environment for mobile money-led pay-as-you-go models to enter India. As India, aided by recent pro-mobile banking policy announcements, takes positive strides in this area, its learning curve could well be smoother as it stands to gain from the successes and failures of countries such as Kenya.

#### Summing up

Yes, it is true that, just like any young sector, the mini-grids space has significant challenges that must be carefully navigated. At the same time, we believe that there is now a confluence of exciting conditions that could support a significant scaling-up of the mini-grid sector in India, given the slew of innovations in business models, the growing interest from small and large players, recent policy changes in the banking and tariff space, the advent of businesses leveraging the mobile money payments platform, and the promise of large amounts of soft money through CSR obligations. ■

**(The views expressed here are those of the authors and do not represent the views of the International Finance Corporation and/or the Schatz Energy Research Center, Humboldt State University.)**