

Sustainable Solution

Microgrid and minigrid experience in rural electrification

Microgrids and minigrids have strong potential to serve the unelectrified parts of the country and cater to the energy needs of rural areas. Several players/operators have been successfully providing services to rural communities. While this market segment has become more mature over the past few years, it continues to grapple with several challenges such as payment collections from consumers and the lack of a well-defined policy and regulatory structure. Developers are also uncertain about their future, once the grid becomes available in their area of operation. Sector stakeholders talk about their implementation experience, key challenges, emerging business models, and expectations from the government...

How has your experience with microgrid implementation been so far? What are the key challenges and how has the scenario changed over time?

Kunal Amitabh

DESI Power has learnt from its past experience that building power plants alone in a village will not serve the purpose. Micro-enterprise development is the backbone of village development and must be given equal importance. When DESI Power started building projects, no affordable and reliable renewable energy-based technology solutions were available. Solar photovoltaic (PV) was very expensive and biogas was not suitable for power generation in every village. DESI Power selected biomass gasification, as this can ensure more social and economic involvement. The biomass supply chain itself can create a lot of jobs. DESI Power spent over 10-12 years to perfect the technology suitable for rural application, with infrastructure and training systems that enabled villagers to run and manage them. It was the first company to field test a modified natural gas/compressed natural gas engine with gasifier in a village. The gasifier technology has been commercialised now for

village application with in-house capability to handle technical problems. It has been hybridised with PV to ensure supply reliability at the lowest cost. The lack of job opportunities in villages is leading to large-scale migration of people, which is adversely affecting village communities due to the non-availability of manpower at critical times. DESI Power builds power plants and microenterprises together, along with water and energy services, so that they are interdependent and the profitability of the project can be maintained.

The main challenge is to raise capital for microenterprises and promote entrepreneurs in villages who can run and maintain the enterprises. Running a training centre for these projects is essential and money for the training centre cannot be a part of the project cost but has to be met by way of grants. The scenario, however, is changing slowly but steadily.

Nikhil Jaisinghani

Mera Gao Power (MGP) is a microgrid company serving rural India. The success of our business is based on our ability to collect revenue from customers in exchange for service. The three key chal-

lenges that need attention are offering service at an attractive price for price-sensitive communities, providing the service we promise and ensuring that the service only comes with payment. Initially, our aim was to identify high-demand electricity services and price those services at cheaper levels than the existing substitutes. We started with lighting as a service and added phone charging soon after. This took up a good portion of 2010 and 2011. By the end of this, we understood the rural market well in terms of who our target customers were, what level of service they wanted, and what they were willing to pay.

We were simultaneously working on the second component – quality service. We are now rolling out a unique infrastructure based on a microgrid that we had designed in 2010. Unlike coal-based power plants or power transmission lines, these microgrids have never been built before, nor has there been any template design or specifications on components. We spent 2010, 2011 and 2012 in piloting, testing and refining the design. In fact, we replaced the key components in 2013, 2014 and 2015, so that the design is not static. However, the majority of develop-



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India

ment works were carried out by end-2012. In 2014, we focused primarily on our construction and maintenance processes as they were clearly the weak link. By 2015, we had updated our operations manual with improved processes, built tools such as a quality control application, initiated formal training for new and existing employees and appointed quality control teams in our branches. In late 2015, we developed a system monitoring device that was able to track real-time performance data and upload it to the cloud for access-anywhere visualisation. The system monitoring devices proved that our microgrids were robust and provided quality service when properly built.

The final component was to ensure that customers do not get free service, which we began focusing on in 2015. Previously, we had been working more on the technology front to minimise power theft. The existing customers were using power from the grid for availing of those services that the grid was not meant to provide. However, little was done to ensure that customers paid on time. To this end, we piloted a mobile application, sent SMS receipts to customers and also conducted management team meetings to review and analyse arrears on a weekly basis. This has resulted in stronger collections in new districts. With these experiences, MGP has been scaling up faster and is constantly learning how to operate a network of microgrids serving 100,000 customers in the coming years.

Jaideep Mukherji

So far, 90 per cent of microgrid projects have been commissioned with the help of either government subsidy or grant-based or charity-intended models, which are

mostly community managed. These mini grids were serving lighting needs only, with no impact on livelihood and revenue generation. Our initial experience with the implementation of commercially sustainable minigrids in India has been challenging. However, over the past one year, we have witnessed positive outcomes within an enabling policy framework. The smart power model is a market-based model that goes beyond household lighting and ensures productive use by creating an ecosystem that drives socio-economic development through sustainable decentralised renewable energy minigrids. The programme aims to reach 1,000 villages, impacting 1 million lives. Currently, we have 81 operational minigrid projects distributing approximately 484 kWh of electricity. The smart power model can help support a mix of solutions for ensuring electricity access to the 300 million people living in villages without electricity today. As a result of our intervention, we have noticed socio-economic impacts on the ground, with children studying longer hours, reduced eye problems due to flickering lights, and a number of commercial establishments diversifying and expanding their businesses.

While the sector has a lot of potential in a country like ours, there are challenges that remain. There is some uncertainty about what will happen when the grid becomes available in these areas. However, there are a set of policies, both at the central and state levels, which are attempting to address these issues. It is critical to have a conducive policy framework to provide a secure investment environment and attract long-term investments in this space. We also expect to see the states come up with minigrid policies and play a proactive role in rationalising procedures for project execution, such as land acquisition and right of way. We are hopeful that there will be a focus on minigrids as a viable option for national energy planning for providing electricity to rural India. This will help us leverage access to long-term and low-cost financing from various schemes and funds.

Shyam Patra

It has been a long journey for us travelling through the rough patches of rural India round the year for the past five years now. However, the good part is that in line with the ever-changing and growing needs of the rural consumer, we have also evolved over time and gained vast experience in dealing with rural customers and ensuring energy access and integrated rural development while deploying solar energy. At present, we are among the top three enterprises in India that are developing smart villages where amenities like street lights, digital literacy, smart classrooms, safe drinking water, irrigation, skills development and livelihood are taken care of in addition to electricity supply to households, shops, etc.

Our experience says that if any programme or technology has failed in rural areas, it is not because rural customers are at fault. Instead, it is the model and the technology solution along with community engagement that have gone wrong or fallen short of the vision and planning. These customers expect to receive electricity at night and that too free of cost. If our model cannot provide power the way the government supplies power in rural India (though unreliable, the quantity remains unlimited in the case of the government's power supply and comes free of cost), then we should make it clear in the beginning itself and have a written agreement with the village community and individual customers. Therefore, to avoid confusion after the commencement of our programme, it is very important to clarify that we would not be able to supply electricity beyond lighting and mobile charging in the beginning itself.

The key challenges remain the same that customers do not like to pay and would like to have unlimited electricity supply for all their basic and aspirational needs. They have inculcated this habit over years owing to free power supply from the state governments. The villages which are un-electrified see the neighbouring villages getting unlimited free power and are therefore reluctant to pay Rs 100-Rs 150



Shyam Patra

Founder and Director,
Naturetech Infra

for a few hours of basic lighting and mobile charging.

The government does not provide a level playing field to operators like us by supplying unlimited power free of cost or nearly free of cost in most of the villages. To top it all, any unelectrified village can be electrified without making the private operator who is already present in the village as the preferred franchisee in that area based on mutually agreed terms. As per the recent tariff policy amendment, only buying power from the minigrid would not protect the interests of the existing operator and investors.

What are the emerging business models in the microgrid space and which ones are the most economically and commercially viable?

Kunal Amitabh

Only a few models are under consideration at present. Some possible models for profitable and sustainable microgrids are as follows:

- Ideally, a company that is jointly owned by investors and an experienced mini-utility (such as DESI Power Kosi) and builds, owns and operates power plants and microgrids will be able to provide the most reliable and cost-effective power to villagers. The downside of this model is the higher risk.
- The other model that appears to be more acceptable to investors is a partnership between investors and operators, in two possible ways:
 - The investor is also responsible for the engineering, procurement, and construction (EPC) and works with a local partner who is based in the village and is at home with villagers and local conditions, with comprehensive experience in off-grid rural electrification projects. The local partner is responsible for the operations and maintenance (O&M) of the power plant and the management of the microgrid/distribution network, including revenue collection.
 - The investor has a local partner (defined as above) who is responsible for

the EPC, O&M and management of the microgrid and distribution network, including revenue collection.

The success of any of these models will depend on the success of the local partner in promoting enterprises, and water and energy services, which provide anchor loads for the power plant. DESI Power is working on all these models.

Nikhil Jaisinghani

More and more technology companies are coming up, which offer tools to microgrid operators. However, my fear is that there are already more service providers than necessary and not enough microgrid owners and operators.

Jaideep Mukherji

The smart power model aims to give rise to a new market that will generate higher household incomes and spur economic development and growth in rural areas. We believe that this model can easily contribute to the enhancement of the government's future grid plans and is not mutually exclusive to the arrival of the grid. The model has created a proper system for billing, collection and metering, while delivering consistent and reliable electricity to an underserved group of customers, which the power utility can capitalise on.

As the smart power model is market-driven, it will be both scalable and sustainable, and it will help unlock the vast untapped economic development opportunities for Indian villages. The unique value proposition of the model is to bring together a network of players – from energy service companies to anchor loads to government and microenterprises. This, we believe, is the key to making the model successful.

Shyam Patra

Until and unless the government provides a level playing field or a preferred franchisee role to operators like us in rural electricity supply, no operator or business model per se would last beyond two to three years. However, if we have to cater

to the needs of commercial or anchor customers like telecom towers, banks and petrol pumps, then it does not matter whether the rural folks are buying electricity or not. Rural populations see us as temporary service providers. They understand that once the government starts supplying free power to villages, operators will not have a bigger role to play.

So far, the models that are selling metered electricity (with a reasonable per unit rate) to customers at least for four to five hours in the evening and are financed by grant, subsidy or equity are considered successful models. Further, models with solar power are better placed than biomass models, as biomass-based models involve fuel cost and a high O&M cost.

What are your expectations from policymakers and regulators at the central as well as state levels with regard to encouraging segment growth?

Kunal Amitabh

There are some critical areas where the central and state governments need to work together with microgrid developers so that the changes can be done rapidly at the ground level. There is a need to harness electricity and energy services to create jobs and increase rural productivity to break the vicious cycle of rural poverty.

There is uncertainty regarding what will happen when the grid reaches the area. In this regard, two parallel sectors – decentralised and centralised – linked at the lowest consumer level, each with its own legal and financial framework, will be the best solution to manage the linked problems of economics, poverty, clean cooking energy, irrigation water services, national energy security and reduction of carbon dioxide emissions. While the centralised power sector should serve the industrial, infrastructure and urban sectors, the decentralised power sector should serve the rural and peri-urban areas.

Renewable energy will mainly drive decentralised power and the energy sector. Local

generation, and distribution will be planned and implemented in each village. Microgrids and tiny grids need to be planned in each village. Close linkages are needed with villagers and village groups.

Governments need to commit to the off-grid renewable energy sector and introduce measures that contribute to the development of the market. These may include drawing up a realistic plan, abiding by it with stable and predictable policies, providing targeted support, rethinking subsidy mechanisms for fossil fuels, cross-usage of distribution lines and fostering innovation.

Decentralised renewable energy (DRE) companies are exploring new types of technology to increase operational efficiency. For commercial viability, it is crucial that DRE enterprises have substantial cash flows that can recover high upfront installation costs. Certain key steps are needed for making stand-alone microgrids economically viable. There is a need for raising patient, long-term social investment capital for the projects. It is a challenge to find capital even for very profitable investments like the replacement of diesel engines with electric motors.

A linkage between rural electrification, rural enterprise, job creation, sustainable farming and nutritional security is needed. Access to modern energy through off-grid renewable energy solutions presents huge opportunities across the health, education, agriculture and water sectors. A recasting of government policies and schemes is needed to take into account these linkages and make them happen to ensure sustainable rural progress. Sustainability of business models is impacted by market distortions, such as kerosene subsidies, which need to be adequately considered when promoting off-grid renewable energy.

Despite being cost competitive on a life-cycle basis, the relatively high capital-to-operational cost ratio compared to conventional systems continues to be a key barrier for stand-alone renewable

energy systems. Overcoming this requires access to end-user financing that is tailored to consumer income, cash flow and current expenditures on energy services (for example, kerosene or candle lighting and mobile charging).

Lastly, training, technology innovation and capacity building of villagers are needed to ensure the sustainability of projects. With focused training, we can increase the number of franchises and village-level entrepreneurs, making it easier for energy service company or energy savings company (ESCOs) to enter and scale up.

Nikhil Jaisinghani

We have recently received a copy of Uttar Pradesh's policy on microgrids. Initially, there was some concern because the policy had been developed behind closed doors. However, it appears to be solid. It has set a floor for the services provided and a ceiling in terms of the cost of microgrids built with government subsidies. The policy also allows microgrid operators to choose to work without any restrictions and subsidies. This is the ideal policy structure. While we choose to continue our existing model, we also expect to see new microgrid companies/investment initiatives emerge as a result of the new policy.

In my opinion, as long as future policies at the state and central levels follow the strong precedent set by the Uttar Pradesh government, the regulatory framework in India will continue to encourage the microgrid segment, which is still in its infancy.

Jaideep Mukherji

In order to ensure that the status of mini-grids is recognised as an important component among off-grid solutions, we have been working closely with the central and state governments to showcase an innovative way to deliver clean energy via decentralised renewable energy minigrids, which is both sustainable and scalable. With the implementation of minigrids in the villages of Bihar and Uttar Pradesh, we have been able to create capacity and learnings,

which are being captured and shared with a range of stakeholders. We believe that this will help in refining community engagement as well as the policy and regulatory framework and, most importantly, in enhancing investor confidence. Meanwhile, the policy environment too is becoming encouraging. The National Tariff Policy has included a special clause on minigrids, focusing on the need for grid interactivity and investment security. This will, to a great extent, nullify the uncertainty around investments in the minigrid sector.

The announcement of a minigrid policy by the Uttar Pradesh government is the first step towards recognising the role of the private sector in promoting electricity distribution through minigrids in rural notified areas. Uttar Pradesh has led the way and we think that other states will also be forthcoming in developing similar policies in the future, thereby recognising that commercially sustainable minigrids have the potential to scale up, integrate seamlessly with the national grid and offer a last mile delivery model.

The Union Budget 2016 has re-emphasised the government's focus on rural electrification. Under the Deendayal Upadhyaya Gram Jyoti Yojana, the centre intends to electrify all villages through grid-connected and off-grid solutions. We believe that decentralised renewable energy minigrids can be one of the measures within the off-grid solutions to meet the target of reaching 100 per cent rural electrification by May 1, 2018, with a crucial focus on livelihood impact and productive use.

Shyam Patra

We expect a level playing field from policy-makers. The more the free power in villages, the more is the subsidy burden for everybody in some form or the other. For us to be able to supply electricity at par with urban areas, the government needs to support the shortfall between the cost and the revenue. At present, the government is supplying unreliable electricity free of cost, which is not only unsustainable but will also result in economic loss. ■