Role of mini-grids in enhancing rural livelihoods in Nagaland

Introduction

It is well understood and appreciated that the socioeconomic development of communities depends on access to energy services (Morris et al., 1999). Electricity is a modern energy form that can be easily produced at various scales of operation and can be transported over long distances through wires. This form of energy has multiple uses and many end-uses, appliances, equipment, and machines powering industries have been developed to run on electricity making our lives comfortable and safe, convenient, and productive. No wonder that access to electricity is one important indicator in assessing the level of socio-economic development of countries. As a follow-up to the Millennium Development Goals (MDGs), in which access to clean energy in a sustainable manner was not specifically mentioned as a separate goal as it was understood that energy cuts across all the themes and hence is a cross-cutting input in meeting the MDGs, UNDP developed the Sustainable Development Goals (SDGs) in 2016 which has a specific goal for the same - SDG 7 – Affordable and clean energy: Ensure access to affordable, reliable, sustainable and modern energy for all.

Benefits of rural electrification

The benefits of rural electrification include social, environmental and economic (Schillebeeck, Simon J.D. et al., 2012). The positive impacts of electrification of communities are generated at the household and the village level. Savings in time, increase in productivity by using appliances running on electricity, improvement in living conditions, and reduction inconvenience in performing various tasks are some of the positive impacts that households experience when they get an electricity connection and supply (World Bank, 2008). Access to electricity also has positive impacts on the health and education of households and promotes gender equality (Cabraal et al., 2005). A study conducted by the World Bank in GGG in six states in India found that the lives of more than 60% of the women living in electrified households were less burdensome and more balanced as compared to those living in unelectrified households (World Bank, 2004). Household electrification presumably increases the productivity of domestic activities to other uses of time. However, this productivity increase may be less as compared to urban households due to the nature of rural economies and opportunities to use the free time in other productive activities. There is evidence that rural households, once they have access to it, first use electricity for lighting, followed by meeting their entertainment needs like powering televisions and radios and lastly using fans (Bernard, 2012). Studies in India also point out that even after access to electricity, households do maintain the option of using kerosene for their lighting needs, primarily due to the erratic nature of its supply (Rehman et al., 2005), which has been a bane in rural India.

The Indian context

India achieved 100% village electrification through the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) by the end of 2018 (“DDUGJY,” n.d.). Begun in 2015, this revamped scheme for rural

electrification subsumed the earlier scheme called 'Rajiv Gandhi Grameen Vidyutikaran Yojana'. The target under DDUGJY was village electrification and providing electricity distribution infrastructure in rural areas. Under the scheme, the Union ministry of power, sanctioned 921 projects to electrify 121,225 un-electrified villages. To electrify the unelectrified households, GoI initiated the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) through which all interested households were electrified by 2020. Though there are some data gaps (Dsouza, 2019), one can safely assume that almost all the households have been electrified and the few ones that are left out will be covered shortly. However, the focus has always been on household electrification and not on the provision of power for the overall socioeconomic development of rural areas (Nhalur et al., 2018).

While universal electrification across the country has happened and almost all households in the country have been connected to the grid, the supply of power to households is not 24X7. Rural areas experience power cuts of up to eight hours interspersed throughout the day. As villages lie at the tail ends of the distribution network, they are also prone to experience poor quality of power supply and low and fluctuating voltages are common. The problem is comparatively severe in the less developed States as compared to the developed ones.

More importantly, access to electricity for productive end-uses like say running motors for various income generation activities like small-scale industrial and commercial activities, adding value to agricultural outputs at the village level, etc has not improved, as the focus of the policymakers and program implementers has been on electrifying households only.

The situation in Nagaland

The overall power situation in Nagaland needs urgent attention. The Department of Power, Govt. of Nagaland (DPN) oversees power generation, transmission and distribution of electricity in the State. The total capacity of power of the State is 229.97 MW of which 201.97 MW is the State's share from Central Generating Stations (CGS) like North Eastern Electric Power Corporation (NEEPCO), National Hydroelectric Power Corporation (NHPC), National Thermal Power Corporation (NTPC) and ONGC Tripura Power Company (OTPC). DPN has only 28 MW of capacity – the Likhimro Hydro Power Project and other medium hydro projects. Regarding demand, the total projected connected load for 2022-23 is 207.56 MW. Hilly terrain and limited availability of coal reserves have traditionally impacted power generation in the State, which is understandable. However, the major challenge that the State faces in the power sector is in its transmission and distribution (T&D) and its economics of it. Aggregate technical and commercial losses (AT&C) is a key metric to assess the efficiency of power transmission and distribution and on this parameter, Nagaland performs very poorly. Among all the States in India, the highest AT&C losses are in Jammu and Kashmir (60.5%) followed by Nagaland (52.9%). The gap between the Average Revenue Requirement (ARR) and Average cost to serve (ACS) per unit of electricity shows the financial viability of power distribution in a State. At Rs 5.62/unit, is the highest in Nagaland among all the States in the country. This means that for every unit of electricity that is sold by the DISCOM in the State, it loses Rs 5.62. Compared to this, in Himachal Pradesh, another hilly State, the gap between ARR and ACS is only Rs 0.01. Limited sectoral reforms over the last two decades— around governance, network and technology capital investments, tariff reforms, structured

PPP (public-private-partnership) and capacity building are identified as the key reasons for the poor performance of the power sector in the State.

On the demand side, a comparison with its neighbour, Mizoram, Nagaland does not perform on some key power sector parameters, as highlighted in Table 1. Although the population of Nagaland is almost twice that of Mizoram, the per capita power capacity available of the former is about half that of the latter. The domestic per capita consumption of electricity is also much lower (around 20%).

Table 1: Comparison of Nagaland and Mizoram[1]

State	Population	# connections (lakh)	Total demand (MW)	Domestic consumption (MUs)	Capacity/ capita (kW)	Consumption/ capita (kWh)
Nagaland	20 lakh	3.03	230	410.74	0.115	205.37
Mizoram	11 lakh	2.65	242	283.44	0.220	257.67

From the above one can observe that at the State-level, the electricity situation is not very encouraging. At the macro level, the dire situation of the power sector in the State has impacted its economic development. At the village level, the situation is worse. The average daily supply from the grid is only for four to five hours, and that too interspersed throughout the day. The supply is characterized by low and fluctuating voltage leading to equipment failures and discouraging people to adopt appliances that can improve their livelihoods and quality of life. The monsoon months aggravate the problem with breakage/ faults in power lines and transformers and putting areas off the grid for weeks at a stretch. The rural population, thus, typically resort to alternate sources of electricity like locally sourced solar modules, batteries and inverters. One can safely assume that making quality and reliable sources of electricity available can positively contribute to the improvement of the lives and livelihoods of the rural population.

So, while there has been universal electricity connection access, access to seamless power throughout the day continues to be a challenge in rural areas across the country, especially in States like Nagaland. The only way to end such widespread energy poverty is the deployment of off-grid renewable solutions like mini-grids.

The rationale for mini-grids

A large number of renewable energy (RE) based off-grid solutions including mini and microgrids and other decentralized solutions like solar lanterns have been promoted by both the Government and its agencies (Bhushan and Kumarankandath, 2016) and social sector organizations (Mohapatra et al., 2019). Over the past decade or so, sensing market opportunities, private parties, backed by donor agencies and social impact funds and armed with cheap, and sometimes poor quality, products (Lee

1 Data source: P&ED Tariff Order for FY 2022-23 (Mizoram) and Tariff Order for the FY 2022-23 (Nagaland)

and Shepley, 2020) have got into this space and have generated quite a few success stories (Mohapatra et al., 2019). While standalone RE products meet the basic lighting needs of communities, they offer the limited potential to generate sustainable rural livelihoods. Mini-grids, however, can do so and there are several successful initiatives across the country for the same.

It has been observed that countries that pursue a comprehensive approach to electrification through main grid extension, mini-grids, and solar home systems achieved the fastest gains. Countries like Bangladesh, Cambodia, Kenya, Myanmar, Nepal, Rwanda, and Tanzania have leveraged a combination of the main grid, mini-grid, and solar home system investments resulting in the fastest gains in electrification between 2010 and 2018 (Energy Sector Management Assistance Program, 2019).

What is a mini-grid?

Mini-grids are not a new phenomenon. Nearly all current centralized electricity grids started with isolated mini-grids, which gradually expanded and got interconnected over the years. In the next generation, which is typically called the second generation of mini-grids, systems set up are typically small and isolated, powered by diesel and in some cases hydro, and built by local communities or entrepreneurs to provide access to electricity to households, primarily in rural areas that were yet to be connected to the centralized grid. These mini-grids also yielded lessons on technical design, productive uses, economies of scale, financial viability, and regulatory frameworks under which such projects can operate and the fine-tuning of regulations that are required for the joint operation of mini-grids with the centralized or main grid. They also underlined the importance of productive uses for

Definition of a mini-grid

A mini-grid is a set of small-scale electricity generators and possibly energy storage systems interconnected to a distribution network that supplies electricity to a small, localized group of customers and operates independently from the national transmission grid (SE4All, 2017).

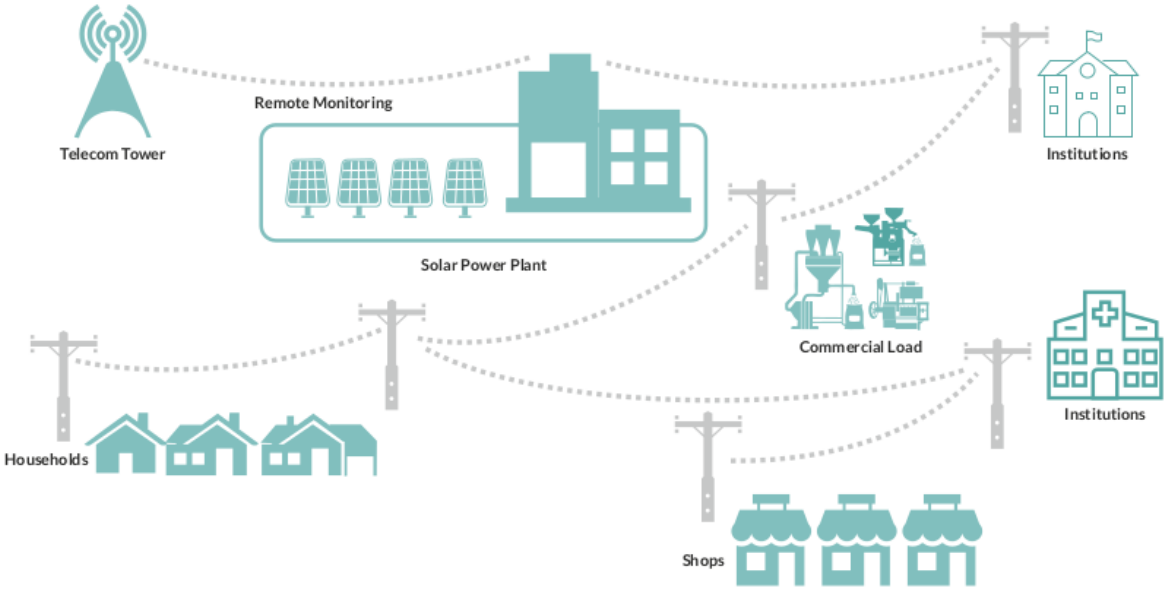

Figure 1: A typical schematic of a mini grid

the financial viability of mini-grids and the need to reduce the risk of stranded assets once the main grid arrives in areas hitherto not connected to the main grid.

Over the past few years, the third generation of mini-grids have emerged. Dominated by solar PV and battery storage technologies, these mini-grids are owned and operated by private companies that leverage transformative technologies and innovative strategies to build portfolios of mini-grids instead of one-off projects. The project developers use remote management systems, prepay smart meters, and the latest solar-hybrid technologies; and incorporate energy-efficient appliances for productive uses of electricity into its business model. These mini-grids are generally grid-interconnection ready and await the appropriate regulatory framework to be put in place for the same.

If we take a look at the Sustainable Development Goals (SDGs) adopted by all United Nations Member States in 2015, there are 17 Sustainable Development Goals (SDGs) defining areas of urgent action by all countries - developed and developing - in a global partnership. The goals recognize that ending poverty and other deprivations must go together with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

As per SDG Goal 7, transitioning to a low-carbon economy is key to tackling climate challenges. This means access to affordable and clean energy has been linked to lower emissions due to the burning of diesel for power, and the use of coal, wood, and kerosene for cooking. It is also a catalyst for good health and well-being as well as quality education and economic growth. Access to affordable and clean energy also reduces inequalities. It is therefore imperative that while we make efforts to mitigate energy poverty, any solution being explored must keep the perils of the climate challenge in mind. Planning for a greener future for communities that are on the cusp of rural and urban living is, therefore, important. This will also ensure that the environment-friendly bearings of rural populations do not get eroded on their path to economic upliftment.

The Rockefeller Foundation, which works through its subsidiary Smart Power India in parts of the country, believes that since “the dawn of the electric age, a great divide has widened between those with access to power and those without.” In the 1930s in America, just 10 per cent of rural households in the US were electrified. The federal government helped fund a massive, decades-long effort to bring electricity to the countryside that American cities enjoyed. Still, it estimates 325 million people currently live without any access to electricity and hundreds of millions more have unreliable access across the Asia-Pacific region.

“That pathway to prosperity has become even more vital in the age of globalized commerce and the internet. Societies locked out of the energy economy are simply unable to rise out of poverty. In much of the world, regions or countries suffering from extreme poverty almost always suffer as well from a lack of steady power. We cannot remedy the one without pushing as well to remedy the other,” says the foundation. India and the developing markets, in general, need access to reliable and clean energy. That relatability factor is important for SMEs and it is difficult to meet with a weak connection or lack of grid connection. Therefore, mini-grids can play a catalytic role in the growth of an economy.

Mini-grids can spur economic activity in rural areas due to their large capacities and the ability to connect to the national grid. A mini-grid, as defined by the Ministry of New and Renewable Energy (MNRE), is an off-grid power system with a generation capacity of between 10 KW and 500 KW. There are several other solutions of smaller capacities that rural areas can use such as a solar lantern, a solar home solution, or even a community solution like a microgrid. But a mini-grid is the only alternative that provides the kind of electricity that can be used for business activities. Mini-grids offer electricity without fluctuation and can easily power machinery as well as equipment.

SPI's goal is to drive reliable access and rural economic development in India to complement the central government's mission for 24/7 power for all, by facilitating the deployment of over 4,000 mini-grids by 2025, in partnership with India's largest power sector company, Tata Power and with Mithun Rural Development Foundation (MRDF) and experienced regional developers such as OMC Power and Husk Power.

Mini-grids and rural livelihoods in Nagaland

In the context of sustainable development, access to energy/ electricity is covered under SDG 7 – access to clean and modern energy services. Modern energy access is an important factor for the achievement of virtually all development goals, but for some SDGs it is essential. Eliminating poverty (SDG 1), achieving Gender equality (SDG 5), creating Decent work and economic growth (SDG 8) and building resilient infrastructure, promoting inclusive and sustainable industrialization and fostering innovation (SDG 9) are a few SDGs which cannot be met without meeting SDG 7. In addition, energy is needed to improve living conditions and ensure basic services, including lighting, education, health and freshwater to meet basic human needs. Access to reliable and good-quality power encourages village-level entrepreneurs (VLEs) to start and/or expand their enterprises. It creates the necessary condition for the adoption of electric motors to run machines rather than running them through diesel engines. The latter is not only expensive thereby reducing the financial attractiveness of enterprises, but also highly polluting. Good-quality electricity for enterprises increases their productivity and generates more profits for the VLEs who are willing to pay for such services. Unlike electricity from the grid, which though cheap, is not reliable and hence in many cases not preferred by VLEs.

The current project of SPI is part of the Indo-German Energy Programme (IGEN Access - II) program of GIZ, which aims at improving the energy supply in rural areas of select states. In the Phase 1 pilot (2020-21), SPI supported livelihood opportunities in rural areas through RE-based mini-grids and supported the enterprises connected to them. The target was 500 village-level entrepreneurs (VLEs) and 200 farmers.

Thereafter, in Phase 2 (2021-23), the target was increased to 3000. Goals under phase 2 include a demonstration of a sustainable working model for electricity supply to 2,500 SMEs including women entrepreneurs.

Take the case of Manthrei Konyak who is a paddy huller entrepreneur in Chenwetnyu village, Mon district, Nagaland. He was running his diesel-powered 10 hp rice huller machine since 2017 and mainly caters to hulling local paddy available in the village. Post Covid, from 2020 onwards he reduced the

operating hours of the machine as landed diesel prices in the village started climbing rapidly and touched as high as Rs 120 to Rs 130 per litre, thereby reducing the number of days of the running of his huller and eating away his profits. In 2022, when the 30 kWp solar mini-grid was installed in the village, he replaced his polluting engine an energy-efficient 7.5 hp electric motor. Today, Manthrei Konyak is again able to operate the electric huller machine four to five days a week. The increased production, low maintenance of the electric motor and the savings that he is accruing from non-usage of diesel is contributing to an increasing his profit margins.

How Chingo Konyak's life was transformed

Chingo Konyak, an agripreneur wanted to do something innovative with the advent of the 30 kWp solar mini-grid in Chenwetnyu village, Mon Nagaland set up by MRDF. He wanted to incubate an innovative enterprise around banana fibre powered by the solar mini-grid. He has already incubated a unit of this micro-enterprise in Aboi, Nagaland in 20202 and wanted to replicate the same in his home town of Chenwetnyu. He discovered this business opportunity with supply of good quality affordable and reliable electricity from the Chenwetnyu solar mini-grid. Wild banana trees grow in abundance around Chenwetnyu village and hence the supply of raw banana stems would not be an issue for him. He approached MRDF for financing a 2 hp electric motor-based banana fibre extraction machine. MRDF studied his business proposal and readily financed the same. MRDF technical team supported him with the installation of the machine in the village and the entire set-up for his business unit. Two local youths were selected from the village by MRDF and trained to collect the raw materials, operate the electric machine, segregate and dry extracted banana fibres, package it for selling in Dimapur, Nagaland and maintain accounts and logistic records.

The banana fibre extraction unit became functional in April 2022 and is presently doing very well. The unit runs for five days a week powered by the solar mini-grid and has a monthly production capacity of around 100 to 120 kg of dried banana fibres. Chingo has developed strong forward marketing linkages for selling dried banana fibres in Dimapur, Nagaland and is presently making a good profit margin. The dried fibres are used for making different artefacts like coasters, table mats, foot mats, wall hangings etc and have great demand in Dimapur and Kohima markets. MRDF is working with Chingo to ramp up the demand for banana fibres as well as build the capacity of local craftsmen and women in making different banana fibre-based artefacts in the village. Going forward, this would increase the value proposition of this micro-business. Enthused by the success of this micro-enterprise in Aboi and Chenwetnyu, Chingo Konyak aims to scale this model in other mini-grid villages in Mon district, Nagaland and expand this micro–enterprise, both in scope and volume.

The case of Pongloi Konyak, a biofloc entrepreneur

Local communities in Mon district want to practice and promote bio floc technology. This is a household-based pisci culture intervention which has been successfully demonstrated and is being scaled across Assam and North-East India. It involves setting up a tank with iron mesh, four feet in height and 10 feet in diameter, covered with tarpaulin. It has a capacity of 6,000 l of water and can hold up to 4,000 to 6,000 fingerlings. This intervention does not require much water and hence is well-suited for water-scarce geographies like Mon. The main fish varieties are common carps which are air-breathing, hardy

fish breeds. The fish tank is powered with two 58 to 60 W micro electric motors for aeration. It has to run for 24 hours. The investment per tank comes from Rs 1.3 to Rs 1.5 lakh (setting up a fish tank, fingerlings, medicine, instruments for a water temperature check, fish feed, micro pump for aeration, light bulbs etc). There is also a very good demand for common carp in the local Mon markets as Konyaks like carp variety of fishes.

Ms Pongloi Konyak from Chenwetnyu village became interested in pioneering this household-based fishery micro-enterprise after returning from an exposure visit to biofloc fisheries in Assam supported by MRDF and NABARD, Dimapur. She comprehended that this would be piloted for the first time in the State of Nagaland and would have a transformational impact on local incomes. Along with Ms Pongloi, two more entrepreneurs from Chenwetnyu village and two biofloc entrepreneurs from another mini-grid village of Totokchingha approached MRDF for technical and financing support to set up this enterprise locally. They wanted to cultivate 'Vietnamese Koi' – a common carp fish variety in the bio floc tanks. This fish variety is suited well for Mon temperature conditions and has a good demand in the market. MRDF facilitated linkage with a bio-floc technical expert from Morigoan, Assam who was a community champion in demonstrating the success of this intervention in his village and increasing its uptake amongst rural families. He is providing on-site training to all five bio floc entrepreneurs on this new intervention. The cost of this technical resource person has been borne by MRDF. MRDF also supported the five biofloc entrepreneurs with financing which they would return in affordable instalments post-harvest of the fish floc. The five entrepreneurs also contributed an upfront amount of Rs 20,000 individually, as their contribution.

All five Bio floc tanks were set up in May 2022 and are being powered by the solar mini-grid. The bio floc entrepreneurs are extremely satisfied with the reliable supply of clean energy by the solar mini-grid for powering two micro electric motors fitted with the tank which must run 24X7 for aeration. Any disruption in this aeration cycle in the fish tanks would lead to high fish mortality. All activities relating to water treatment, disinfection of the fish tanks, applying for medicine, the release of fingerlings, fish feed etc have been successfully executed. The fish have grown and increased in size. All five entrepreneurs are taking utmost care of the floc and expecting a good harvest in October 2022. Ms Pongloi Konyak feels excited about her new micro-business venture in Chenwetnyu. She is already in talks with local market actors for selling her harvest at a good price in October 2022. Today, she also feels confident as a bio-floc entrepreneur and sees herself as a community champion for promoting bio-floc fisheries across the entire State of Nagaland.

Meeting of Minds

Various stakeholders are now realising the potential that DRE solutions, especially based on solar PV offer in improving livelihoods and improving the overall quality of life of rural people. Electricity generated from solar mini-grids supply reliable electricity to households enabling women to undertake their household chores more conveniently. it allows children to extend their study hours under proper light. Households also use electricity to run television sets and other electrical appliances making their

lives more comfortable and enjoyable. Overall, this increases the per capita electricity consumption, which is a key parameter to assess the socioeconomic development of communities.

More importantly, with falling costs and increased reliability of solar-based DRE solutions, VLEs can reduce their cost of energy in their enterprises and increase their productivity thereby increasing profits.

However, some of the factors to be kept in mind while finding ways to raise the incomes of VLEs:

- Productive use of electricity access through mini-grids should lead to the generation of hard cash for entrepreneurs
- VLEs need support to supplement economic activities in the form of loans, marketing and logistics support and training
- Examining the Government's role in enabling village-level enterprises, apart from setting policies
- Mini-grids themselves have to be financially sustainable for businesses to become sustainable. Suppliers must be clear about whether mini-grids are sustainable in terms of per-customer revenue.

MRDF has implemented three mini-grids which has led to the development of over 70 micro-businesses with micro-enterprise development support from NABARD, GIZ, SPI and Rang De. MRDF intends to scale the project to all 132 villages of Mon and 1,000 villages in Nagaland. To this effect a roundtable meeting was organised in Dimapur, Nagaland on November 2022. It was hosted by NABARD and organised by MRDF. The roundtable aimed to analyse the learnings of MRDF's experience of installation, operation, micro-enterprise development and powering public infrastructure and derive lessons for scaling the project to 1000 villages in Nagaland. Several organisations like DC Mon, WRI, Runway Enterprises, NTTC, NSCB, Assist International, and NEDFI, among others participated in the event. Through the event, a set of issues have been identified that need to consider during the upscaling of the initiative in the State.

- **Financing micro-enterprises**: the financial sustainability of mini-grids depend on the financial viability of the enterprises it supplies electricity to. NABARD plays a crucial role in this area as it finances rural financial institutions (RFIs) that finance rural enterprises. NABARD runs several programmes/funds like the Farm Sector Promotion Fund, Financial Inclusion Fund, Watershed Fund, Climate Change Fund, etc which can be tapped.
- **Ensuring environment sustainability:** poverty contributes to environmental degradation and mini-grid power rural livelihoods reduce the consumption of fossil fuels thereby alleviating pollution and GHG emissions. The power supply scenario in Nagaland is poor with around six hours of supply a day and that is too erratic and of low quality. This acts as a constraint for the economic development of rural areas.
- **Carrying the community along:** taking the community along in the interventions is a very crucial part of the approach that a development agency should adopt. Without the key decision-makers' participation in the village community, ownership and cooperation become difficult, thereby jeopardising the long-term sustainability of interventions on the ground.

- **Exposure of entrepreneurs:** the Northeast region is constrained by its geographical isolation, which limits entrepreneurs' exposure to new and innovative ideas.
- **Costs and the need for grant support:** due to its topography and geographic challenges, the cost of setting up mini-grid projects in the hilly regions of the State and the region is at least 30 to 40% higher as compared to the mainland. Communities in Nagaland are located on hilltops where all-weather road connectivity is poor. Being hilly, the effect of shade is much higher. Also, the region experiences more foggy and rainy days. The net effect is lesser electricity generation from the mini-grids leading to longer 'lead times' for attaining financial sustainability. The supply chains of equipment and limited technical capabilities at the local level act as constraints too. To overcome this challenge, grant funding is required.
- **Capacity building of VLEs:** Developers also need to invest in training VLEs in improving their businesses. Training is also required for local members for the operation and maintenance of the mini-grids so that downtime is minimised. Most importantly, communities need to be trained on how to use electricity in their enterprises. Also, adaptations required in existing machinery need to be identified.
- **Promoting multiple enterprises:** communities in rural area practice multiple economic activities which can be powered by mini-grids. MRDF has been working in promoting activities like dehusking, milling, poultry feed, welding, biofloc, etc. Covering multiple livelihoods is essential for making the mini-grids relevant in the village context.
- **Focus on women:** women are key stakeholders in mini-grid led interventions. In addition to building their capacities through focussed training programmes, designing interventions on the ground should be through the gender lens. In many instances, the technical solutions need to be modified and adapted keeping women in mind.

Way forward

Drawing learnings of MRDF's pilot interventions, the following key action points emerge for the upscaling stage of mini-grids in the State.

- Access to finance is a bottleneck for village-level enterprises and needs to be addressed. Micro Finance Institutions (MFIs) need to come in along with RFIs and NABARD can play the role of a refinancing institution for these institutions. In many cases, accessing financing for working capital is a bigger hurdle than capital investments, and financial institutions need to design appropriate loan products for working capital financing.
- Not just working capital solutions, VLEs need support and guidance for also marketing products, bookkeeping and logistics to ensure their ventures turn viable and financially attractive.
- Awareness generation and capacity building must go hand in hand with field interventions as the beneficiaries need to develop their understanding and capabilities to use electricity from the mini-grids for their enterprises.

- Establishing partnerships among project implementers, mainstream financial institutions, MFIs, technical solutions providers and Government agencies/ Departments is crucial as such partnerships enable leverage of each other's strengths and capabilities that can create maximum positive impact at the village level.

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