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MEE PANYAR

LIVING IN THE DARK

Adaptive Learning for Rural Energy Development in Myanmar

ABOUT THE TEAM

Natasha Allen is the Founder and Executive Director of Mee Panyar. She has recognized expertise in developing training programs for solar education and a strong technical background that she has employed in improved cookstoves engineering with Potential Energy and user-experience testing with We Care Solar. Natasha was awarded the prestigious Thomas J. Watson Fellowship for her research in best practices for building capacity and ensuring sustainability in energy access interventions.

Benjamin Attia is Mee Panyar's Director of Market Development & Strategy. He has recognized subject-matter expertise in renewable energy policy and markets and community-based finance and long-term O&M business models for off-grid and mini-grid projects. He authors regular solar industry research publications, providing market research and bespoke strategy advisory to key stakeholders in on-grid and off-grid solar markets in emerging economies at GTM Research. Ben has experience working in PV asset management and commercial operations at SunEdison.

Nithya Menon is Mee Panyar's Director of Technology. She has worked in India, Myanmar, Cambodia, and Mali to develop and implement water access and agricultural products and services with organizations such as Proximity Designs and iDE. She has woven her skills in people-centered design methods through these experiences, enabling her to combine technical and social parameters when building solutions.

Jack Pegler is Mee Panyar's Director of Operations. Jack spent over 4 years as a key manager in one of Cambodia's leading solar energy companies, NRG Solutions, where he was in charge of all off-grid activities. Extensive experience coordinating work in the field has given him an excellent understanding of the challenges faced by the field teams working in energy access, allowing him to develop the tools and guidelines necessary to ensure that the business model is implemented correctly. Jack holds a Master's degree in Particle Physics from University College London.

Dustin Zubke is Mee Panyar's Director of Business Development. His work and research in the clean energy sector have brought him to 11 different countries. He is driven to address two of the most pressing global problems: climate change and inequality. While in Myanmar, he performed an assessment of 45 villages' potential for solar-powered mini-grid development with Yoma Micropower. In addition to his own work in rural clean energy development, he brings more attention to the work of others as the off-grid solar correspondent for PV Magazine.

DISCLAIMER

CONTACT US

Please check out our website at meepanyar.com or inquire at info@meepanyar.com to get in touch directly.

EXECUTIVE SUMMARY

Our mission is to enable rural communities to manage and operate community mini-grids while saving money on maintenance and operational costs, offsetting rural diesel consumption, and serving more households with reliable electricity.

Mee Panyar is pioneering a novel community-based business model for operations, maintenance and workforce training for rural mini-grids, starting in Myanmar. Leveraging the country's existing 13,000 diesel mini-grids –many of which are in disrepair or running inefficiently— as learning tools for rural electricians, Mee Panyar will rehabilitate or hybridize these systems while filling the capacity gap in long-term operations and maintenance (O&M), which has been de-prioritized in recent national energy planning.

Mee Panyar's lean approach to rural electrification increases economic and social impact by enabling local communities to manage and operate mini-grids and significantly lower operational and maintenance costs in the long term. In traditional mini-grid and electrification models, these costs are exacerbated for rural systems by the distance from servicing infrastructure, replacement parts, and skilled labor. Through Mee Panyar's participatory education program and apprenticeship model, locally employed operators who manage and maintain the system can perform frequent and preventative maintenance, significantly reducing O&M costs and extending system lifetimes, addressing the underlying local capacity deficit, and placing control over the system's reliability in the community's hands.

This business model offers diversified flows of revenue. Per engagement, Mee Panyar will receive a service fee proportional to project revenues and the upfront cost of parts. Overall, the company and business model has been internally evaluated to have a return on investment of 159% and a return on capital of 40% by 2024. Project level returns on hybridizations have a forecasted internal rate of return of 20% with a 3.5 year payback.

On a community level, reliable energy access will boost economic productivity and equip trainees to manage the mini-grid and earn a reliable income with transferable skills. Additionally, the emphasis on preventative maintenance and proper management will ensure system longevity and save up to 80% of system lifetime O&M costs.

A rural household in Tanintharyi State, Myanmar.

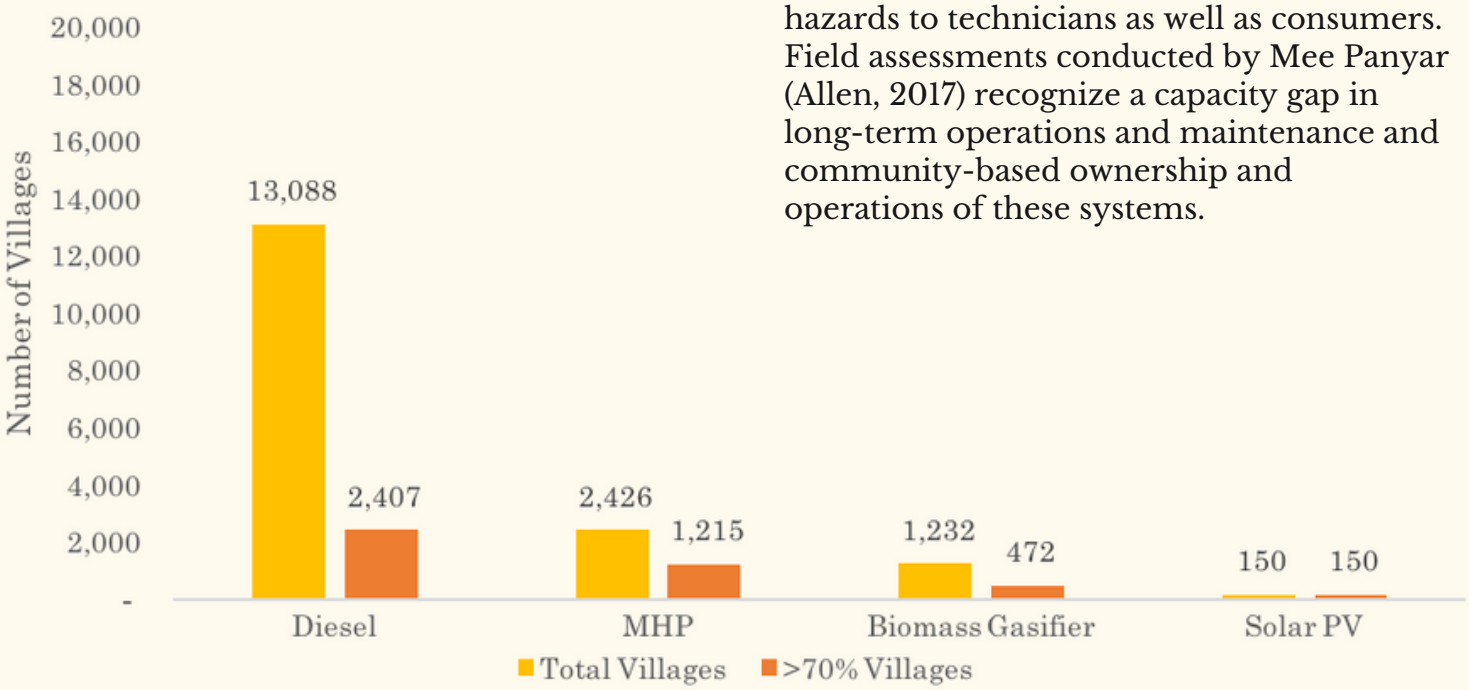
THE OPPORTUNITY

Myanmar's rural mini-grid market is globally exceptional

Myanmar is home to an estimated 13,000 (DRD, 2015) villages currently operating diesel mini-grids, and 3,500 more operating unsubsidized renewable energy mini-grids, representing 135 MW of off-grid generation capacity. No other rural mini-grid market in the world is as mature, has been in operation for as long, or has self-developed to this level of maturity with no public assistance. Some of these systems have been in operation since the 1970s, when many remote villages became self-sufficient in meeting their own energy needs under the previous military government.

As a result, improvised diesel generator-powered, micro hydro, and village-scale solar installations are commonly found in some of the most remote parts of the country, particularly Tanintharyi Region, Shan State, and Karen State. These systems were primarily financed by the village leadership and in some cases entrepreneurial individuals. However, most of these installations are in disrepair and only 25% of them connect at least 70% of households in the community.

Currently, existing diesel mini-grids face severe deterioration and distribution losses, resulting in lengthy outages and systems operating at less than 50% of their rated output (Ya, 2017). Poorly maintained systems end up costing the village operators several times the initial capital investment over the operational lifetime. In such cases, long power outages of weeks or months are common, and electrical failures pose safety hazards to technicians as well as consumers. Field assessments conducted by Mee Panyar (Allen, 2017) recognize a capacity gap in long-term operations and maintenance and community-based ownership and operations of these systems.



Generation Technology Mix for Rural Mini-Grids in Myanmar, including Diesel, Micro-Hydro Power, Biomass Gasifiers, and Solar PV. (Source: 2014 National Census)

THE CHALLENGE

Since the country opened to foreign investment in 2015, Myanmar has seen a dramatic increase in electric power systems investment targeted at the country's 4.5 million households that spend more than $200 million per year on candles, kerosene, batteries, and diesel (IFC, 2016). The National Electrification Plan (NEP) allocates US $400 million in project funds to electrify the 77 percent of the population living in the dark by 2030, and a number of studies and infrastructure planning assessments (Modi, 2016) have been undertaken on the ground to inform utility planning. While roughly US $60 million of the NEP is allocated for off-grid energy projects in Phase 1 of the program, only 16 percent of those funds are reserved for Technical Assistance, of which O&M of remote mini-grids is a very small part of the total scope.

Private mini-grid developers have not yet been able to invest in O&M technicians while operating in regulatory uncertainty and satisfying investors. It is expensive to send trained technicians to remote sites while covering the cost of equipment replacement and labor, and developers are still focused on managing short-term returns.

As the global mini-grid sector develops, efficient long-term operations and maintenance services are critical to the long-term bankability and productivity of electricity generating assets. In rural areas, maintenance interventions are often cost-prohibitive due to the travel distance from central servicing infrastructure, which has been found to represent the largest cost driver in these contexts (Attia, 2016). When diesel costs spike or corrective maintenance is delayed, the opportunity cost of these blackouts only magnifies the need for system rehabilitation, local management and capacity building, and, when appropriate, technical assistance for solar-diesel hybridization.

Among other looming challenges in the off-grid energy marketplace, it is clear that the top-down and bottom-up market actors struggle to prioritize long-term strategic planning for O&M services.

A donor-funded solar mini-grid system near Naypyidaw, Myanmar. Typically, donors only fund the installation of mini-grids, neglecting the cost of long-term operations and maintenance.

On the village level, the **meesayar** (local mini-grid operators and electricians), are chronically challenged by the financial and technical limitations of running the diesel mini-grids. Systems are often running inefficiently (sometimes at a loss for the operator), while the operator typically earns 1,400 Myanmar Kyat (roughly USD 1.04) per day, mostly through their regular farming practices. If the mini-grid system is not running or for households that are not connected, people must resort to kerosene lanterns or candles for lighting which typically cost 8,000 kyat per month (USD 6), almost 20% of their income (Allen, 2017). Lack of access to modern energy sources is a severe monetary, productivity, and health burden to the rural communities in Myanmar (SE4ALL, 2017).

Previous work by PACT (PACT Myanmar, 2016) and the World Bank (Greacen, 2016) have identified a need for greater repair and maintenance skill amongst Myanmar mini-grid operators. The literature on sustainable energy access recognizes O&M capacity building as a pillar of effective interventions; however, few organizations have focused on long-term O&M. For example, some rural energy-focused developers in the region have been providing minimal upfront maintenance training to community members but managing long-term O&M from central offices, translating to staff travelling, on average, 600 miles to the installation sites which adds roughly USD 300 in operational costs annually, per system (internal estimate, including labor and transport).

Mee Panyar addresses many of these challenges and adds value by restoring existing systems and establishing local management and technical capacity, while adding generation output and increasing system reliability while reducing cost.

Village in Sagaing with a diesel mini-grid and self-designed distribution system, with electrical poles made from scavenged tree trunks and incorrectly gauged wires as well as second-hand generators.

OUR SOLUTION

Our approach to serving the long-term O&M and hybridization needs of the remote mini-grid market in focuses on building local capacity for the long-term sustainable management of these remote energy systems. Mee Panyar will rehabilitate under-utilized and broken systems through a training program that teaches advanced technician skills and troubleshooting. While some are old and operating at low efficiency, many of these sites can be refurbished to use modern, efficient, reliable equipment for considerably less cost than building greenfield projects. There is also significant potential for profitable hybridization with solar PV and battery storage. Local trainees will receive hands-on training from Mee Panyar to complete the retrofit, manage the mini-grid, and other income generating projects.

Community-Based Business Model

Mee Panyar will enter into a service agreement with village partners (typically the Village Development Committee or Village Electrification Committee) or the private owner of a community's mini-grid to establish the terms of the project, both during the rehabilitation phase and for the lifetime of the system. Mee Panyar is responsible for the training and learning tools, the negotiated capital for specific needs (such as essential and missing parts), and in the case of system rehabilitation, technical assistance for solution design and implementation. This service agreement will also specify that village partners continue to hold liability for operational expenses, specified data reporting requirements, and a service fee payable to Mee Panyar in the form of a revenue percentage. This percentage is negotiated based on an assessment of the marginal benefits of service as well as rent-seeking optimization.

Training Product & Curriculum

Mee Panyar's curriculum and tools will safely demonstrate necessary electrical engineering concepts to trainees. Curricula will cover the basic electrical engineering practices, all aspects of the training and practice for the system development, and technical support for the technicians once the training is complete. The educational kit will capture lessons from earlier capacity-building and vocational training fieldwork, and training sessions will be adaptive to local knowledge and the technical specifications of each village's proposed system. This B2B product could be sold to off-grid developers as an all-inclusive training package, bundled with training session hours, enabling them to build O&M capacity in their own projects. The training program is developed and founded on the principles of participatory development, pioneered and championed by academics (Freire, 1993) and practitioners like Practical Action and Schneider Electric.

Solar-Diesel Hybridization

In order to create an adaptive solution outside of Mee Panyar's core business, collaborations with solar mini-grid development partners on the engineering, procurement, and construction phases of the hybridization may be attractive. This would require a partnership and referral agreement and would entail an equity stake and a flat referral fee for Mee Panyar. Mee Panyar will hold no liability for the project development process and no liability beyond the equity stake in the success of the project, unless the same community is also a Mee Panyar client for the basic service.

Mee Panyar expects to see even greater improvement to quality and cost of service through adding solar hybridization. In the Philippines, solar hybridization of existing diesel mini-grids saw reductions in levelized electricity costs from 1-2 EUR/kWh to as low as 0.28 EUR/kWh (Gaur, 2013). Beyond the benefits of reducing dependence on diesel and lowering carbon emissions, solar hybridization allows for the mini-grid to operate for increased hours of service, spreading demand across the day and supporting productive uses of energy.

REALIZING IMPACT

As the global mini-grid market continues to grow, long-term operations and maintenance strategy will become ever-more critical.

With the thousands of diesel mini-grid systems that are likely in need of serious repair and rehabilitation combined with the sudden need for millions of more connections across the country, Mee Panyar has tremendous scope to work with villages and developers involved in the electrification rollout that lack resources to implement a proper O&M strategy.

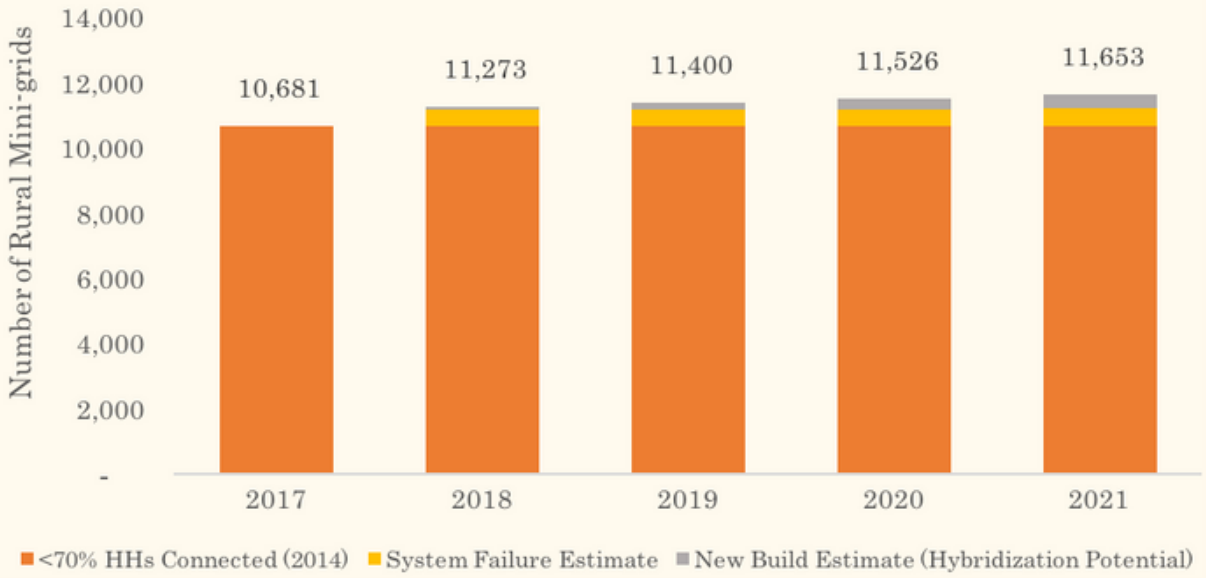
SCALABILITY

Mee Panyar's market assessment suggests that there is a large and growing addressable market for long-term community-led O&M, capacity building and training, and solar-diesel hybridization in Myanmar. The total addressable market (TAM) for system rehabilitation and solar-diesel hybridization contains all sub-70% connected households (HH) in a village, reasonable assumptions for future system degradation without intervention, and a portion of newly build mini-grids that could also benefit from capacity building and training.

These conservative TAM estimates grow at a modest compounded annual growth rate of 2.2% from 2017 to 2021, but represent no perceptible cap for Mee Panyar.

These estimates are conservative because system failure is assumed at under 5%, quite low given the age and maintenance schedules of some of these systems. Additionally, new build estimates are based on the NEP, which is based on an out-of-date geospatial model that undervalues mini-grids and overestimates their costs. Lastly, these data are from the 2014 census, meaning market activity from 2015-2017 is not captured in this assessment.

The Mee Panyar business model and value proposition are well situated to capture increasing shares of this market, and currently, face no apparent direct competition from any firm globally focused on this portion of the mini-grid value chain. Myanmar's existing market provides a unique environment to trial and refine this business model.



Total addressable market for diesel mini-grids in Myanmar for Mee Panyar.

SunSawang in Thailand and Schneider Electric in India have piloted capacity building training programs for solar home system repair, and NGO Border Green Energy has conducted similar trainings for solar home systems and developed some MHP projects along the Myanmar-Thailand border. There is little direct overlap between these competitors and the Mee Panyar model.

Mee Panyar's competitive advantage is connected to its one-of-a-kind business model focused on existing diesel mini-grid system rehabilitation and hybridization and capacity building for remote O&M services. We are not aware of any firm focused on this portion of the value chain for mini-grids and are not aware of any efforts under development in the public or private sector.

Once Mee Panyar is well established in Myanmar, there is massive potential to replicate our model in other countries with mini-grid development underway, such as Cambodia, Tanzania, and India. The IEA estimates that, by 2030, over 150 million people will be connected through mini-grids (Daly & Walton, 2017) and as the energy access sector begins to focus more on mini-grid deployment, Mee Panyar's potential market will only continue to grow.

LIVELIHOODS IMPACT

50% increase in hours of electricity service

Reduced outages increase consumer satisfaction and community buy-in. This also translates to increased productivity and feasibility of income-generating activities.

500% increase in rural technician income

Electrical technician could go from earning a maximum 10,000 Kyat per job, to earning 50,000 Kyat per job through more frequent work and greater range of potential jobs.

80% decrease in OPEX

Regular preventative maintenance can cover 80% of a diesel system's lifetime maintenance costs for the operator, and proper education on battery management can triple lifetime and prevent toxic waste disposal.

The global mini-grid market is challenging, and Myanmar is no exception; however, the unique large locally available market is an opportunity to pioneer new solutions to global challenges.

The most direct threat to Mee Panyar's business is the current lack of regulatory framework around mini-grids and off-grid independent power producers. However, this threat is secondary, as Mee Panyar is a services provider to mini-grids already in operation rather than an energy services company. As a result, there are no insurmountable risks or gaps impeding Mee Panyar's growth.

Currently, the regulatory landscape for off-grid independent power producers in Myanmar is murky and ill-defined. While this does create a significant amount of regulatory risk in the country, the lack of clear regulations has not stalled the growth of the existing base of installed diesel mini-grids, so there is still a massive addressable market for capacity building and solar-diesel hybridization.

As with any rural development work, challenges around understanding local cultural contexts can make or break the success of the project. To address this head-on, the learning and curricula components of the innovation will be designed directly by people with local expertise and experience working in similar contexts. Learning about gender roles, learning styles, existing knowledge, and user needs will be the centrepiece of Mee Panyar's curriculum and technology development.

LOOKING FORWARD

Mee Panyar is currently in a Proof-of-Concept Phase predicated on preliminary evidence from on-the-ground and academic research conducted by the team. Developing the curriculum set and pilot projects, beginning this year, will validate the business model. The pilot projects would consist of two trainings with diesel mini-grid village systems to test the curriculum in a low-risk setting, and a more capital-intensive hybridization project to validate internal modelling. Mee Panyar will commission a baseline and follow-up assessment by an experienced third party.

Key performance metrics that will be evaluated during projects include: tariff collection rates, load and usage statistics, income for trainees, and ongoing maintenance expenses. In addition to accessing the existing grid and financial data, it will be important to survey community members to understand the impact of the renovated system and track the numbers of household connections. After the pilot stage, Mee Panyar will also monitor conversion rates on leads, the number of participants who pass the training, retention rates of trainees, and projects successfully rehabilitated. Given that Mee Panyar's method is novel, close monitoring and follow up for each project will be important to refine the model and measure impact.

After the process has been streamlined and a sufficient customer base is built, Mee Panyar will explore and pilot program additions such as:

- An Android-based mobile monitoring platform for operators to report and track customer subscriptions, maintenance incidents, etc.
- An internal recruiting program for high-achieving trainees to become regional managers/trainers for Mee Panyar

Within the large addressable market, Mee Panyar will scale significantly through the skill-building cycle intrinsic to the training program. Trainees can be promoted to trainers, building an expansive network of certified practitioners that can do and teach repair-work in future Mee Panyar projects. As the business matures, debt finance will be capitalized towards high throughput project volumes. Preliminary internal modelling suggests that Mee Panyar can be cash flow positive after five years of operation, assuming the completion of 93 diesel mini-grid programs and 175 hybridization projects.

CALL TO ACTION

Together, we can build a more sustainable future for off-grid communities.

As the global mini-grid market continues to grow, long-term operations and maintenance strategy will grow ever-more critical. In Myanmar, there exists a unique opportunity to pioneer community-based O&M by utilizing existing energy generation systems and leadership infrastructure, tapping into a large addressable market.

Investing in Mee Panyar is an opportunity to be at the forefront of addressing the O&M part of the mini-grid value chain in a vibrant and growing market with high potential social impact and financial gains. The significant community benefits and job-creation potential make Mee Panyar's method of teaching through repair impactful beyond the tenure of a project and provides a truly valuable opportunity to build local capacity.

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