

## **MINIGRIDS (India)**

### Current Challenges and Future Strategies

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## **Summary**

The mini grid model is an approach to provide electricity to villages that are off-grid and/or under-electrified. A mini-grid generates electricity primarily via solar power and distributes it via poles and wiring infrastructure that serves households, businesses and institutes within a particular geography/segment. A variety of stakeholders- including governmental, multinational companies, start-ups, non-governmental organizations, large philanthropies, corporate social responsibility arms of multiple corporations and social enterprises-are engaged in mini grid initiatives.

Smaller mini grids are often referred to as pico or micro grids. Till date in India, only a couple of organizations have gone beyond the pilot stage and thus it is difficult to define a successfully demonstrated example of a mini grid. Although some of the pilot models work in principle, it still seems to be challenging to create, scale and replicate projects that have a positive social impact and that are economically viable in the long term.

With the change in interests and the needle shifting more towards private players (from many of the subsidy and government led programs of the past) the author analyzes the current trends and challenges among mini grid stakeholders and provides potential recommendations.

The study covers over 10 mini grid implementation agencies with different structures and in different phases - implemented, in progress and in planning stages. Field visits and detailed discussions were made with 6 of the organizations with focus on conversations with respective management, field and operational staff. Their point of view on the performance of mini grid initiatives, the key challenges and successful practices and potential future strategies were shared and discussed.

The challenges are linked to demand estimation, technology, financial viability, improving livelihoods, strategic and operational measures, customer interface, collections, security and safety, overcoming mafia and current systems, business models etc. Many organizations have come up with apt strategies to handle issues and acquire necessary resources. Although best practices have been previously documented, newer insights still continue to emerge.

The paper goes on to discuss certain myths among stakeholders and recommends future strategies that could be considered. By collecting, analyzing and presenting insights, experiences and opinions the author hopes of contribute to the knowledge exchange between mini grid practitioners and their stakeholders in order to strengthen their joint efforts on electrification.

## **Introduction**

High transaction costs, inefficient infrastructure, lack of capacity to maintain and collect, law and order issues, very remote areas- are some of the reasons why the Indian government cannot provide in a viable manner, mostly powered by fossil fuels, to all through the central national electricity grid. This lacuna, which has been persisting from last 3 decades, has presented an opportunity to bridge the last mile connectivity gap with decentralized renewable energy. Whether it's through individual solar powered systems, small and medium sized wind and hydro power plants or biomass powered village level generation, multiple solutions have been implemented across India.

Although the official rural electrification rates as per census data is phenomenally high (90% +)<sup>1</sup>, the definition of electrification does not include aspects like reliability and quality, instead only has the clause of minimum of 10% of the households per village having access to government provided metered wiring - then the village is deemed to be electrified.

Mini and micro grids (powered by pico-hydro, wind, biomass and solar) have been consistently touted as a one of the ways to bridge factors of reliability, inclusivity and qualitative electricity supply. Specifically solar powered mini grids have been most significantly implemented in India since the late 1980s. Strong publicly supported schemes and programs like VESP (Village Energy Security Program) and RVEP (Remote Village Electrification Program) are among other energy related government agency schemes have a lot to offer in terms of learning and possible future strategies of mini grids.

Since 1996 to 2011-12 WBREDA (West Bengal Renewable Energy Development Agency), OREDA (Odisha Renewable Energy Development Agency), CREDA (Chhattisgarh Renewable Energy Development Agency) (some in partnership with private local agencies) and a couple of private organizations have installed built-owned-operated-maintained or built-operated-maintained mini grids to supply energy for lighting, mobile charging, fans and other productive loads. It is however, a common sight to come across systems that are dysfunctional, or surviving due to new external grants, displaying very limited functional performance and in many cases have been abandoned. The reasons for these largely stem from inefficient planning of budgets, business models, human resources and insufficient understanding of community and stakeholder needs/capacities. The successes are largely attributed to unique individuals, private funded stakeholders that run the models or creative collection and maintenance techniques that have been put in place which are rare to find.

“Often, weak institutional structures and organizational systems contribute to the poor performance of the projects. Cust et al. (2007) argue that even economically viable projects can fail simply because of an inadequate appreciation of the importance of appropriate organizational structures and institutional arrangements. Past experiences also show that a large number of off-grid electrification projects have had limited success (especially VESP) because of the disproportionate focus on technical installation without adequate attention to the long-term sustainability of the projects (Kumar et al., 2007). A typical example is that of VESP projects, implemented by numerous NGOs and state government agencies, where there was a lack of clarity on the roles and responsibilities among different stakeholders that resulted

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<sup>1</sup> Status of Village Electrification in India 2013 - IOSR Journals, study of rural electrification

in sub-optimal community participation and the failure of most of the projects (Palit, 2011).”<sup>2</sup>

In the past 3-4 years however, there is been a sudden up rise in funding, investing and promotion of mini grids as “the solution” for rural India’s energy needs. A peaking interest in the private sector and impact investing has brought back the attention on solar powered mini grids. For instance, the Smart Power program by the Rockefeller Foundation to implement 1000 mini grids in rural India, OMC Powers plans to own and operate 500 mini grids in Uttar Pradesh, MLinda Foundations active plans to implement 100 mini grids in Jharkhand, Boond’s plans to experiment with 50 mini grids for very poor communities and many other small, medium and large funders, investors and research grants being pumped into efforts all across Indian states like Maharashtra, Odisha, Bihar, Jharkhand, Uttar Pradesh, West Bengal etc. Experimentation largely in the areas of technology types, sizes and value adds, operational techniques and end-user diversification to enhance the working and viability/ sustainability of mini and micro grids.

Newer private corporations/ institutions or local NGOs are branching out into becoming RESCOs (Rural Energy Services Companies) officially recognized by the Indian Government. A Renewable/ Rural Energy Service Company (RESCO) is an ESCO Energy service company, which provides energy to the consumers from renewable energy sources, usually solar photovoltaics, wind power or micro hydro. RESCOs include investor owned, publicly owned, cooperatives, and community organizations.

This paper aims to explore the different parts (successful and failures) of mini grids, analyzing the current trends and challenges.

## **Analysis**

The study investigates renewable energy-based rural electrification in India, with a specific focus on the solar powered mini and micro-grid experiences of the private sector in the past 3-4 years (2011/12-2015).

The research framework of the study draws primarily from field visits to 6 different RESCOs, NGOs and private enterprises those implement/operate mini grids. The author also conducted stakeholder interviews and extensive discussions with field and operational staff that operate the mini grids on the ground. The following companies are referred, discussed and quoted in the paper-

<b>Company Name</b>	<b>Company Type</b>	<b>Type of grids</b>	<b>Cur</b>	<b>Load Types</b>	<b>no. done</b>	<b>stage</b>	<b>Primary Ownership Model</b>
Company A	NGO	mini 5kW-10kW	DC	household basic energy	5	pilot	self
Company B	RESCO + NGO	mini 35kW-40kW	AC	household +businesses	15	pilot-scale	self

<sup>2</sup>GNESD - UNEP The minigrad experience from India -Debajit Palit and Gopal K Sarangi

Company C	Social Enterprise	pico 400W-800W	DC	household basic energy	12	pilot	self
Company D	RESCO	mini 35kW-50kW	AC	household +businesses	70+	scale	self
Company E	RESCO + Enterprise	pico 150W-2kW	AC	household +businesses	300	moving to mini	Community
Company F	Social Enterprise + NGO	mini 2kW-10kW	DC	household basic energy	5	pilot	entrepreneur

Within the analysis, accounts and experiences of older mini grid and mini-grid related technology, finance and research players have been taken into account. Every entity has a different idea and approach for impact, viability and their future strategies.

However each one has contributed to unique learning's, processes and outcomes which can become extremely essential to building more efficient cohesive long term solutions and avoiding reinventing.

The table above is provided only to give the reader a brief idea of the types of implementation agencies. The paper however moves away from discussing each company in isolation and encourages a discussion around their efforts, models and processes in the mini grid space which include social, technical, financial, operational, structural, strategic, operational and organizational learning's.

## **Current trends and challenges**

### ***The mandate***

From a governmental and largely a social mandate of extending energy access via government agencies there is a clear shift: to move towards viable business models by attracting philanthropic funds or impact investors to prove its viability in the medium or long term.

Traditionally government grids have sometimes been active and sustaining until the term of the government in charge continues to prevail. Some of the private entities that run the pico/ mini grids have a longer term view of the model and envision making profits in the 8th, 10th or 12th year or operation. Only one company has just started to get a subsidy of 30% for all its mini grids (making use of a recent government scheme that gives a 30% subsidy if 1/3rd of the mini grid energy generated is being supplied to rural households).

### ***Technology***

Almost all of the mini grids are being designed keeping future needs of rural households and businesses in mind. There is a shift from DC to AC, from just households lighting and mobile

charging to household and commercial appliances. Also there is a shift from fixed sizes to expandable mini grids in terms of power and reach.

For example in some (simple) mini grids they are designed to work for 6-8 hours a day for basic loads, by installing a load limiter. Each pole equipped with a controller for 5 connection and in turn each connection can be adjusted in terms of the load required and the time it needs to be limited to, it is a similar case for both metered and non metered connections.

Technology has come a long way in the case of mini grids with the adoption of remote monitoring, load limiters and tracking. Most mini grids have an automated diesel back up provision as well. Prepaid technologies are just about being tested out for the mini grid sector. However, the shift to newer technologies have only made the transactional efforts and costs marginally lesser and but not solved the problem of management, ownership or collections which are typically faced in a mini grid model.

The AC, village level, load limiter based, metered system is only justified when the loads are varying with the ability to pay via increased incomes due to reliable energy. Household load increasing along with the capacity of the household to pay for the increased loads has not been noticed as yet by any of the entities. Even though there is an increase in demand the same increase has not been seen in willingness and ability to pay for rural households.

### ***Financial viability - Push for Anchor and Livelihood loads***

With viability and feasibility becoming the major concern, most entities are applying the following strategies:

1. An anchor/ base load which guarantees substantial and consistent fee for the energy supplied via the mini grid
2. Increasing the number of livelihood or productive loads in a village (this has been done successfully in villages where businesses already exist and have been using diesel generators)
3. Following strict policies on cutting off energy due to non-payment of monthly fee so that there is a strong culture of regular payments

The Anchor load is a single or combination load that can be a telecom tower(s), water pump(s) or other livelihood related larger loads. Apart from one organization no other entity has managed to successfully replicate and scale the idea of anchor loads due to challenges like land ownership and or diesel dealer intervening, time taken to develop and convince an anchor load customer/ anchor load customers, agreement or legal issues or just not enough potential (no income generating/ commercial application depending on energy) for an anchor load in that particular village/ town.

Household packages of 1.6\$-3\$ for 1-2 lights and mobile charging point, packages for 50W-100W usage or packages which offer refrigeration or Laptop/photography shops between 11\$-22\$ or larger packages of water/ petrol pumps around 70\$ per month are common, for and beyond higher packages a metered connection is preferred. Depending on commercial or institutional loads the connections can sometime yield month rents of even above 220\$ for bank, colleges or factory connections.

Minimum size of a village especially for RESCOs to begin operating is 150-200 households and 50 shops. Making periodic collections from households for an agent, entrepreneur or a RESCO has been very challenging and intensive in terms of resources and efforts. About 20%-30%<sup>3</sup> (or more) of the captive households in any village there is a tendency to “pay tomorrow”, “pay some now and some late” or “pay when asked 3-4 times”. For the field collector in-charge this is a call that he takes on a case-by-case basis as he does not want to lose a potential paying customer. Very often the loss is also due to other competing factors or motivations like individual solar products, grid improving, diesel mafia and tampering.

Cutting off a client's power due to non-repayment is a very common trend among all implementers. Collection agents use the load limiters as ways to control and collect monthly payments similar to the way a pre-paid service might work: although this tends to lead to a generally under utilized mini grid. Capacity wise- apart from 2-3 sites whose capacity was above 80% the rest were all under-utilized ranging from 20%-60% utilization. One entity uses pre paid technology to overcome the collection woes, which however, does not guarantee a minimum recharge per month. In the past some private mini grid players have witnessed consumer attitudes of non-payment being attributed to the fact that the investment to install a mini grid is already done, and that shifting or removing it is not an easy task, hence they can carry on using and not paying.

Almost all organizations in their 2-4 years of operation have not been able to or have barely been able to recover monthly operational costs of running the mini grid. The consensus remains (especially for RESCOs) that in the future once the capacity is being 100% utilized there will be a profit.

Bringing in newer livelihood opportunities in the village or increasing the demand for reliable energy access has been by 1 or 2 entities through their non-profit arms. Efforts are put into training, capacity building, supply chain and market linkages and funding/ financing for capital, infrastructure costs. Building an ecosystem however is a process, which takes time, human and monetary resources which may or may not result in a consistent consumer for the mini grid. One company has over the past two years manage to create one new entrepreneur just initiated a new business in the village.

However, further threats to collections have been discussed in ‘Myths’ and ‘Future strategies’ sections.

### ***Implementation Models***

There are 3 different types of models that stand out in the mini grids currently being implemented-

1. RESCO built, owned, operated and maintained
2. Entrepreneur or Franchise owned and operated
3. Community or Group owned and operated

In the first case the RESCO becomes a utilities provider and continues running and maintaining the mini grid. However due to the size, captive market and alternatives it is difficult to compare the mini grid to a government utility service. In a RESCO model each grid has a dedicated guard at each site, a dedicated or shared technical, a collection agent and a community mobilizer who may or may not do sales for the RESCO.

In the second and third case an enterprise or RESCO builds and maintains the mini/pico grid. A local entrepreneur or private entity owns and operates the system on the ground. In this model there could be an ownership component or an incentive component for the entrepreneur. This model is rare. Most of entrepreneur models across the entities have been working with individuals who already have multiple small and medium businesses in the community and a history of transacting with the community. This tends to bring down transaction and initiation costs significantly for the owner and the enterprise or RESCO.

The third type is where a group of households or businesses invest in the pico/ mini grid and own it collectively (this maybe built and maintained by an enterprise or an NGO). Although commonly found, this model is being phased out due to high transaction costs. It works well only in cases where there is an existing cohesion within the community and a culture to share commodities or where there is significant time and effort put in by the NGO or enterprise that maintains the group.

Although each model has its pros and cons, practitioners across the board have mentioned that a mini or pico grid model needs to be subsidized 50-70% to stabilize and make it sustainable depending on terrain and community dynamics.

Many ways to capture and keep customers are applied by the field operations: registration discounts in summers, attractive rental packages for business owners, bringing in diesel generator entrepreneur to supply solar energy, long term agreements with institutions etc. The operational costs are mainly related to maintenance and servicing, collections, management of the system, monitoring and safety and security.

In all mini and micro grid site irrespective of the ownership model there is an issue of security and safety, even through tampering is rare issues of pilferage and thefts is not uncommon in the operation terrains of all the organizations. 2 out of 6 of the organizations employ ex army, police and security means and measures to maintain discipline and avoid losses through pilferage. One entity also has close circuit cameras installed and a local security agency employed for the monitoring and maintenance. Around 2 to 3 individuals are required to manage and maintain each mini grid (of 20kW+). There are 4 roles that need to be covered- a guard, a technician, a salesman and a line man (collection + servicing). The collection agent either gets a salary from the RESCO or a 10-20% incentive to make on time collections.

In general, the number of women working in RESCOs are nil. According to one of the operational staff it is work that runs into late evenings, nights and even Sundays, hence very difficult for local women to participate. However in the experience of another entity that runs community owned joint liability group (JLG) models women run groups are much more likely to succeed smoothly as opposed to all-men JLG groups.

Apart from safety and security another example of an entity dealing with unforeseen operational costs is shifting the mini grid if there isn't enough market for it due to central grid improving, not enough willingness to pay or too few commercial loads in the village. The

same entity has been working with both households and businesses and in their experience, they have never lost a commercial load client even if the grid has improved. The reliability that mini grid implementers offer is much beyond the grid or the diesel supplier. And once a business load becomes hooked to consistent and reasonably priced energy (30-40% cheaper than diesel) which is good for the business they do not want to take the risk of losing the connection.

In terms of the size of mini grids, players running larger mini grids want to shift to multiple pico grids as ensuring a captive consumer group for the larger one is a painstaking process as opposed to maintaining smaller pico ones. On the other hand, due to very high transactional costs of pico grids, the entity running pico grids is now shifting completely to a mini grid model with a focus on livelihood loads in the villages.

Across the three types of models there are two types of strategies emerging are:

- a. 2-3 organizations that work with very poor households and are committed to doing only household lighting and mobile charging with the future possibility of expanding into other household or business applications if and when the communities income levels rise. Since their system costs are lesser they show better repayment times (5-10 years depending and continue to collect monthly rentals endlessly as RESCO. Exit strategies for these organizations are not an option at the moment.
- b. The growing trend of implementing large village level mini grids which can support growing business and household loads from its installation. Generally implemented in low income communities where diesel is being used. Implementers are on the look out for anchor and larger business loads which decrease their transaction costs and ensure income for the grid from day 1. Also run mostly as RESCOs with no exit solid exit strategy, although there is a thought of selling it off to larger companies to run once the RESCO has made a substantial profit.

Both strategies seem to be scaling even if they may be in a pilot mode, many stakeholders believe that only over a period of time can their success be determined. Currently most practitioners either get large subsidies from philanthropies or subsidize the operations through a non-profit wing to implement mini grids.

In couple of experiences, the central government grid has reached and in an improved manner in the most remote areas. Even through a government dialog, there can be no guarantees of grid spread or subsidies of for over a 5 year period. Organizations however, are certain, that in selected states and areas the quality and reliability can never improve due to broken down, loss making governance and electricity infrastructure.

## **Current Myths**

### ***Solar energy access = increase in income levels***

There is no doubt that reliable energy access uplifts the wellbeing and income levels. Immediate impact in terms of increased incomes because of access of energy is actually not always true. Increased incomes depend on the type of interventions and related eco-systems.

Thus a family can benefit truly only when other linkages are put in place and that requires time - energy access is only one part of puzzle.

The major challenge is to bring in livelihoods based interventions in poor and very poor communities that have not been able to afford other forms of energy access. In other low income villages where livelihoods options exist there is a definite benefit of savings (30%-40% from diesel) and potential for incrementally increased incomes due to reliable energy access. To significantly elevate a community to one rung above its current socio-economic strata, the parts of the ecosystem that need to be built on include: awareness, training, capacity building, access to appropriate infrastructure and machinery, access to finance and market linkages.

### ***Mini-grids is a proven viable long term business model***

The question still remains if ESCOs can succeed in utility type collections and more over if the operational and capital subsidy required for ESCOs to operate would decrease over time. Considering the goals of ESCO type models, the break even could take 8,10 or even 12 years in many of the cases. Currently agencies that implement mini grid rule out or do not consider the fact that as the cost of solar decreases alternative models are bound to pose competition. Even if the costs remain the same there will be other solutions - individual, pico, mini that can very possibly be a good alternative option for their current customer base. Especially with lower costs and decentralized ownership options, larger consumers and very small consumers of the energy provided can be easily opt for another option.

Since mini grid consumers do not have any stake, investment or attachment to the mini grid itself, but to the electrons they receive from it- these electrons may as well be from other sources just as long as they get it.

For example the laying cable wire for everyone to get access to cable television but dish suppliers and different dish TV suppliers can challenge that model. What matters to the end user is good quality and choice of number of channels. The customer loyalty could change at any point in the next 3 years, 5 years or 7 years.

A few entities expressed measures like marking operational territory or proving better services or cheaper rates, but none of these are long-term strategies. Business models are currently envisioned to be long term with a fixed captive market being essential to operational sustainability (let alone capital break even or profit making).

Another case to consider is from a user perspective-

1. Consider the case of a entrepreneur who runs a huller in the village and caters to the paddy farmers in the village. Firstly the amount that the entrepreneur has been paying to run his/her machine on diesel is extremely high (about 180\$). If the entrepreneur continues to shell out this amount over 3-5 years towards a bank loan he or she could very well own the system needed to power the machine. In the case of an ESCO the entrepreneur will continuously pay about 100\$-130\$ (with no ownership). In this case ownership model will be more attractive.

2. The same analogy could also be used for small household users who currently end up paying endlessly to an entrepreneur or an ESCO. Since their need is so minimal a sturdier home system may be a better option if financing is available.

At the planning stage of a pico-mini grid these issues need to be considered of better longer term sustainability.

### ***Capital subsidies are good and needed***

Subsidy is one of the first words that comes out of any stakeholder trying to push for any service that largely caters to poorer parts of the population. The second step is always connecting subsidy to the capital cost of the intervention – as it always seems the easiest way of disbursing the subsidy. Same is the case when one comes to making mini-grids ‘affordable’ to the targeted populations. One also can keep discussing the definition of affordably – and that would be beyond the scope of this paper.

There are also numerous comparisons to cost structures of typical grids and mini-grids.

The two critical ones are:

1. People have consistently argued that while large grids are subsidized why shouldn't the mini-grids be also subsidized: why should poor pay for full price while rest of society does not.
2. There should be grid parity when supplying power via mini grids. The argument is that mini-grid players charge 6 to 7 times more than what a traditional grid would have charged.

Both arguments (1) and (2) have been built on the assumption that the ‘grid’ model is ideal (financially has been taken care off) and one is comparing apples to apples: thus leading to the ‘need’ for subsidies. Both arguments need to be challenged.

The grid model, or any large infrastructure are subsidized not from a ‘capital’ perspective but from longer-term payment mechanisms (long term infrastructure loans at lower interest rates). This is a very difficult analogy to be applied for small systems and thus is equated by subsidizing the capital costs: which is not sustainable in the long run. Larger infrastructure based grids have ‘eggs’ in multiple baskets and can have wider margins of error while that is not the case of mini-grids.

A typical mini-grid would consists of:

- a. Basic Power Plant and related electronics
- b. Wiring and related infrastructure
- c. Maintenance (spare parts etc)
- d. Business, Individual and Community based loads
- e. Human Resources to run the plant and make the collections (operational part).

The hardware (capital) costs (a,b) would come in a financial bracket that will not be attractive for any lender to provide similar terms as large infrastructure loan and can maximum be equated to a decent sized asset loan. Any provider, to match, the capital cost either has to offload the costs on to the end-users (as if they are also on a short term lease) or get parts (a)

and (b) subsidized upfront: this is exactly what is happening in the field. The collections from the end-users are enough<sup>4</sup> to maintain (c),(d), (e) and some profits (higher subsidies has led to higher profits).

The danger of such models is that, because of relatively shorter area of ring fence (in terms of clients), any unforeseen financial shock can force the operator to abandon the running of the project (these chances are higher once the operator has been able to recover the costs of the system).

Thus begs the question how should one structure the subsidy in a way that incentives the continuity of the project/program. Right from the end 80s (when then the experimentation of mini-grids started) – that particular question has been never being answered. Failure to answer it has in fact pushed the policy makers to think that main grid is the ultimate answer: result of poor analysis.

There is also an analogy to road infrastructure and toll collection. There is a big difference here. The vehicles plying is not constant and or homogeneous (from the same place etc.) not the road in confined to certain geography of population. Also there is a choice to use it or not – the toll collector needs basic number of vehicles to ply. It might be analogies to a migratory populations (like slums) – where ultimate ownership might not be a competitive option. In terms of stable populations, potential decentralized ownership model, competitive services/ technologies could be a major threat: analogous to the cable television and the dish network comparison.

Subsidy in the case of mini-grids have to be mapped out more thoroughly than how it is done right now – though well intentioned right now – might actually be a great disservice to the poor in the long run. For example, it would be more attractive to subsidize a rice mill (cheaper loan - as it generates incomes and livelihoods) than subsidizing the electrons running it: the end-user will always be incentivized to pay for the service else his/her income is lost.

### **Potential Future Recommendations**

In many ways micro-grid has been confused between a product and a service. Designers and Implementers have concentrated too much on ‘perfecting’ the technology without simultaneously paying attention to the other parts of the eco-system. The eco-system has been looked at after the technology has been determined (with a major assumption that the technology part need not be re-looked at). Each stakeholder needs to re-look at his or her role – else there is a high chance the micro-grid could go the way micro-finance got branded in India.

#### ***For Implementers***

Implementers need to spend more time assessing the market in a more holistic manner. The present and medium term future needs of the targeted clients have to be mapped out along

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<sup>4</sup> During the research out of the 5 companies out of 6 said they were just about or not even breaking even on the operational costs , and they will reach a stage where they make a marginal profit operationally once the grid starts running at full capacity

with the potential financial and collection models. They should be ready to look at both centralized and decentralized models depending on the loads (business versus household for example); The implementers should think themselves as solution provider rather than micro-grid players: micro-grid in one way of providing the electrons. The factors they need to look at:

- I. The needs of the segments and to bifurcate them into (leading to better design of technology)
  - a. Domestic loads – small and large
  - b. Commercial – small and large
  - c. Immediate and long term.
- II. The financial models for each of the above parts
  - a. Link the loads to appropriate financing model (short term to long term)
  - b. To be very clear on the need of soft funding and for which part of system
- III. Type of partnerships needed
  - a. Partners with community relationships
  - b. Partners with experience in finance and collections
  - c. Partners with experience in market linkages (for livelihoods loads)
- IV. Human Resources
  - a. With personal more experience in community relationship
  - b. Ability to customize solutions according to the needs
  - c. More adaptive to social innovations

Today, the thinking is for the most part, unilateral in one direction or the other. Many of the problems have been swept under the carpet for future 'solutions'. The primary reason been too much soft monies have entered the market leaving less room for actual innovation and thinking process.

To further illustrate some of the above points –

- Strategies to reduce operational costs could include identifying existing local social glues. Utilizing a local petty/ ration shop as the entrepreneur, leveraging on the rent a owner of multiple migrant houses collects and/or convincing the diesel operators captive market into the gamut of mini grid users by making him a solar mini grid supplier. All these 'glues' have traditionally built transitional connections with the end user, it is easier for them to understand risks and user behavior- hence this would decrease the time taken for a model to stabilize and drastically minimize the transactional and operational costs.
- Holistic approach to decentralized energy access: As there are different types of poor communities, abject, very poor and low income, different types of geographies, terrains and contexts there is no one solution that can fit all the different states in India.. Considering conflicting trends of larger mini grid players moving to pico models as well and pico mini grid players moving to larger mini grid models- there is scope for all energy service providers to implement systems which suit user needs which may be individual, pico, micro, mini, RESCO, entrepreneur, enterprise, group owned- every model is a piece of a puzzle which can be implemented if the end goal of the mini grid players becomes providing reliable energy access in a social, financial and environmentally sustainable manner.
- Financial and Business model innovations: Within the entire study and previous literature there is a lot being worked on from a technology perspective. However, the driver for the technology innovation has not been contextual to the issues faced in mini grids. The technology innovation needs to be a push on financial and social innovation in the mini grid

space and vice versa. No entity is currently working on or experimenting with financial or business model innovations

### ***For Present and Potential Funders***

Presently the funding is being determined by the potential of micro-grids to 'scale up' and reach thousands to poor clients that no other model can: at least that is the perception. The funders need to understand that micro-grid is really not a service or product in itself – it is one of the ways of channelizing electrons. The more important part is what will people do with the electrons.

The monies should, now, be diverted for subsidizing the required eco-system and not the capital product. For example how to spur up long term financing for potential entrepreneurs and end-users (who want to buy large livelihood assets to run off electricity) or to push for innovation in making larger livelihoods loads (like rice mills) more efficient.

The funders should be more diligent in asking for medium and long-term strategies before committing the monies: learning's from failures of the micro-finance sector should be brought into this sector. It would be very worthwhile to bring in advisors from the micro-finance/finance world before any implementation.

### ***For Government and Policy***

Micro-grids have been experimented and implemented in many parts of India, over the last three decades with very mixed results. Conflicting policies, lack of coherence at the ground level (between technology providers, local governing officials, other service providers, community etc.), unrealistic design models (financial and social designs) etc. have in many ways hampered a sustainable implementation of micro grids in the country.

This section of the report would concentrate on potential policies that could help the diffusion of micro-girds in a better manner, wherever micro-grid is applicable and desirable.

One of the biggest threats to private players is the sudden expansion of grid that could render their efforts useless from both social and economical point of view. The utilities, which are mostly government owned, should view as micro grids as complementary efforts to their plans to electrify the un-served and underserved populations. Today, they are perceived to be not providing 'real' electricity that could match the growing aspirations of the poor. This is an incorrect perception as policy makers need to bifurcate the channels of delivery (decentralized, micro-grids, etc) to the actually service being provided at the end-users doorstep.

The policy should be in way an example of good public-private partnership with private players allowed to provide the needed service (electricity to people for what they need at times when they need it) by allocating specific geographies of operations and appropriate complementary services (like extra power via grid, financial resources for end-user financing for income generating activities etc). Such collaboration would ideally bring all development agencies together and not forcing each one to create its own channel.

Micro-grids, wherever applicable (mostly for a bunch of livelihood application), can in-fact be a boon to the government utilities in India – as they would in fact help in reducing the financial losses. Micro-grids will help them avoid the huge T&D (transmission and distribution) losses and as they would be connected to better mechanisms of lively hoods – would lead to better collections from the end-users (a nagging problem that most of the utilities face in India).

Policy has to be streamlined to make sure that easy financing is accessible for implementers, as the returns from micro-grids are longer than usual. The National Bank of Agriculture and Rural Development (NABARD) should create a special window for micro-grid and livelihood financing: longer term financing at lower interest rates.

The government should also facilitate the creation of a third party monitoring team that can keep a tab on the technical and financial performance of the enterprises – ensuring both the rights of the end-users who are mostly be poor and also of the enterprises themselves (if they are financially sustainable).

The government and some of the large foundations should also set up a fund to facilitate application based innovations (primarily concentrating on livelihoods) that could make micro-grids socially more relevant and financially viable.

The future of micro-grids does not lie in the technology but on the application side of the equation: economic activity will lead to better social acceptance.

### **National Tariff Policy Regulation**

The Government has sent out a new notification on January 16th 2016 regarding micro-grids and their future. The primary intention of the notification is to safeguard the interests of any private player regarding the investments made by installing a micro-grid at the remote location. The notification in the National Tariff Policy amendment says that if the grid reaches the area of a Micro grid before the completion of the useful life of the asset, the micro-grid owner would be entitled to receive a regulatory determined tariff (determined as per tariff principles offering a reasonable return on equity presently about 16%) for the rest of the useful life of the asset.

“Micro-grids supplying renewable energy are being set up in such areas where the grid has not reached or where adequate power is not available in the grid. Investment involved in setting up of such micro grids is substantial. One of the risks of investment is grid reaching the area before the completion of the project life and thereby making power from micro grids costly and unviable. In order to mitigate such risk and incentivize investment in micro grids, there is a need to put in place an appropriate regulatory framework to mandate compulsory purchase of power into the grid from such micro grids at a tariff to be determined under section 62 of the Act considering depreciated cost of investments and keeping in view industry benchmark and with a cap if necessary, as approved by the Appropriate Commission. The Appropriate Commission shall notify necessary regulations in this regard within six months”<sup>5</sup>

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<sup>5</sup> National Tariff Regulation Policy 2016 - India

While the intentions are in the right place - the devil is in the details. Normally public-private partnerships in delivering essential services is complicated. The issues that one needs to cater for are:

1. Would there be a tendering process of putting up the micro-grids? Would the smaller entrepreneurs and enterprises lose out if it happens?
2. Would the needs of the poor be always be taken care or would financials drive the process?
3. How much long term commitments can the government do - do we learn anything from the Spain experience of feed-in tariff promises?

Also the question would be the long term motivation levels of micro grid players to keep the level of service after they have recovered all their costs and expected profits. It is a challenging model to create and emulate. It would be beneficial to study other public-private partnerships in the world and how can some of those best practices be brought into this sector.

## **Conclusion**

As mentioned in the earlier paragraphs, the author believes presently there is a type blind rush to implement mini-grids: for providing immediate energy access to 300 million Indians who still do not have access to electricity. The rush does not take into account learnings from the mini grids which need to address long term ownership and sustainability, user perspective and alternative financial and business models. While the intentions are noble, many of the methods and thought process are still naïve – which could be disastrous in the long run.

Attention needs to be given to aspects other than technology: like true needs of the poor, financial models etc. In many cases the models mimicked the same issues plaguing the large utilities but were masked because of enormous amount of soft money that is being ploughed into this sector: making the case of how philanthropic money is in fact distorting and hindering the growth here.

There needs to be an urgency in rectifying this sector, from a development perspective, else should not be another case where the poor were made the guinea pigs just like in the micro-finance area.

Lack of attention to details of eco-system and lots of soft money led to derailing of the micro-finance movement in India and that seems to be the same case for micro-grids. But on a positive note – it is still not too late. Learning's from micro-finance and other sectors can be brought in here and good models could still be implemented and scaled. For that to happen personal with many years of ground experience need to be brought in and design of micro-grids should be done with a multi-disciplinary approach.