INTERNATIONAL SOLAR ALLIANCE

Japan - India Friendly Relations 70th Anniversary of the Establishment of Diplomatic Relations

NEDO

CASE STUDY

OPERATIONAL USE OF "ANCHOR LOAD BUSINESS COMMUNITY MODEL" SOLAR MINI-GRIDS UTTAR PRADESH, INDIA

Source: *OMC Power*

Preface

About ISA

The International Solar Alliance (ISA), established in 2015, undertakes joint efforts to reduce financing costs and the cost of solar technology applications and services. The ISA aims to bring solar energy into people's lives and homes by making it affordable, more reliable, and easier to connect to the grid and contributing to universal access to clean energy. The ISA seeks to help countries mobilize $1 trillion of investment by 2030 for a massive deployment of solar energy technologies and expand solar markets, thereby, paving the way for future technologies adapted to the needs of the Member Countries. By leveraging a unique political opportunity to empower developing and emerging economies, the ISA also promotes a transition to clean truly global energy, while simultaneously advancing principles of economic development and social equity.

The ISA currently has 81 member countries. 22 countries that have signed the ISA's Framework Agreement would soon become members in the coming months. The amendment to ISA's Framework Agreement to expand the membership to all 195 UN Member States is also effective. While OECD nations have dominated the processes and outcomes of the United Nations Framework Convention on Climate Change (UNFCCC), ISA offers a pathway for empowering lesser-developed nations to design and drive clean energy and climate solutions, along with sustainable development goals. The current membership includes 51 Least Developed countries (LDCs) and Small Island Developing States (SIDS) Member Countries where the need for energy access and energy security is acute. In these LDCs and SIDS Member Countries, there is also a demand for various livelihood applications powered by solar energy.

To meet this demand and set up a vibrant solar energy ecosystem in these countries, the ISA is facilitating member countries to develop a pipeline of bankable projects through its nine programs: 1) Scaling Solar Applications for Agriculture Use, 2) Affordable Finance at Scale, 3) Scaling Solar Mini-Grids, 4) Scaling Solar Rooftop, 5) Scaling Solar E-Mobility and Storage, 6) Solar Parks, 7) Solarizing Heating and Cooling Systems, 8) Solar PV Battery and Waste Management and 9) Solar for Green Hydrogen.

About NEDO

The New Energy and Industrial Technology Development Organisation (NEDO) is a national research and development agency that creates innovation by promoting technological development necessary for the realization of a sustainable society. It acts as an innovation accelerator to contribute to the resolution of social issues by developing and demonstrating high-risk innovative technologies having practical applications. NEDOs has an objective to address energy and global environmental problems and enhance industrial technology.

To contribute to the resolution of social issues, NEDO formulates technology strategies and project plans and, as part of its project management, establishes project implementation frameworks by combining the capabilities of industry, academia, and government. NEDO also promotes technology development by carrying out, evaluating, and allocating funding to promising projects to accelerate the practical application of project results.

With an objective of knowledge dissemination to fill the policy and knowledge gaps in solar mini-grid adoption, the International Solar Alliance and NEDO jointly put forward this case study. It will further encourage other member countries to examine the applicability and replicability of similar solar mini-grids and proven business models to accelerate clean energy transition.

This case study is jointly developed by the International Solar Alliance and NEDO with the support of the OMC Power.

Disclaimer

This case study is meant for knowledge dissemination purpose only. The views/ analysis expressed in this case study does not necessarily reflect the views of the International Solar Alliance or its partners. The International Solar Alliance also does not guarantee the accuracy of any data included in this publication, nor does accept any responsibility for the consequences of its use.

Executive Summary

Mini-grids are conventionally viewed as a beeline solution to the problem of electricity access, which is true for areas where electricity grid extension is an expensive affair. Most of such mini-grids are solar-based because it is renewable and emissions-free, modular, and scalable, suitable for both off-grid and on-grid applications, relatively easy to install, increasingly affordable, and well suited to "sunshine country" environments. The same is recognized by other international organizations as well. Thus, solar mini-grids have quite a relevance in the Middle East, developing Asia, Latin America, and Small Island nations where people either have no access or have limited access to electricity.

However, for essential businesses to prosper, the duration and quality of electricity supply are equally significant. Some businesses are the backbone of economic development in any country such as fueling stations, telecom towers, schools, health facilities, etc. Such businesses require a continuous supply of electricity to make the economic case and curtail emissions from the otherwise use of conventional fuels such as kerosene and diesel. Solar electricity in sunshine countries through innovative business models with the right blend of financing is a key to reducing the friction on the path of economic development. The case study highlights the business models ensuring stable cashflows through essential businesses and anchor loads herein telecom towers and ensuring basic electricity supply for the residential segment to fulfill all basic needs. Additionally, the case study highlights the impact of reliable electricity supply on the lives of people having no access or limited access to electricity. The study purposes to fill the knowledge gaps in solar mini-grid adoption and encourage other countries to examine the applicability and replicability of such business models to accelerate the path of economic development.

This case study presents the classic example of a conducive policy and regulatory environment in terms of mini-grids in the state of Uttar Pradesh in India. The Uttar Pradesh Mini-grid policy 2016 has been successful in encouraging private sector participation in the segment of mini-grids. The case study looks into a solar hybrid mini-grid project, by OMC Power, located in Bilgram and highlights the social impact generated with the installation of a large number of solar mini-grid projects in the state of Uttar Pradesh, India.

Also, the business model discussed in the subsequent section of the case study is an effort-intensive model that the member countries may adopt. The ABC (Anchor Loads, Businesses, and Community) business model highlighted in this case study, is designed not only to ensure continuous and uninterrupted electricity supply but also to improve the livelihoods of people and make them financially capable enough to pay for the metered connections. Moreover, a continuous engagement with communities not only offers a path of all-inclusiveness development but also improves the economic viability and sustainability of solar mini-grids.

Contents

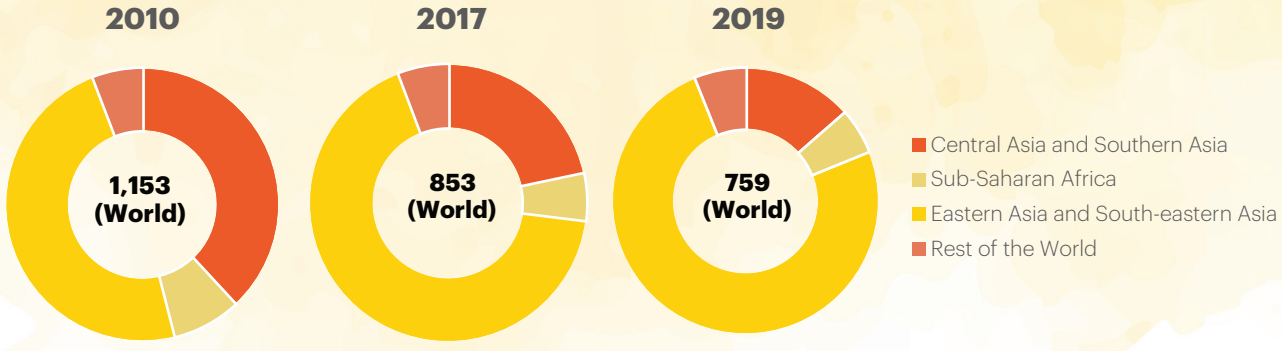
1 Context

1.1 Relevance of mini-grids in expediting economic development by improving electricity access

Access to reliable, secure sources of energy and electricity are fundamental requirements for public health, education, and businesses to run, culminating in economic development. However, 600 million people continue to remain without access to electricity in Africa, and tens of millions more lack electricity in the Middle East, developing Asia, Latin America, and Small Island nations.[1] While lack of energy access is most severe in rural areas, even in urban areas within LDCs, weak electric grids inhibit energy security, resulting in sporadic or inconsistent power supply.

In the absence of low-cost and reliable electricity, residential communities turn to pollution-generating energy sources such as kerosene and biofuels for meeting their energy needs to carry out their day-to-day activities. Moreover, essential businesses and institutions are left with no alternative option but to run on conventional fuels such as Diesel for economic development such as schools, health facilities, telecom towers, fuel stations, agriculture facilities, water purification or cold storage facilities, and banks, etc. Despite the global fluctuations in fossil-fuels prices the

Regional electricity access deficits (in millions of people with access to electricity) for 2010, 2017 and 2019



Source: IEA, IRENA, UNSD, World Bank, WHO. 2021. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC

[1] "Access to Electricity – SDG7: Data and Projections – Analysis," IEA, accessed July 8, 2021, https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity.

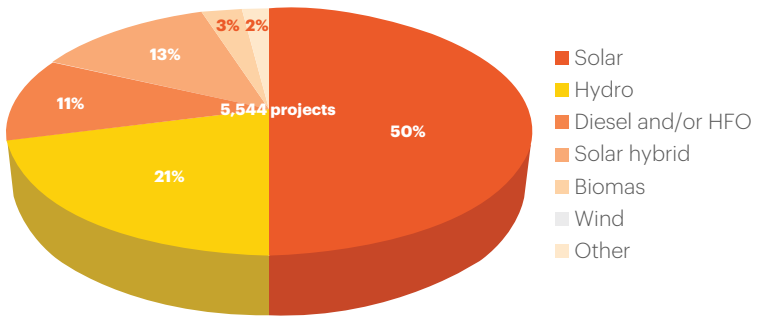
advancement of the UN Sustainable Development Goal targeted towards universal energy access (SDG7) will likely occur at the expense of increasing fossil fuel consumption, air pollution, and carbon emissions in LDCs and SIDS because fossil fuels remain relatively familiar and easy to access. Moreover, the essential enterprises will always find it difficult to sustain their businesses without the availability of reliable electricity. Thus, the path to economic development for these countries is bleak.

IEA recognizes universal energy access by 2030 as a key milestone in the pathway to net-zero that would provide a major boost to well-being and productivity in developing economies. This would require 630 gigawatts (GW) of annual solar photovoltaics (PV) additions by 2030.[2]

As the costs of PV and battery energy storage systems have continued to fall over time, solar energy through mini-grids offers myriad advantages for bringing power to many more people – it is renewable and emissions-free, modular, and scalable, suitable for both off-grid and on-grid applications, relatively easy to install, increasingly affordable, and well suited to "sunshine country" environments.

Thus, there is a solution, solar through mini-grids or solar mini-grids, but it is not always accessible to those making these choices for heating, cooling, and lighting. The solar mini-grids is an answer to both, problems of electricity access and electricity reliability.

Thus, the most popular segment of the global mini-grids market is solar hybrid mini-grids. The same has been affirmed through various studies as well, among 5,554 projects surveyed under State of Global Mini-grids Hybrid Report 2020, around 63% of the total mini-grids are solar-based and around 50% were solely solar-based.[3] Third-generation mini-grids, mostly use solar PV coupled with energy storage. At present, lead-acid batteries are the first choice of system integrators because they are more easily available and have a lower upfront cost than lithium-ion batteries. However, with the steep decline in lithium technology costs, lithium-ion batteries are gaining gradual prominence as a storage option in the mini-grid space.



Source: BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers

[2] https://iea.blob.core.windows.net/assets/deebef5d-0c34-4539-9d0c-10b13d840027/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

[3] State of Global Mini-grids Hybrid Report 2020 by BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers

In Asian mini-grid space, India leads with 1,792 mini-grids installed, followed by 1,061 in Indonesia and 326 in the Philippines.[4] Indonesia and the Philippines have island locations that are favorable for mini-grid deployment. In India, mini-grids are not only contributing to the electrification of rural households but also contributing to rapid economic development and delivering a positive social impact on rural communities by providing reliable electricity supply for the establishment of banks, health facilities, schools, and installation of fueling stations, telecom towers and other essential enterprises in rural areas.

In 2019, India had achieved 100% electrification at the household level through grid extensions under the SAUBHAGYA scheme, however, reliability & quality of electricity supply for productive loads was not the prime focus of the grid-based rural electrification scheme in India. Rural communities not only pay higher tariffs for a reliable electricity supply via diesel-powered generators but also contribute to contamination of the environment through releasing of GHG emissions produced by burning easily available conventional fuels such as diesel and kerosene.

Some of the Indian states such as Bihar & Uttar Pradesh are completely electrified at the household level[5] but rural enterprises in the states still prefer mini-grids due to reliable and affordable electricity supply. Even residential consumers carry a positive outlook towards mini-grids if electricity is available at an economically competitive price.[6] **This case study deliberates on operational use cases of solar mini-grids in the state of Uttar Pradesh and replicability of the same in the ISA member countries to expedite economic development by improving electricity access and helping essential enterprises to prosper.** The adoption of mini-grids at scale also depends on the receptivity of existing regulatory and policy regimes. While some countries (such as in India) allow mini-grids to operate majorly in a de-regulated fashion, other countries require licenses to build and distribute power locally.

[4] State of Global Mini-grids Hybrid Report 2020 by BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers
[5] https://npp.gov.in/dashBoard/cp-map-dashboard
[6] The Adoption and Use of Solar Mini-Grids in Grid-Electrified Indian Villages, Anjali Sharma, Shalu Aggarwal, Johannes Urpelainen

2

The Mini-grid experience from the state of Uttar Pradesh

With the current non-fossil fuel share at ~39%[7], India is set to surpass its INDC target of 40% non-fossil fuel well ahead of time. Furthermore, the Government of India (GOI) has set an ambitious target of 175 GW of RE capacity by 2022 and 450 GW by 2030. Out of which 40 GW was expected to come from the solar rooftop. With a strong mandate at the national-level, and accompanying political stability, India remains favorably placed to achieve its net-zero target by 2070, in line with the recent announcement made by the Hon'ble Prime Minister of India Shri Narendra Modi during the COP26 climate summit at the Glasgow.

GOI has implemented numerous policies and schemes, through various ministries, towards energy transition, security, and electricity access. These include the National Solar Mission, Solar Cities program, Production Linked Incentive scheme to boost domestic manufacturing of high-efficiency solar PV and ACC batteries, PM-KUSUM Scheme for solar water pumps, National Off-shore Wind Energy Policy, round-the-clock power etc. Furthermore, Indian states have also developed their policies and schemes in RE, to complement the efforts of GOI.

From the institutional structure perspective, India's power sector consists of a mix of state-owned and private players. At the national level, the Central Electricity Regulatory Commission (CERC) regulates the inter-state generation, transmission, and distribution of electricity. At the state level, there are respective state regulatory commissions, in this case, the Uttar Pradesh Electricity Regulatory Commission (UPERC) coordinates state-level regulations and enactment, including tariff determination and license overseeing. Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA) has been established to develop the capacity in renewable energy sources such as solar energy, small-scale hydroelectricity, and biomass-based electricity production in the state functioning as the nodal agency for the implementation of various schemes in the state.

Though the state has achieved complete electrification at the household level the reliability of electricity supply, specifically in rural areas is still a cause of concern to some extent. According to the electricity monitoring initiative by Prayas Energy Group (PEG), rural consumers in UP, the average duration of daily power cut in rural set-up is of more than 4 hours, and a typical power cut may go up to almost 14 hours. Research results suggest that users, especially enterprise owners, value reliable power supply. However, the provision of a reliable power supply for productive purposes has not been the focus of grid-based rural electrification in India.[8]

[7] cea.nic.in, January 2022

[8] The Adoption and Use of Solar Mini-Grids in Grid-Electrified Indian Villages, Anjali Sharma, Shalu Aggarwal, Johannes Urpelainen

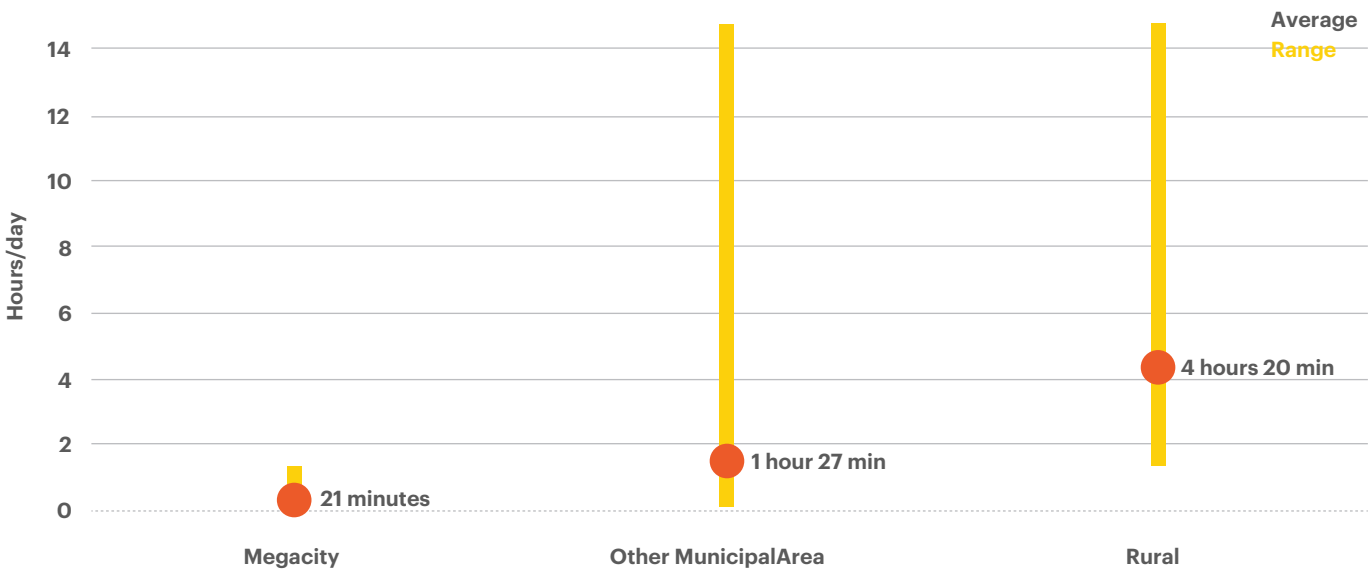


Figure 2: Range and Average outage hours in the state of Uttar Pradesh

Thus, solar mini-grids offer a win-win situation for end consumers, enterprises, and electricity distribution utilities instead of supplying power through long agriculture feeders.

2.1 Policy and Regulatory landscape relevant to mini-grids

The state of Uttar Pradesh has been a classic example of supporting regulatory and policy environments to expedite the adoption of solar mini-grids and overcome the challenge of reliability of electric supply. There has been a synergetic regulatory push from central & state governments to accelerate the deployment of solar mini-grids by enticing private sector interest and successfully engaging private players in solar mini-grid space in the state. Moreover, UPNEDA notified the mini-grid policy of the state before the draft national policy was released by the Ministry of New and Renewable Energy (MNRE). The table below highlights the various national as well as state level policies that are enabling a conducive environment to develop solar mini-grids.

Table 1: Brief overview of national & state policies on solar mini-grids

Name of the Policy	Description
Rural Electrification Policy	In August 2006, under sections 4 & 5 of the Electricity Act 2003, the Indian government has notified rural electrification policy which promotes distributed generation as an economic way to improve electricity access[9]
Mini-Grid Policy Uttar Pradesh	UPNEDA had issued a mini-grid policy to promote the renewable energy-based decentralized generation and encourage private sector participation before the draft national policy was released by MNRE. The policy of Uttar Pradesh was the first of its kind globally and has been emulated by various other states in India and countries internationally to frame mini-grid regulations. It addresses[10] ▪ Strategies for mini-grid players to co-exist as also collaborate with the distribution companies. ▪ Exit policy in case of the arrival of the grid. Operator's right to determine tariff based on mutual agreement between the operator and the end customer.
Draft National Policy for Renewable Energy based Micro and Mini-Grids	MNRE released a draft national policy Ministry target to achieve deployment of at least 10,000 RE-based micro and mini-grid projects across the country. It also encouraged the states to draft their policies[11]
Sahaj Bijli Har Ghar Yojana – SAUBHAGYA	In October 2017, the GOI launched – the SAUBHAGYA scheme, focusing on last mile connectivity and electricity connections to all the unelectrified households in the country. The scheme also promoted SPV based standalone systems for households located in remote/ difficult areas[12]
PM-KUSUM (Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan)	In 2019, the PM-KUSUM scheme was launched to ensure energy security for farmers in India, along with honoring India's commitment to increase the share of installed capacity of electric power from non-fossil-fuel sources to 40% by 2030 as part of Intended Nationally Determined Contributions (INDCs). In the scheme, component A is specifically for setting up 10,000 MW of Decentralized Grid-Connected Renewable Energy Power Plants on barren land. While component B & C is about the installation of stand-alone solar agriculture pumps & solarizing grid-connected agriculture pumps respectively[13]

The Electricity Act of 2003 allows the rural electricity service providers to be exempted from tariff regulation and licensing. When government agencies do not give finance or subsidy support to private companies, regulatory commissions have no power to impose tariffs or service standards. As a result, unregulated power purchase agreements with consumers are used to operate such privately owned and operated mini-grid operations.

Most of the mini-grids in the state of Uttar Pradesh are financed and operated by private entities supported through different funding mechanisms

[9] https://cercind.gov.in/2018/whatsnew/REP.pdf
[10] http://upneda.org.in/mediagallery/Mini-Grid-Policy-2016.pdf
[11] http://cdn.cseindia.org/userfiles/draft_national_mini_grid_policy_aruna.pdf
[12] https://powermin.gov.in/en/content/saubhagya
[13] https://www.india.gov.in/spotlight/pm-kusum-pradhan-mantri-kisan-urja-suraksha-evam-utthaan-mahabhiyan-scheme

such as low-cost financing, grants, and equity from non-governmental sources. The handful of publicly financed mini-grid projects procured by UPNEDA does not run on a commercial basis.[14]

The development of enterprises for livelihood generation would require mini-grid developers to get engaged with the community in their local planning activities and provide services beyond electricity which is both time-consuming and cost-intensive. Thus, the participation of the private sector was essential for the proliferation of solar mini-grids within the state to expedite the path of economic development. The policy support puts Uttar Pradesh as a state to make off-grid rural electrification a legitimate, mainstream business. It reduces policy uncertainty and enhances access to domestic and global commercial capital for the industry.

2.2 Solar mini-grid business model

The policy & regulatory environment certainty has been able to attract private sector participation to accelerate solar mini-grids deployment in the state. Rural customers in need of electricity supply, mostly have limited power demand and cannot pay. Some developers are targeting small businesses and industrial users alongside, residential consumers, to increase the average level of revenues and hence profitability. An increasing number of developers are looking into opportunities to supply C&I customers or other business customers with large predictable loads (e.g., for irrigation pumps and cold storage) while also using the mini-grid to provide electricity to residential customers. This increases the utilization rate of the mini-grids and reduces risks, hence lowering the cost of electricity and increasing profits for the developer. DESI Power and OMC Power are pursuing this approach in India. These plausible business models are referred to as "ABC" and its variants, which are briefly discussed. Other notable developers in this area are Freespanz, Husk Power, and Tara Urja. Developers may limit mini-grid connections to high-demand customers in a small catchment area and offer solar home systems to low-demand customers further afield. The aforementioned companies develop mini-grids in one of three broad categories[15]:

- The 'ABC' model developed by OMC Power (OMC),
- The 'tier 1' model developed by Mera Gao Power (MGP), and
- Mini-grid models that provide productive power at a micro-enterprise scale (as well as services for households), such as Husk Power and TARA Urja

This case study is highlighting the ABC business model for solar mini-grids which has been successfully providing reliable, clean, affordable power to small and medium businesses and households, in the state of UP.

OMC's Power, formerly known as Omnigrid Micropower Co. Pvt. Ltd, ABC-based mini-grid delivery model has ensured resilient rural electrification as a means of economic development in rural areas. The concept of

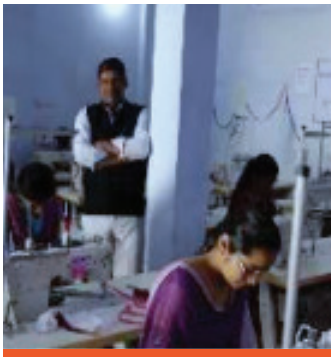
[14] https://openknowledge.worldbank.org/bitstream/handle/10986/29021/ESM-fUttarPradeshMiniGridsCaseStudyConfEd-PUBLIC.pdf?sequence=1&isAllowed=y

[15] https://openknowledge.worldbank.org/bitstream/handle/10986/29021/ESM-fUttarPradeshMiniGridsCaseStudyConfEd-PUBLIC.pdf?sequence=1&isAllowed=y

OMC`s business model has been consistent with the theme of "ABC" by addressing the 3 key segments: the "**A**" anchor, "**B**" business, and "**C**" community. The long-term power purchase agreements with one of the largest telecom tower company (Anchor load) have ensured positive and stable cash flows to solar mini-grids.

To address these segments, the company has been innovating across technologies and models over time. The innovation and optimization undertaken have enabled the business model to be framed with different variants to address the dynamic requirement of each location. These variants have enabled the infrastructure architecture to be standardized while maintaining cost efficiency as well as ease of operation. The four (4) main architectural variants are discussed below.

Clean and reliable energy access to 'A'nchor customers. (Telecom towers)



Reliable and customised packages for 'B'usinesses. (small and medium scale rural businesses)

Affordable and reliable energy to 'C'communities (rural households) through our smart mini-grids.

Variant O-Original

"ABC"-Model

- Balanced risk allocation
- maximum outreach through Anchor, Business & Commodities

Variant 1 Outdoor & RMS

"A" Only Model

- Cost optimization
- Outdoor plants
- Faster rollout (Plug & Play)
- Subsequent expansion to BC

Variant 2 Diesel Free

"B&C" Model

- Realization of "Diesel Free" clean plants
- Stable profitability
- Standalone business case with "B&C" only segment.

Variant-3 Energy + layered Service

"Evolved ABC" Model

- Layered services
- Conversion of clear energy to Clean Services
- Maximization of per plant value addition and impact to communities

Figure 8: Architectural of Variants of ABC Model

Table 2: ABC Model and its Variants

No.	Business Model	Focus Area	Customer Segments
1	ABC	Energy Services	Anchor – Telecom Tower(s) Business – Micro Enterprises/Workshops etc. Community – Homes, small shops, etc
2	A-Only	Energy Services	Telecom Tower(s)
3	BC	Energy Services	Business – Micro Enterprises/Workshops etc. Community – Homes, small shops
4	Evolved ABC	Energy + Layered Services • Clean Drinking Water • EV Charging • eHealth, Remote Tele-Diagnostics • Micro/Mini Cold Storage	Anchor – Telecom Tower(s) Business – Micro Enterprises/Workshops etc. Community – Homes, small shops, etc.

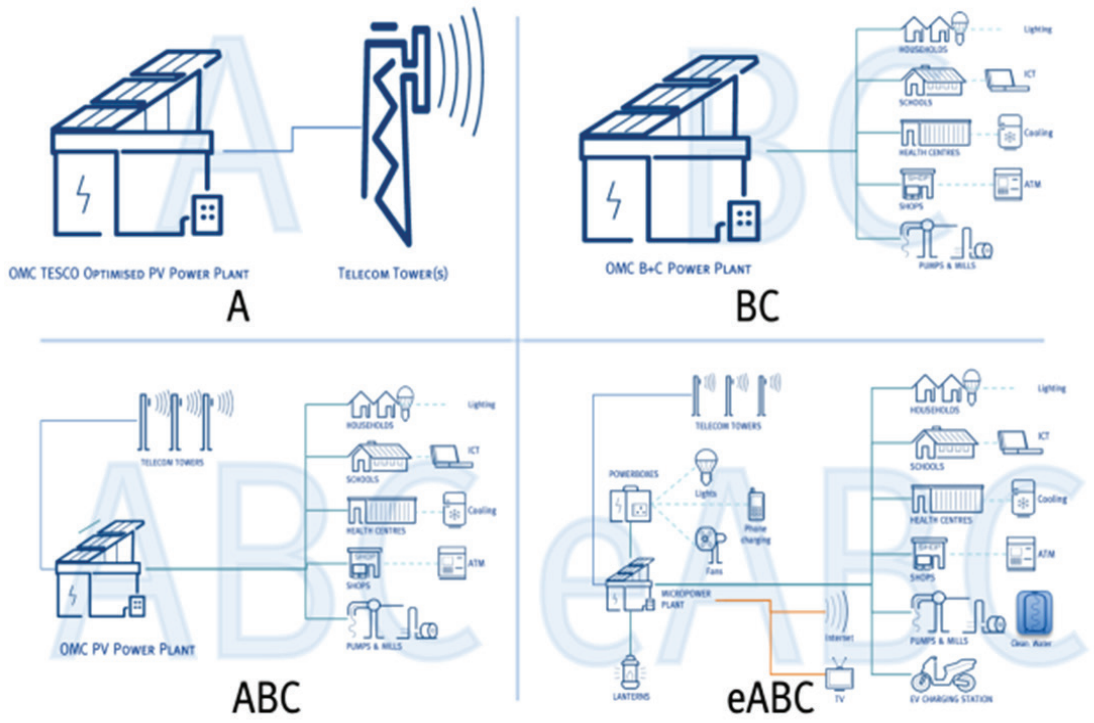


Figure 9: Schema for the deployment construct for the different variants

The unique "A-B-C" business model sets it apart from competitors by simultaneously serving telecom, businesses, and households. Solar power plants ranging from 25 to 100 kW are installed in rural areas depending on the customer requirement. 'A-B-C' model consists of:

1) **'A' – Anchor loads are telecom towers (in this case) that provide for stable, long-term, predictable revenues through PPAs**. The PPAs typically range from 10 to 15 years. In the PPAs the tower company agrees to not source power from any source other than the state electricity grid or other players in the market, which further guarantees the demand. As a hedge against rising diesel costs, the PPAs price is typically partly indexed to the diesel price. The bankable PPAs and guaranteed anchor load and early cash flows make the tower segment an essential part of the ABC model.

2) **'B' – Essential businesses and commercial customers, such as small and medium enterprises, shops and small shopping centers, malls, banks, fuel stations, hospitals, and colleges**. Early experience shows great promise for serving business customers. The "productive load" segment spans a broad continuum between the anchor load and community customers. Some of the larger commercial customers such as petrol pump operators sign bankable PPA arrangements similar to the mobile towers. Others, such as an individual village micro-entrepreneur with a sewing machine, are closer to the household customer in nature but may need a larger and more flexible load. The nature of the business customers varies significantly across sites.

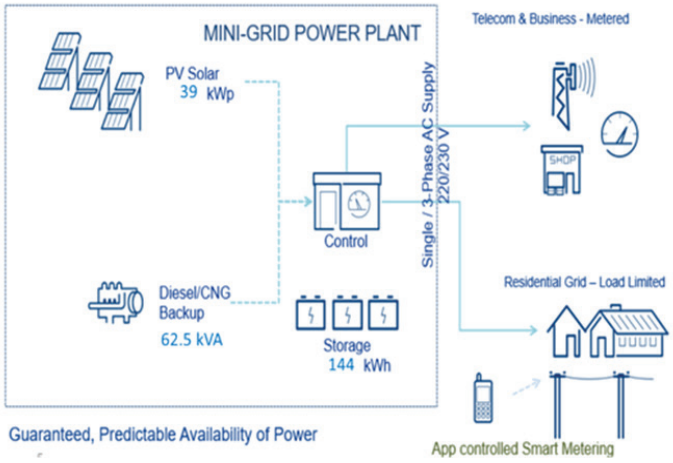
3) 'C' – Community households – **rural household customers** can choose between different **pre-paid power packages** for lighting, mobile charging, and appliances. Most rural households can afford reliable clean electricity, many for the first time. Some relatively better-off customers go straight to larger pre-paid packages or even a metered connection up to 2 kW and beyond, while others replace their kerosene budget with the lowest package consisting of one LED light bulb and a mobile charging socket for six hours every evening.

On average, such a 'ABC Model' mini-grid plant serves 1.2 telecom towers, about 5-10 metered business customers, and about 200-500 households. The 'A' and 'B' customers are migrating from diesel to electricity as their primary source of energy. Increasingly, there is evidence of new businesses also starting up because of the new access to reliable power, hence leapfrogging from no energy to clean energy. Most households ('C' customers) are migrating from kerosene lamps, candles, and cumbersome off-site charging solutions for mobile phones or batteries, to clean energy and efficient lighting. A smart load limiter controls the amount of power that each customer can pull from the grid. The load limiters are set not only to provide the right amount of power but also to provide power exactly when the customer wants it (e.g., two hours during the day and four in the evening). The smart load limiters also have the significant added benefit of avoiding theft.

[16] Source: OMC Power

SNAPSHOT OF 'ABC' MODEL BASED BILGRAM HYBRID SOLAR MINI-GRID PROJECT IN UTTAR PRADESH, INDIA

The solar hybrid mini-grid system installed under the ABC model in Bilgram is illustrated in the figure below, Bilgram is a small town in Hardoi district in the state of Uttar Pradesh, India. The project has been an outcome of an investment from Promoters Group, Mitsui & Co.Ltd, Khattar Holdings Pt Ltd, The World We Want Foundation, Mr. Vallabh Bhanshali, and debt from Rockefeller Foundation, RBL Bank, Sumitomo Mitsui Banking Corporation.



a) Connected Load - 11.5 kW
b) Maximum Load - 14 kW
c) Load Limit for individual: Residential Consumer: 15 W – 20 W, depending on the package Commercial Consumer: 30 W – 40 W,

Anchor Load:~ 6kW on telecom towers

d) Percentage Load Share for each type of load:
   - Residential: 4% (x25)
   - Commercial: 44% (x 159)
   - Anchor: 52% (x2 Telecom Towers)

e) Operational duration: 24x7

Attractive Payback Period–5 to 7 years
Internal Rate of Return–25% to 35%

- **Goal:**

  To provide guaranteed, reliable power across the various (Anchor, commercial and residential) segments of consumers.

- **Services provided:**

  Primarily, mini-grid provides solar-generated electricity to Telecom customers in case of the non-availability of the grid or an outage. The diesel generator is kept as a last resort to power telecom towers.

  Ensuring the Telecom Customers achieve 100% service level agreements despite erratic power supply. The Service Level Agreements require up to 99.95% uptime, with severe penalties for non-compliance.

The power outages may last up to 14 hours a day on some instances

- **Economic Benefit to the Anchor Load Consumers:**

  Solar-generated electricity is a better substitute for diesel from both economic and environmental perspectives. Telecom customers can achieve 20%-30% cost savings due to a reduction in diesel consumption and also help in reducing GHG emissions.

- **Business Modality for micro-Enterprise and Residential Load Consumers:**

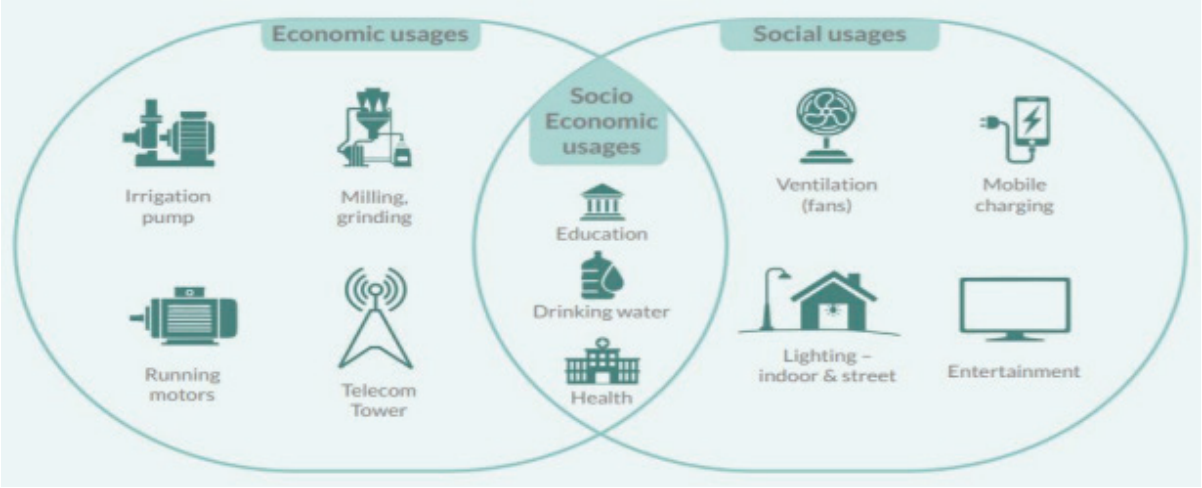
  Usually, pre-paid packages are offered at INR 125-199 /month (USD 1.5-USD 2.7) for a 15 W load, which is sufficient to light 1 LED bulb (provided by the developer) and charge a mobile phone. Initially, households preferred to choose the basic packages and then gradually move up the energy ladder by subscribing to the round-the-clock post-paid energy connection. The packages offered include pre-paid packages of 15W, 20W, 40W, 50W, 60W, 75W, 140W, 250W, and 499W, as well as metered (post-paid) packages up to and beyond 2kW.

3

Social Impact Assessment of Solar Mini-grids

In order to develop a viable business model for solar mini-grids, a balanced approach towards the economic and social benefits is required.

The economic and social usage enabled through the ABC model based solar mini-grids can be categorized as:



Source: RF-OMC Impact Assessment study

As part of the independent impact assessment conducted by the Rockefeller Foundation, in 2019, the facets for around 200 solar mini-grid projects of OMC power that stand out and catalyze impact on ground include:

The ABC model type of solar mini-grid projects are well in line with the pathway to net-zero and sustainable development goals as they contribute to curtailing GHG emissions by providing reliable, clean, affordable power to small and medium businesses and households. Through improved energy access, such projects can bring a positive and visible change to women's empowerment, safety, and security of women, job creation, economic development of the community by enabling business and entrepreneurship. The power served is clean, reliable and affordable as compared to conventional sources of energy such as biomass, kerosene, diesel gen-sets and leads to cost savings across all customer categories. The figure below briefly showcases a comparison of pre and post-installation of mini-grids in terms of resource-based consumption, use of diesel in DG sets, and kerosene for lighting purposes has been reduced drastically.

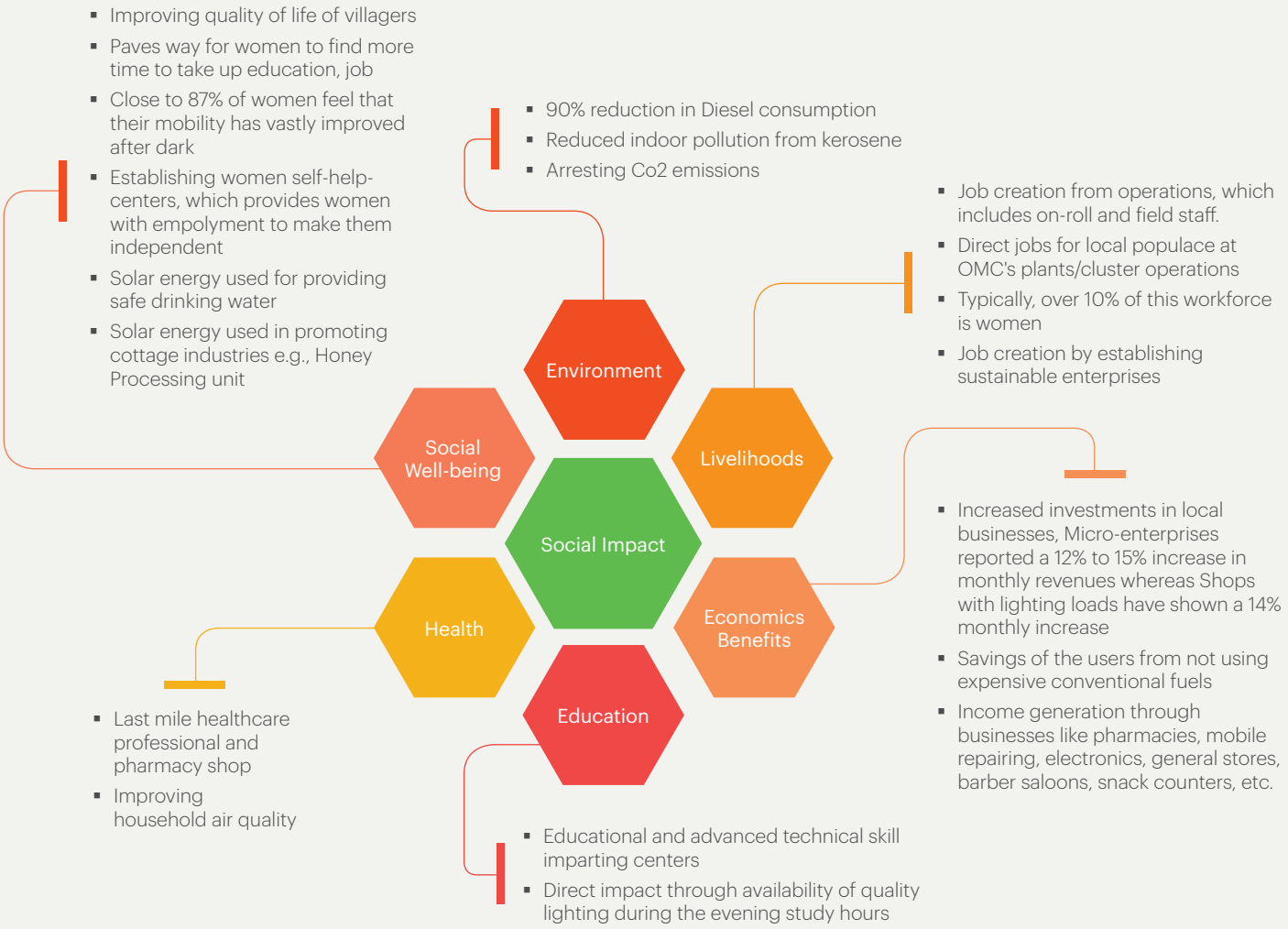


Figure 4: Social Impact of Mini-grids in Rural Set-up

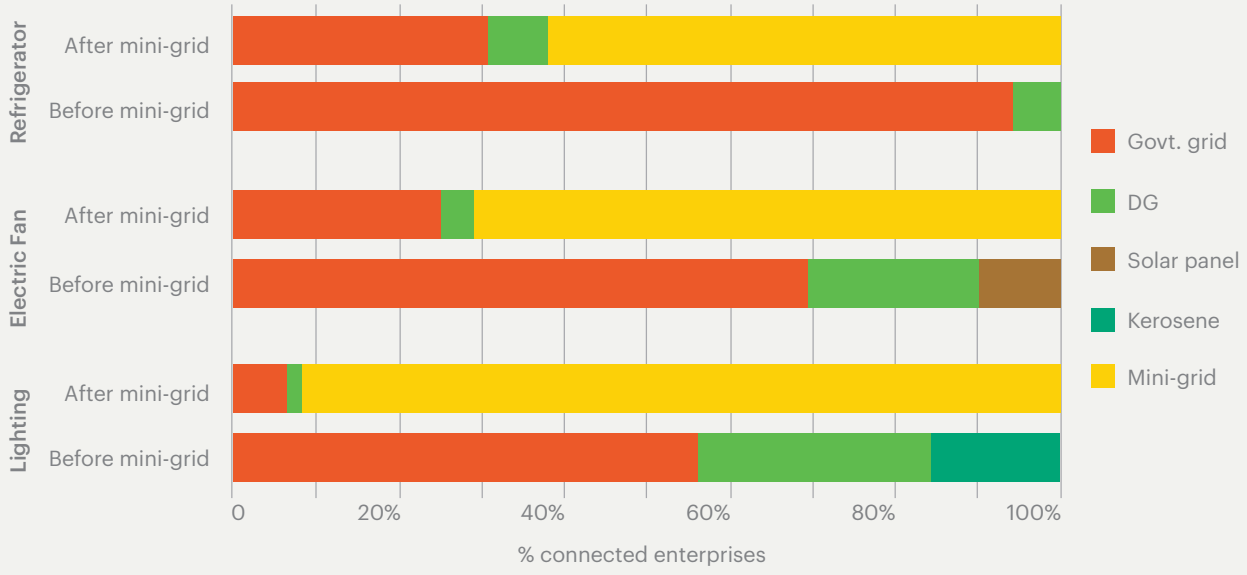


Figure 5: An illustrative view of the preference accorded to mini-grid given its resilient supply

SUPPORTING MICRO-ENTERPRISES

- OMC has enabled community empowerment/ development initiatives in its geography of operation, including a women's self-help center in Kamlapur that offers women with employment to help them become independent.

  The 25-woman garment factory is powered by the solar mini-grid electricity and utilizes the same amount of power as telecom towers.

Figure 6: Garment manufacturing under a women's empowerment scheme in Kamlapur

- Mr. Mehendi Hassan, a customer at the OMC Pipargaon plant, runs a barbershop in a roadside shack on the edge of the road and was just able to make ends meet with a meager income of INR 2,500 per month. When the solar mini-grid started its operation in July 2015, Hassan was an early customer for a pre-paid lighting package which enabled him to keep his business open longer, with a corresponding increase in income. Subsequently, Hassan upgraded to a 24x7 post-paid connection and, with the help of OMC's partner network, added appliances like trimmers. Today, with an income of INR 8,000 per month, Mr. Mehendi Hassan is a satisfied customer with a steady and adequate income and employs his siblings also.

Figure 7: Mehendi Hassan's Barber Shop in Pipargaon

4 Key Observations

Following are the crucial observations from the case study:

4.1 Solar mini-grids have applications beyond electricity access

Solar mini-grids are seen as a convenient solution to provide electricity access in areas where the main grid is not available, or it is expensive to extend the grid to such areas. Because of these reasons, in remote locations with limited or no grid availability, stand-alone systems were given preference over the main grid to provide immediate electricity access to the rural households who could not get electrified in the first phase of the national electrification program.

However, for essential businesses to prosper, the reliability and quality of electricity supply are equally significant. Some businesses are the backbone of economic development in any country such as fueling stations, telecom towers, schools, health facilities, etc. Solar mini-grids in sunshine countries through innovative business models with the right blend of financing is a key to reducing the friction on the path of economic development. The regions such as Africa, the Middle East, developing Asia, Latin America, and Small Island nations should examine the applicability and replicability of such proven business models to accelerate the path of economic development.

4.2 Involvement of local communities in scaling up of solar mini-grids

Mini-grid developers must engage with the community in their local strategic planning and provide services in addition to electricity, addressing the socio-economic concerns such as electrifying school building, providing community-based water pumping solutions and installing streetlights to ensure safe movement of locals at night, etc. Such measures contribute to the development of a positive narrative among the locals and increases the willingness of potential consumers to get benefitted from the offered solution.

4.3 Scalability of the business models

The implementation of ABC model, highlighted in this case study, is unique in terms of a wide range of replicability. It is not always necessary that the mini-grid derives sustainability from anchor load – telecom towers. The economic sustainability could also come from other essential businesses such as health facilities, schools, fueling stations, Agri-chain applications, education centers, banks, and ATMs, etc. which is the second category of load, 'B' – Essential businesses and commercial customers. Such loads are either easy to find or could be culminated through community engagement exercises. The economic viability of such mini-grids may differ on a case-to-case basis. Thus, site selection and community engagement are two key pillars to the success of the project.

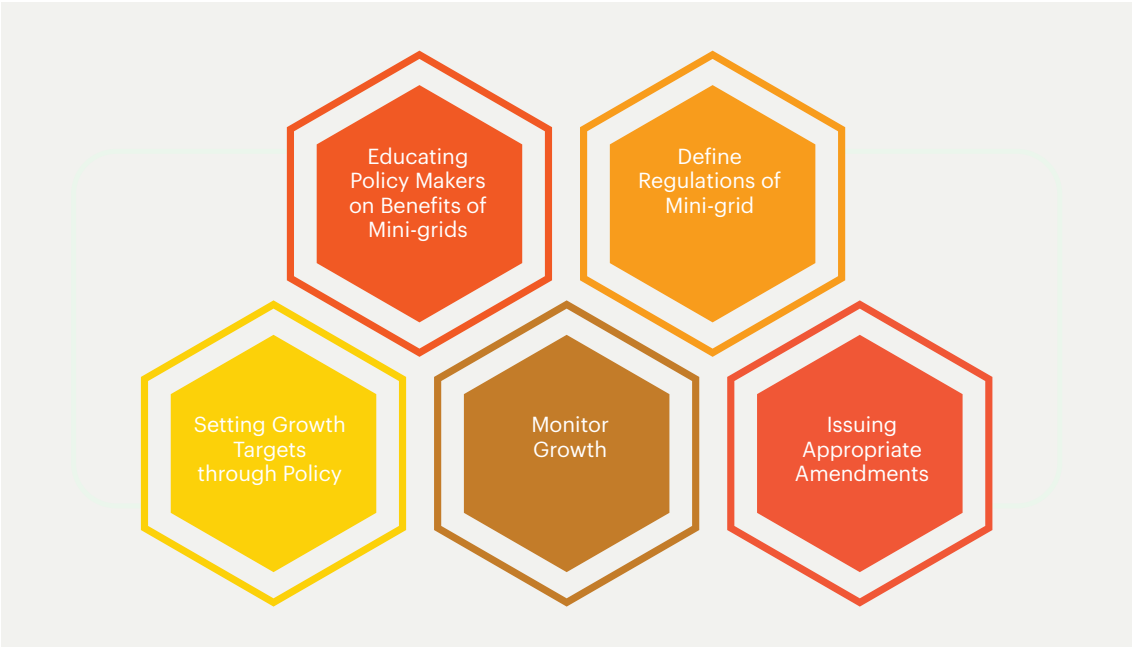
4.4 Partnerships are necessary to reduce initial risk and facilitate financing

Creating such a huge footprint and scalability of solar mini-grid requires collaboration and funding arrangements. Most of these projects are an outcome of joint efforts of various entities including funding agencies, investors, and technical leaders in the sector.

National and international development finance institutions (DFIs) have a key role to play specifically in the African region, SIDS, and Latin American regions to provide initial funding support to engage the private sector by providing concessional financing support. They are usually majority-owned by national governments and source their capital from national or international development funds or benefit from government guarantees. This ensures their creditworthiness, which enables them to raise large amounts of money on international capital markets and provide financing on very competitive terms.

4.5 Adequate policy and regulatory support is essential for attracting private sector interest

A conducive policy & regulatory environment would keep mini-grid developers motivated through ensured returns on investments. The whole process could be segregated into the following steps:



A mini-grid policy should have rational growth targets in terms of aggregated capacity with specified timelines. It should include a monitoring mechanism; a data repository should be created which should be updated by the concerned renewable energy agency in specified intervals. It should offer appropriate incentives through appropriate channels depending on a case-to-case basis to bring mini-grids under the regulatory purview with defined minimum supply & operational standards and attract private investment at the same time. Moreover, such policy should be based on inputs of all key stakeholders including different categories of consumers, electricity distribution companies, developers, and concerned government agencies.

Although ABC is an effort-intensive model for countries to adopt, with the right kind of joint efforts, coordination among stakeholders, and investment, countries could not only consider it to rapidly expedite electricity access within limited financial resources but also improve the existing reliability and quality of electricity supply to prosper essential businesses and enterprises within rural communities.

CONTACT US
International Solar Alliance Secretariat
Surya Bhawan, National Institute of Solar Energy
Campus Gwal Pahari, Faridabad-Gurugram Road,
Gurugram, Haryana – 122003, India
Email: info@isolaralliance.org