LARGE-SCALE MINI-GRIDS

Product Catalogue - 2014

Prepared by MicroEnergy International GmbH
with the collaboration of Davide Forcella (CERMi-ULB)

EUROPEAN MICROFINANCE PLATFORM
NETWORKING WITH THE SOUTH

e-MFP ACTION GROUP
ON MICROFINANCE
AND ENVIRONMENT

Description and Working Principle

Large-scale mini-grids are power infrastructures that provide energy services in rural and peri-urban areas where the main grid has not yet reached and is unlikely to do so in the near future. Relying on available local resources, energy can be generated from different renewable energy technologies (RETs), such as solar, wind, hydro or biomass. Depending on how fluctuating the electricity generation from this resource is, battery storage systems and diesel generators can be included in the mini-grid. The system's design and implementation nature and their integration into the existing infrastructure divide mini-grids into greenfield and brownfield types. Furthermore, mini-grids can potentially be interconnected to the main grid. Large-scale mini-grids usually operate as an AC system. This allows the usage of a wide range of domestic appliances, such as light bulbs, mobile chargers and information and entertainment technology, as well as powerful productive appliances with motors for agricultural and semi-industrial activities such as fridges, freezers, power tools and pumps.

Technical Characteristics

Target group	Rural off-grid villages/towns, islands
System size	10 kW to 5 MW
Fuel type needed	Normally hybrid between diesel / solar irradiation / water flow / wind / biomass
Fuel replaced	Diesel
Preparatory work	Current and forecasted load profiles, commercial scheme including power or energy tariff calculation, detailed design, costing, environmental impact, social impact, implementation, operation and management
Role of user	Smart usage - demand side management training necessary
Lifetime	Approx. 20 years if well sized, operated and maintained. Replacement of battery will be necessary at least every 8 years.
Electricity price	Approx. 0.6 -1.3US$/kWh, depending on location and technology

Ease of Distribution, Installation and Maintenance

Large-scale mini-grids are robust systems, usually providing a considerable amount of power and requiring a significant level of knowledge on different fields. As a consequence, a strategically defined business model, including operation and maintenance (O&M) services, is a key factor for guarantying the sustainable long-term development of the system, optimizing its lifetime.

Depending on the system's configuration as well as the geographical area in which it is implemented, different technical, economic, legal, social and environmental factors will apply, which shall determine the operational model of the mini-grid. This can be from a community-based model, to private- or utility-based as well as combination models. The installation, operation and maintenance contracts will be defined based on these structures and should ensure enough financial resources and high technical capabilities to implement and manage the project. A close relationship with the community should be established to avoid risky issues arising and the inclusion of training and capacity building is recommended in order to optimize the system's lifespan. This should particularly focus on future technicians who will be in charge of the operation and maintenance services of the mini-grid infrastructure and should also integrate the community from the beginning of the project development.

Technology Options

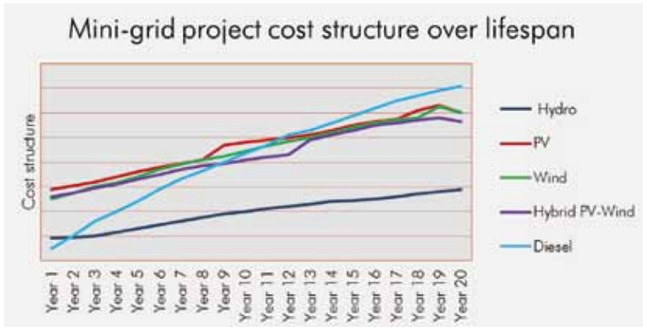
Several clean energy generation and storage technologies can be used. These hybrid systems are commonly selected thanks to the synergistic connection between different renewable and conventional fuels. Smart metering technologies at the end of the distribution network ease the implementation of the desired billing and tariff system, which will depend on the established business model. Furthermore, demand side management strategies can be implemented by using smart meters.

Price Range

The price range associated with a large-scale mini-grid varies according to the following factors:

- Local natural resources – most adequate technology or technologies.
- Required system size (number of connections, energy demand, and peak power demand).
- System configuration (use of batteries and/or hybrid mini-grid).
- Fuel price dependence.
- Associated O&M costs.
- Desired hours of operation.

Figure 1: Costs associated to a mini-grid over its lifespan.



Source: Alliance for Rural Electrification.

Table 1: Case scenario conditions.

Local natural conditions and mini-grid service characteristics	
Hours of service	24
Energy demand	270 kWh/day
Peak power demand	26 kW
Solar insolation	6 kWh/m2/day
Average wind speed	5 m/s
Hydro resources	80 L/s
Oil price	USD $0.70/L

Source: Alliance for Rural Electrification.

Table 2: Component's price based on conditions.

Estimated cost of components	
Genset	USD $400/kW
Small wind turbine	USD $2,120/kW
PV	USD $2,800/kW
Small hydro	USD $1,790/kW
Battery	USD $225/kW
Converter	USD $1,445/kW

Source: Alliance for Rural Electrification.

In order to provide a reference for the size of the up-front capital expenditure of a large-scale Mini-Grid, a case scenario is presented below including the type and amount of resources available. According to those resources, an approximate cost per technology is also presented. This only refers to the capital expenditure required to install the equipment. However, due to the weight or proportion of operation and maintenance costs, as well as fuel costs (in the case of a diesel based Mini-Grid), also presented is the cost structure of a mini-grid over its lifespan. For this, different sources (see Figure 1) are considered to run the Mini-Grid.

A financial institution can be interested in providing loans for devices directly targeting end-users. Examples for this segment are:

- Metering technology: Pre-paid and remotely controlled meters (will depend on the business model) ranging in price from USD $100 to USD $250.
- Load limiters and securing electrical installations: This part includes fuses, miniature circuit breakers, PTCs thermistors, and electronic circuit breakers. These devices range in price from USD $5 to USD $30.

Connection fee: Connection fees are usually applied to end-users willing to connect to a Mini-Grid. The price of such a connection varies according to the location. For instance, the connection fee for a mini-grid in Bangladesh is 5,000BDT (~USD $65).

Type of Financing

Considering the high costs of components for large-scale mini-grids, microfinance instruments are viable only in the case of syndicated loans, i.e. when several microfinance institutions (MFIs) jointly participate in financing the system. In this case, risk-sharing and combined resources and competencies of MFIs may facilitate project implementation. For financing system components, financial microleasing is the most suitable option.

Economic and Social Impact for End-users

Large-scale mini-grids can support the socioeconomic development in under- or non-electrified communities, not only to satisfy the basic needs of the households, but also to use more powerful appliances that have an impact on the quality of service and comfort. On the one hand, learning and working during night time become possible, while information and entertainment technologies improve the level of social connectivity. On the other hand, a more reliable energy access brings the possibility of using bigger agricultural and industrial appliances for productive use, supporting the creation of jobs within the community. Furthermore, a reduction of the every-day physical work of the population could be achieved through devices such as water pumps requiring a reliable electricity supply.

Benefits for the MFI

Financing of large-scale mini-grids by MFIs will bring these institutions to a brand new level of their product portfolio management and technical as well as financial expertise. Cooperation with other MFIs to make this product available to communities will also involve knowledge sharing, risk sharing as well as more favorable after-sales service. Moreover, it also provides an individual institution an opportunity to extend their product offering to financing metering devices and connection fees.

Environmental Benefits

Environment: it reduces particulate emissions and pressure on natural resources used to produce electricity. It reuses wasteland and it reduces waste coming from dry batteries and leakages from kerosene or diesel.

Climate change mitigation: it reduces greenhouse gas emission.

Climate change adaptation : it reduces the vulnerability to electricity and fuel price volatility, and it reduces the vulnerability to volatility in energy provision.

Potential positive synergies with: efficient air conditioner, and energy efficient refrigerator.[1]

[1] For further information on potential synergies check the other product catalogues for EE and RE technologies.

European Microfinance Platform

The European Microfinance Platform [e-MFP] was founded formally in 2006. e-MFP is a growing network of over 120 organisations and individuals active in the area of microfinance. Its principal objective is to promote co-operation amongst European microfinance bodies working in developing countries, by facilitating communication and the exchange of information. It is a multi-stakeholder organisation representative of the European microfinance community. e-MFP members include banks, financial institutions, government agencies, NGOs, consultancy firms, researchers and universities.

e-MFP's vision is to become the microfinance focal point in Europe linking with the South through its members.

e-MFP Microfinance and Environment Action Group

e-MFP Action Groups facilitate synergies among e-MFP members and encourage them to implement activities together, thus contributing to the advancement of the microfinance sector.

The aim of the e-MFP Microfinance and Environment Action Group is to bring together microfinance practitioners to discuss and exchange experiences in dealing with environmental issues and to create new practical tools to advance environmental microfinance. The Action Group is also intended to act as a think tank that disseminates its results among e-MFP members and the microfinance sector at large with a view to increasing the awareness of and commitment to act on these issues. It is meant both as an internal knowledge-sharing and external awareness-raising platform that serves as a reference in the microfinance sector.

Head of the Action Group: MicroEnergy International GmbH, www.microenergy-international.com

European Microfinance Platform
39 rue Glesener
L-1631 Luxembourg
Tel: +352 26271382
contact@e-mfp.eu
www.e-mfp.eu

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