

# KNOWLEDGE NOTE



## Increasing Rural Energy Access through Mini-Grids

### CONSIDERATIONS FOR MINI-GRID SYSTEMS:

#### Policy and Regulatory Framework

- Ensure alignment with rural development goals
- Reduce transaction costs by simplifying licensing and approval schemes
- Set suitable tariffs and subsidies that, for example, cover systems and replacement costs

#### Technical

- Secure sufficient primary energy resources
- Design based on careful considerations of local context, as well as energy demand and energy supply
- Invest in technical assistance mechanisms that lead to technology development and manufacturing

#### Financing and Resources

- Source and secure sustainable finance to cover operational, maintenance, and management costs

#### Stakeholder Engagement and Capacity Building

- Ensure all relevant stakeholders (e.g. government, local residents, and enterprises) are engaged in project design and development consultations
- Ensure access to information and training for sustainability of project/program

Source: GVEP International. 2011. The history of mini-grid development in developing countries.

*Increasing rural energy access remains a major development challenge. Extending the grid to rural areas is often costly, unlikely to be prioritized over major public works projects, or simply economically unfeasible due to high dispersion of the rural population. For many pilot countries participating in the **Scaling Up Renewable Energy in Low Income Countries Program (SREP)** under the Climate Investment Funds, mini-grids offer a promising solution for providing energy access to rural communities.*

More than 1.4 billion people worldwide do not have access to electricity. Roughly 85 percent of these people live in rural areas and a large proportion are in Africa<sup>1</sup>. To date, many utilities and governments have been unable to meet the energy needs of rural areas, as the focus has often been on meeting the demand of major industries or highly-populated urban areas. Consequently, mini-grids supplied by isolated power sources

<sup>1</sup> International Energy Agency (IEA). (2010) Energy Access: How to make modern energy access universal. Retrieved from [http://www.worldenergyoutlook.org/media/weowebsite/2010/weo2010\\_poverty.pdf](http://www.worldenergyoutlook.org/media/weowebsite/2010/weo2010_poverty.pdf)

hold promise as a low-cost means of providing rural energy access.

The SREP is helping eligible pilot countries expand energy access and stimulate economic growth through various renewable energy technologies and systems, including mini-grids. To date, more than \$90 million—amounting to nearly a quarter of the investments in the SREP portfolio—has been allocated for the development of mini-grid systems.

### LESSONS LEARNED

Although there are numerous approaches to mini-grid system development, the most effective are 1) designed with local context in mind, including socio-economic, energy resource, and human capital conditions; 2) structured with sustainable and robust finance models that adequately meet operational, maintenance, and management costs; and 3) supported by appropriate national institutions and policies that effectively



## COUNTRY EXAMPLES

In **Kenya**, the SREP-funded Hybrid Mini-Grid Systems project aims to increase the amount of renewable energy in existing and planned mini-grids up to 30 percent. The private sector will be invited to participate in the hybrid projects under a subsidy scheme as a complement to the government's efforts. The project proposes to install 3 MW of renewable systems (solar and wind) in hybrid with the existing diesel generators in 12 isolated mini-grids with a total installed capacity of 11 MW.

**Liberia's** SREP investment plan aims to achieve 35 percent rural electrification by 2030, through the use of off-grid electricity solutions—mini-grids and stand-alone renewable energy services, such as solar photovoltaic—that will supplement the expansion of centralized generation and transmission facilities. The program is expected to benefit 360,000 people (9 percent of the country's population in 2013) living outside Montserrado County, the most populous county and home of the capital.

In **Tanzania**, the SREP contribution to the Renewable Energy for Rural Electrification project will be used to generate a major, rapid increase in rural electrification. The project will offer transaction advisory services, financing, and risk mitigation for 25 renewable-energy mini-grids and 50 micro grids to directly benefit an estimated 47, 500 households, as well as 10 sustainable solar market packages projects to directly benefit an estimated 70, 000 households.

Table 1: Mini-Grid Projects in the SREP Pipeline

COUNTRY	PROJECT NAME	IMPLEMENTING AGENCY	SREP FUNDING US\$ MILLION	SYSTEMS AND TECHNOLOGY CHOICES
Kenya	Hybrid Mini-Grid Systems	World Bank Group	10.0	Hybrid Mini-Grid (solar and wind)
Mali	Rural Electrification Hybrid Systems	World Bank Group	15.4	Hybrid Mini-Grid
Tanzania	Renewable Energy for Rural Electrification	World Bank Group	15.0	Hybrid Mini-Grid/Micro-Grids( options include hydro, solar, biomass, biogas, and wind)
Liberia	Renewable Energy for Electrification	World Bank Group and African Development Bank	41.7	Hybrid Mini-Grid
Nepal	ABC Business Model	World Bank Group	8.0	Hybrid Mini-Grid

incorporate the interests of relevant stakeholders.<sup>2</sup>

The technology behind mini-grid systems varies and can include single generation technologies, such as diesel and hydropower, or hybrid systems that include two or more technologies. For example, the hybrid mini-grid delivery system combines renewable energy sources with dispatchable power (e.g., diesel generation) as a backup. A major benefit of this system is the cost savings generated by the decreased dependence on fossil-fuel inputs and the increased reliability of available power.

In terms of institutional and financial arrangements, mini-grid systems can be owned and managed by the state, private sector entities, or communities. Typically, a combination of different stakeholders is involved in the various operational stages.

Under the SREP, Liberia has explored using a cooperative model. This type of arrangement could work well for small, isolated mini-grid systems that self-generate and supply electricity to the cooperative members or local populations. This is an alternative to a commercial

enterprise that produces its own power that it then extends to local residents, or an independent power producer that sells power to mini-grid systems.

## LOOKING FORWARD

Achieving universal modern energy access will require transformations in how countries conceptualize and finance energy systems. Although the mini-grid space is attracting interest, investment capital has traditionally been limited. Lending institutions have been cautious about providing capital to governments and businesses without strong in-country track records.

Through the SREP, pilot countries are working towards building tangible experience with mini-grid systems that should enable further replication. Sharing the lessons learned through the SREP experience with the wider energy community will be vital to ensuring best practice towards the expansion of modern energy access to rural areas.

**THE \$551 MILLION SCALING UP RENEWABLE ENERGY IN LOW INCOME COUNTRIES PROGRAM (SREP) STIMULATES ENERGY ACCESS AND ECONOMIC GROWTH BY WORKING WITH GOVERNMENTS TO BUILD RENEWABLE ENERGY MARKETS, ATTRACT PRIVATE INVESTMENT, AND TARGET RENEWABLE ENERGY TECHNOLOGIES THAT ALLOW FOR THE GENERATION AND PRODUCTIVE USE OF ENERGY IN HOUSEHOLDS, BUSINESSES, AND COMMUNITY SERVICES.**

<sup>2</sup> USAID and The Alliance for Rural Electrification (ARE). (2011) Hybrid Mini-Grids For Rural Electrification: Lessons