Guidebook

Designing rural electrification programs

A policy design guide for practitioners

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2021

Electrification – from globalities to localities

Since the turn of the millennium, countries around the world have made great strides to expand access to electricity to their populations, increasing overall electricity access from 73% to 90% of the global population in just 20 years.[1] In Sub-Saharan Africa, home of most of those who still lack access to electricity, the expansion of access has outpaced population growth for the first time in 2015. Globally, the total number of people lacking access to electricity has shrunk every year since.[2] In 2020-2021, though, it is expected to increase again as a result of the Covid-19 pandemic.[3] Of the estimated 770 million people worldwide who lack electricity access,[4] over 610 million live in rural areas, the vast majority in Africa.[5] The global rate of electricity access in urban areas is 97%, whereas rural areas lag behind at 82%.[6] Projections by the Energy Sector Management Assistance Program (ESMAP) indicate that if ambitions are not raised, 650 million people will likely still be without electricity access in 2030.[7]

Traditionally, governments have sought to provide energy access through expansion of the central electricity grid. However, grid expansion is a slow process, and tends to be financially and technically difficult in sparsely populated rural areas. Transmission and distribution infrastructure also require constant maintenance, in the absence of which the grid can become unreliable. Thankfully, off-grid renewable energy technology provides an affordable, quick to deploy, reliable and climate-friendly alternative to grid expansion. Worldwide, 420 million people already use off-grid solar technology (primarily solar home systems and mini-grids) for electricity access.[8] To achieve universal energy access by 2030 (Sustainable Development Goal 7), these solutions will need to be deployed at even greater scale, especially in rural areas.

The Covid-19 pandemic has severely disrupted the supply chains and operations of off-grid energy companies. Their business models tend to rely on close personal relationships with customers. Lockdowns have severely impacted their customers' livelihoods and their ability to pay for energy services and hence curtailed

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[1] World Bank Data (2021).
[2] World Bank Data (2021).
[3] International Energy Agency (2020).
[4] International Energy Agency (2019).
[5] Energy Sector Management Assistance Program ESMAP (2019): *Tracking SDG 7: The Energy Progress Report*, Alliance for Rural Electrification; World Bank Data (2021).
[6] The World Bank (2020).
[7] Energy Sector Management Assistance Program ESMAP (2019): *Tracking SDG 7: The Energy Progress Report*.
[8] World Bank (2020): Off-Grid Solar Market Trends Report 2020.

their revenues.[9] Despite these challenges, though, investments in off-grid solar have remained robust.[10]

Rural electrification through off-grid solutions requires a very different approach by governments compared to grid expansion. Governments have traditionally not been directly involved in deploying off-grid energy solutions, which remains the remit of private sector companies. However, to accelerate their growth and help them reach more people, governments can and should work with these companies to develop and implement rural electrification strategies. Off-grid renewable energy companies are still viewed as risky investments and therefore tend to face difficulties attracting financing. Sound government-led electrification plans can help put investors' minds at ease and offer the structure necessary to build vibrant markets and allow companies to build partnerships, secure long-term commitments and investments, and roll out energy solutions at scale.

This guide presents a number of strategies and approaches that provide a starting point for the development of a rural electrification strategy.

The essential components of a rural electrification strategy

To accelerate rural electrification, governments must incentivize and support the private sector by developing regulatory frameworks, policies and mechanisms that create favorable market conditions. Such an enabling environment is also necessary to attract investment.

Based on expert advice and our own experience, we have created a template for the design of rural electrification strategies. The template is flexible, allowing users to tailor their strategy to their country's specific context. Using this template, governments can develop a comprehensive strategy consisting of twelve incremental components, developed in five distinct phases.

Several of the phases provide opportunities for stakeholder consultation and community-level engagement. As rural electrification strategies are designed specifically to reach unserved communities, these communities must be consulted throughout the development process. In addition, the strategy must be results-oriented to be effective and meet the requirements for results-based financing. Furthermore, the government must create an enabling environment for companies and investors for projects to succeed. Finally, commitment and support from the highest level of government are key to building market confidence and consumer trust in off-grid energy technologies.

[9] SEforAll (2020): Identifying options for supporting the Off-Grid sector during COVID-19 crisis.

[10] GOGLA (2021): 2020: Off-grid solar investment remains robust during COVID-19 pandemic.

Phase I: Defining the purpose

- Set strategic goals
- Define socio-economic and environmental objectives
- Set electrification targets
- Establish a timeline (the length can impact investment decisions: rapid implementation would require loans with short tenors, which tend to be more affordable)

Phase II: Data collection

1. Review the current energy access status and assess barriers to electrification

Through a census or similar survey method, assess the current electrification rate, the prevalence of different tiers of energy services, energy usage patterns, energy demand and the capacity of existing energy infrastructure. Next, assess current barriers and challenges to rural electrification. These may include institutional barriers; policy gaps; a lack of agreement between end-users, stakeholders and acting authorities; a lack of private sector supply capacity; technical capacity barriers; environmental considerations; political and financial barriers.

2. Assess demand and create a demand forecast

We suggest employing a bottom-up model based on socio-economic surveys of the area, allowing for an accurate analysis of relevant rural areas and their specific characteristics. Based on this, develop a detailed demand analysis, assess ability and willingness to pay, investigate local preferences and identify relevant market segments. The bottom-up method uses demand profiles from various types of end-users to produce an accurate projection of the demand at the local level, as well as a precise demand growth model. It is also important to gather information on potential productive use of energy (how and which productive purposes).

3. Assess resources

Identify renewable energy potential. Assess the feasibility and weigh the options of different technologies.

Phase III: Planning and analysis

1. Develop an economic analysis

Assess the efficiency, the viability, and the scope of off-grid energy technology options for the targeted areas. Identify the best electrification solution for different areas. Based on the demand analysis carried out in Phase II, determine the optimal tier level to serve these areas in the short, medium and long terms. Prioritization of end-users would also fall under this category.

2. Develop a financial analysis

Calculate the national capex requirements to electrify all currently unelectrified households/institutions, broken down by region. Develop several pathways to universal electrification, at least a basic scenario and an enhanced scenario. An equal distribution mechanism can be employed to ensure equitable allocation of budgets, especially when prioritization is required. Develop an annual forecast of the financial impact of electrification for the duration of the project and forecast the costs for the operator.

3. Define business and ownership models

Explore all potential business and ownership models to identify the most suitable options. All technological approaches and delivery models should be considered. First, determine the organization and ownership of off-grid renewable energy assets – whether they are owned by public utilities, private owners, NGOs, community cooperatives or partnerships between several of these actors. Next, outline the desired financial structures, which requires the setting of tariffs (including connection and consumption fees) and the establishment of subsidies (investment based, connection based, output based, lifeline rates, or operation based). Furthermore, define the customers by distinguishing between domestic users, productive users and public users. Lastly, decide which technology is most suitable for the project and keep in mind that this will influence the choice of business model.

Phase IV: Stakeholder engagement

1. Develop stakeholder consensus on the way forward

Perform a multi-criteria decision analysis (MCDA) to develop consensus on solutions to complicated problems by inviting multiple stakeholders to evaluate different, at times conflicting criteria for these solutions (e.g., for energy generation: what is more important – affordability or capacity?), discuss their different preferences, and rank or prioritize strategies to ultimately come to a decision.

2. Assess the investment environment

Conduct a De-risking Renewable Energy Investment (DREI) analysis to identify the most significant barriers to investment in the off-grid energy sector and rate the effectiveness of various policy instruments that aim to address these.

Phase V: Drafting and preparing for execution

1. Draft policy and regulatory frameworks

A policy gap analysis is recommended to align the electrification strategy with the existing policy and legislative landscape. The regulatory framework should incorporate some of the suggested policy and finance instruments from the DREI analysis. An additional suggested instrument is NREL's Quality Assurance Framework (QAF) for Mini-Grids, which ensures accountability for service provision.

2. Develop an implementation outline

The implementation of the electrification strategy should be coordinated with ongoing sector reforms to ensure maximum impact. The implementation plan can follow any of a number of different templates, but most importantly, it should consist of a sequence of milestones, leading from the inception and approval of the strategy, all the way to its completion.

3. Scope out potential funders

Identify potential funders to support the strategy's implementation and contact these to source funding.