TARIFF-SETTING APPROACHES FOR RURAL ELECTRIFICATION

Presentation by MCG
Rural Electrification Tariff-Setting

April 25, 2018

MEISTER CONSULTANTS GROUP | A CADMUS COMPANY

About MCG-Cadmus

CADMUS

- International technical and strategic consultancy with offices in the United States and Germany
- More than 600 experts in energy, transportation, environment, and other topics

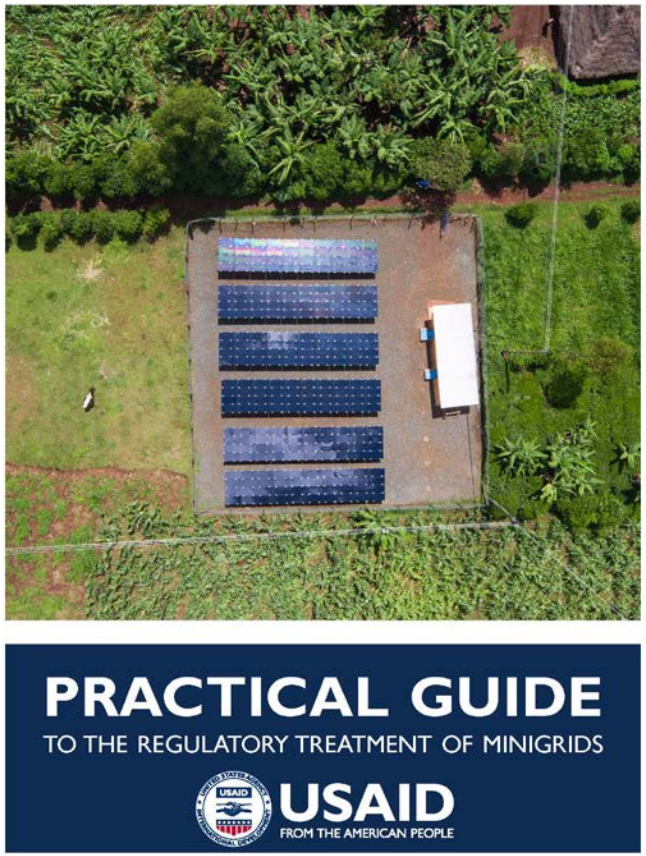
MEISTER CONSULTANTS GROUP | A CADMUS COMPANY

- International sustainable energy consultancy based in the United States
- Frequent collaborator with the World Bank, USAID, GIZ, and other multilaterals on energy planning and development topics
- Acquired by Cadmus in 2017

Key Resource

- **USAID/NARUC Practical Guide to Mini-Grid Regulation** (developed by MCG-Cadmus)
  - Provides detailed guidance on developing a regulatory approach to mini-grids in rural electrification contexts
  - Includes options for 20 key regulatory design decisions, including policy & planning issues, retail tariff decisions, and technical standards.
  - Available at:

    www.naruc.org/minigridguide/



Overview

This webinar will cover…

- Differences between mini-grid and national grid tariff-setting.
- Approaches to determining optimal tariff levels.
- Approaches for setting tariff structures.
- Options for social tariff implementation and consideration of cross-subsidies.
- Illustrative examples in mini-grid tariff setting in international contexts.

Intro to Mini-grids: Why Mini-grids?

- Worldwide **1.2 billion people lack access to modern electricity services**
- **More than half** of could be served efficiently and effectively by remote, isolated mini-grids
- Allow for **different business models** including ownership, tariff design, technology standards and quality of service that can accommodate different country contexts
- Significant interest from national governments, international donors, and private firms in mini-grids
- Significant investment is needed for mini-grids – **USD 20 billion annually**
- Mini-grids **must be commercially viable** to attract **private sector investment**
- Requires mini-grids to be able to **cover their costs** and **earn a reasonable rate of return** through **tariff collection and/or subsidies**

Intro to Mini-grids: Costs & Revenues

Costs

- Project development and investment
- Generation and distribution equipment
- Operations, maintenance and management

Revenue Streams

- Connection fees
- Electricity tariffs
- Grants/subsidies

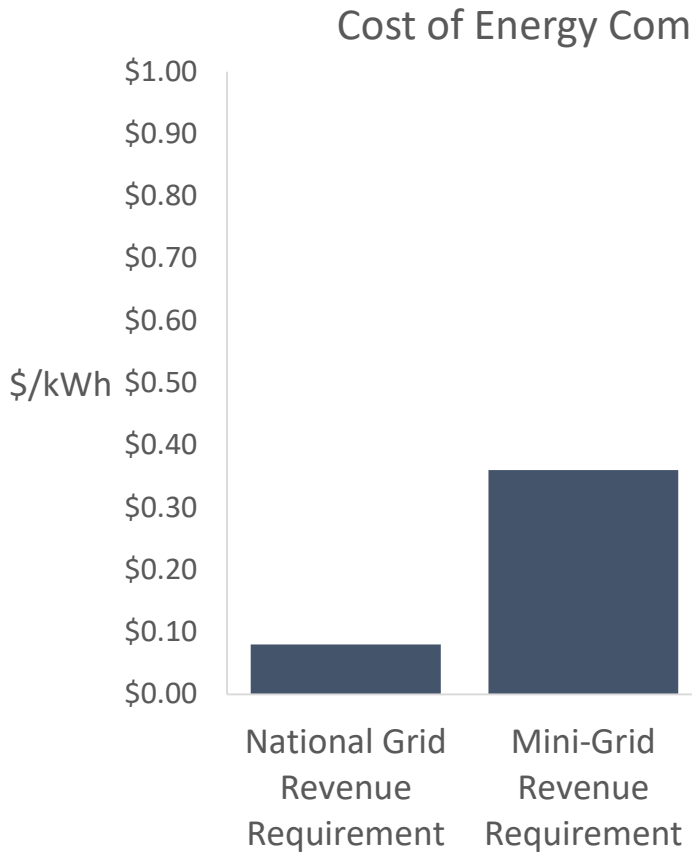
Revenues of mini-grids are dependent on:

- Demand for electricity
- Affordability of connections and tariffs

To be commercially viable, revenues need to cover project development, investment, equipment as well as the operations, maintenance and management costs.

Intro to Mini-grids: National Grid vs Mini-grid

- Mini-grids tend to require higher per-kWh revenues than national grid utilities due to:
  - The decreased economies of scale of a mini-grid
  - The remote nature of mini-grid service areas
- **Example:** Mini-grids in Nigeria charge higher retail tariffs than the main grid (2015 data):
  - Main Grid Tariff: USD $0.08/kWH
  - Avg. Mini-Grid Tariff: USD $0.36/kWH
- Compared to non-grid energy sources (Kerosene lighting, mobile phone charging, etc.), mini-grid tariffs still provide substantial value to customers



Source: World Bank. 2017. Mini Grids in Nigeria: A Case Study of a Promising Market.

Intro to Mini-grids: Stakeholder Perspectives

Mini-grid Developer

- Recover capital and operational costs
- Ensure a return on their investment
- Long-term predictability (e.g. 10 yrs or more)
- Affordable for customers

Investor

- Ensure a return on their investment
- Long-term predictability and certainty

Regulator

- Tariffs are fair and reasonable
- Mini-grids recover costs and earn a reasonable rate of return
- Affordable for customers
- Protect customers

Policymaker

- Meet rural electrification goals
- Affordable for customers
- Politically favorable

Mini-grid Tariff Setting: What is an Optimal Tariff?

1) Ensures mini-grids are able to earn a reasonable rate of return, and recover costs
2) Ensures customers rates are affordable
3) *Politically feasible*

Most Common Tariff Levels

Uniform National Tariffs
All customers in the same tariff category (e.g., residential, commercial, industrial) pay the same retail tariff, no matter where they live or how they receive their electricity (i.e., from the national grid or a mini-grid).

Avoided-Cost Tariffs
When customers transition from other energy sources to the mini-grid, their bills are equal to or below what they would have paid for past energy purchases (e.g., kerosene for lighting).

Cost-Reflective Tariffs
Tariffs allow mini-grid operators to recover their full capital and operating costs and receive a defined and reasonable return

BEST PRACTICE

Mini-grid Tariff Setting: What is an Optimal Tariff?

Uniform Tariffs

Benefits

- May be politically preferable
- Ensures that rural customers will not pay more for electricity than urban customers.
- Generally viewed as a fair and equitable approach, and is easy to communicate and justify to customers.

Drawbacks

- **Often insufficient for mini-grid developers to recover their costs**
- Will need subsidies to make up the difference between revenues and costs – often termed the viability gap
- Without a supplemental revenue stream to close the viability gap mini-grid investment may be discouraged

Mini-grid Tariff Setting: What is an Optimal Tariff?

Avoided Cost Tariffs

Benefits

- Ensures that customers will either
  - Save money
  - Will at least receive better services for the same or less level of expenditure

Drawbacks

- Must study the costs in question, which can be difficult to ascertain.
- Runs the dual risks of (1) setting a rate that is too low for developers to fully recover costs or (2) setting a rate that is too high and unaffordable for customers and more than what developers actually need to recover costs.
- Mini-grid customers are likely to pay more for electricity than national-grid customers.

What is an Optimal Tariff?

Cost Reflective Tariffs – Best Practice

Benefits

- Most effective option for incentivizing private-sector investment in mini-grids.
- Maximizes developers ability to recover costs and earn a return on investment.

Drawbacks

- May not be politically preferable
- Mini-grid customers are likely to pay more for electricity than urban national-grid customers
- Different rates for customers of different electricity providers
- Need to ensure affordability

Mini-grid Tariff Setting: Cost of Service Regulation Overview

- Cost of service (cost plus) regulation is based on a simple fundamental formula
  - Allows utility to recover costs and maintain a regulated profit
  - While there are alternatives, cost-of-service regulation remains the dominant approach

$$Revenue\ Requirement = Rate\ Base \times (1 + Allowed\ Rate\ of\ Return)$$

- Using the cost-plus approach for each mini-grid project may require significant resources.
  - Senegal: developed tariff caps for different classes of projects based on technology and subsidy level
  - Nigeria: the regulator developed a cost-plus software tool (Multi-year Tariff Order (MYTO) tool) for mini-grid developers to calculate tariffs for individual projects

Mini-grid Tariff Setting: Potential Tariff Structures

» There are several common rate structures for mini-grid tariffs:

Energy Based Payments
- based on the amount of energy consumed (measured in kilowatt-hours [kWh]).

Demand Based Payments
- Based on the peak power consumed (measured in kW) in a given payment period.

Flat Payments
- Flat payments are fixed payments per month (or other payment period), regardless of consumption level.

Pay As You Go Payments (PAYG)
- based on pre-purchasing "energy credits" when possible and that can be consumed when desired

» Other tariff structures include energy as a service, per-device tariff, seasonal tariff, lifeline or inverted block tariff, time of use tariff

Tariff Design Options (I): Who will design the tariff?

» The mini-grid developer, the regulatory, or a combination of the two can design the tariff

Mini-Grid Developer

- The developer will design a tariff that recovers their cost and solicit agreement from a community
- It is in the developer's interest to charge a tariff that customers can afford and are willing to pay
- However, customers may have an information disadvantage in tariff negotiations

Regulator

- The regulator will set the tariff using the method they deem most appropriate
- Regulators maintain control over the process
- However, overly controlled regulatory tariff-setting could limit flexibility, ignore circumstance, or result in uneconomic tariff level

Mini-Grid Developer & Regulator

- The developer and regulator work together to design a tariff level
- Typically, the developer will design and propose a tariff level to the regulator
- The regulator will then review, and either approve, amend, or reject the tariff

Tariff Design Options (II): Subsidies and Social Tariffs

- It may be preferable to charge a lower tariff to some or all mini-grid customers
  - But, to ensure financial viability this revenue shortfall (viability gap) must be made up for elsewhere

Approach A. Charge cost-reflective tariff but subsidize connection costs

Mini-grid customers may be able to pay ongoing tariff payments, but unable to pay upfront connection costs.

Grants to cover these connection costs could be provided either by the government (and therefore socialized among all taxpayers/ratepayers) or from international donors where funds are available.

Approach B. National-grid customers cross-subsidize mini-grid customers

Mini-grid customers could be charged under the uniform national tariff if the a funding mechanism were established to collect funds from national-grid customers and use this to fill the gap between costs and revenues for mini-grid developers.

This requires a modest increase in uniform national tariff rates.

Approach C. Certain classes of mini-grid customers subsidize others

In cases where mini-grid customer vary in terms of ability to pay (e.g. a large commercial customer compared to residential customers), mini-grid developers may be able to charge higher rates to one customer class and lower rates to another.

Such an approach may only be possible in certain situations.

Case Study: Setting Cost-Reflective Tariffs in Tanzania

- Tanzania permits developers to set cost-reflective tariffs and has a tiered regulatory approval process:
  - For projects **smaller than 100 kW**, no regulatory approval of a tariff is needed
    - Regulators will intervene and may adjust a tariff if more than 15% of customers file a complaint
  - For projects **larger than 100 kW**, developers propose a cost-reflective tariff to the national regulator, who will approve or amend the proposal
- This dual approach allows Tanzania's regulator to conserve resources used to review and approve tariffs
  - Developers have shown a tendency to size projects in a way that avoids regulatory oversight

Case Study: Setting Cost-Reflective Tariffs in Nigeria

- Nigeria also permits cost-reflective tariffs, with two options for **projects under 100 kW**:
  - Developers may use a **regulator-provided financial model** to calculate a cost-reflective tariff
  - Developers may **negotiate terms with the community**, with the agreement of customers representing 60% of load
- As of 2017, all Nigerian mini-grid operators have chosen the option of agreeing to tariffs with the community
  - Either the developer or the community may request a regulatory review of tariff levels

Case Study: Implementing Cross-Subsidies in Peru

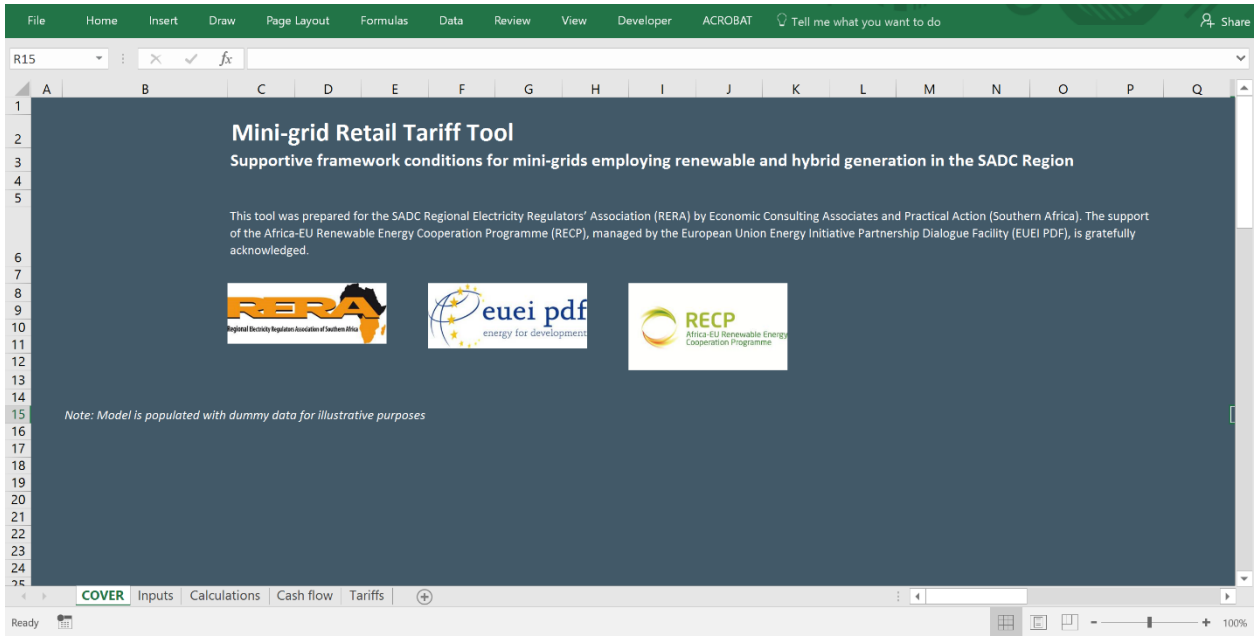
- Peru's government has prioritized achieving maximum participation in mini-grid development
  - To do this, has set **maximum mini-grid rates to equal the county's national grid tariff**
- To allow for this, the country has put several subsidies in place
  - **Direct subsidies** to mini-grid project developers
    - Paid to offset both capital and operational costs, paid out of rural electrification fund and other sources
  - **Surcharges** on national grid customers subsidize mini-grid customers
    - A 3% surcharge on national grid customers is redistributed to mini-grid developers by the national regulator, to compensate for low revenues
- With this regulatory scheme, **Peru's rural electrification rate increase from 30% in 2007 to 55% in 2010**.

Case Study: Weaning Off Subsidies in the Philippines

- The Philippines have long enforced a **cross-subsidy between national grid and mini-grid customers**
  - This cross-subsidy allowed mini-grid developers to charge customers only half the national tariff rate
- The Filipino government has **attempted to reduce subsidy amounts but have encountered resistance**, as customers are accustomed to low tariffs
  - This is compounded by issues with developers, who have had no incentive to provide efficient service, and are therefore very dependent on subsidies

Retail Tariff-Setting Example

- EUEI PDF Retail Tariff Excel Tool
  - Part of the EUEI Mini-Grid Policy Toolkit
  - Available at: www.minigridpolicytoolkit.euei-pdf.org/



Conclusions

- Mini-grids tariffs demand separate consideration from national uniform tariffs, due to higher costs of service
- To successfully encourage private investment, mini-grid developers must be able to achieve profitability
  - If developers cannot charge cost-reflective tariffs, subsidies must be provided
- There are many options in designing a regulatory structure to oversee mini-grid tariff and no single best approach
  - Regulators may find it helpful to conserve their efforts reviewing large projects or small projects with persistent complaints from customers
- Social tariffs are possible for mini-grid customers, but generally require a small surcharge on national tariffs

Thank You

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For Additional Information:

USAID/NARUC Practical Guide to Mini-Grid Regulation

Available at: www.naruc.org/minigridguide/