Developing Minigrids Under the Grid

Improving Electricity Service for Underserved Customers

ECOWAS Sustainable Energy Forum

24 October 2019

Executive Summary

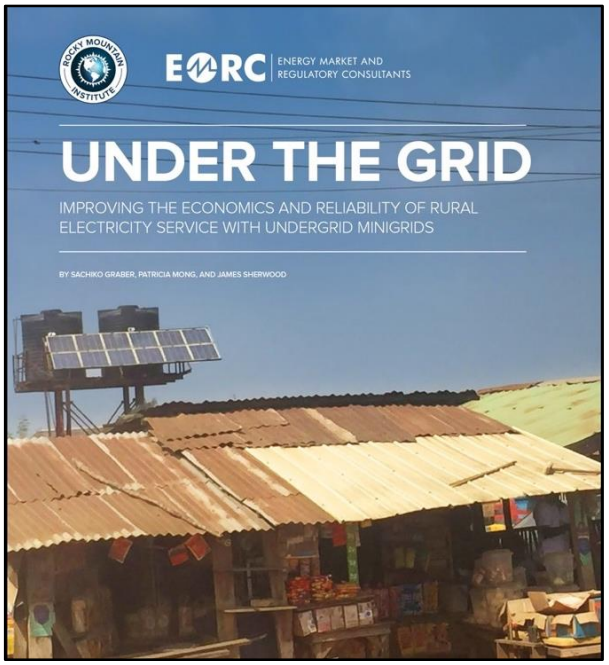
- **Thousands of rural and peri-urban communities are *under the grid*—**underserved by their utility with unreliable or no power
- These customers can be **better served by undergrid minigrids**, which would save customers $0.15/kWh and reduce distribution utility losses by 60–100%
- In Nigeria alone, this could create a **$1 billion/year undergrid minigrid market**, while **reducing project capital costs by 12–30%** through sharing distribution infrastructure
- Undergrid communities tend to have **greater existing load and economic activity** than off-grid communities, with high potential for growth and further productive use stimulation
- **Four business models can be readily implemented** under today's social, political, and economic environment, including a *minigrid operator-led* approach, an *SPV-led* model, a *cooperative-led* approach, and a *collaborative SPV-led* model

AGENDA

1. Background
2. The Business Case for Undergrid Minigrids
3. Implementable Business Models

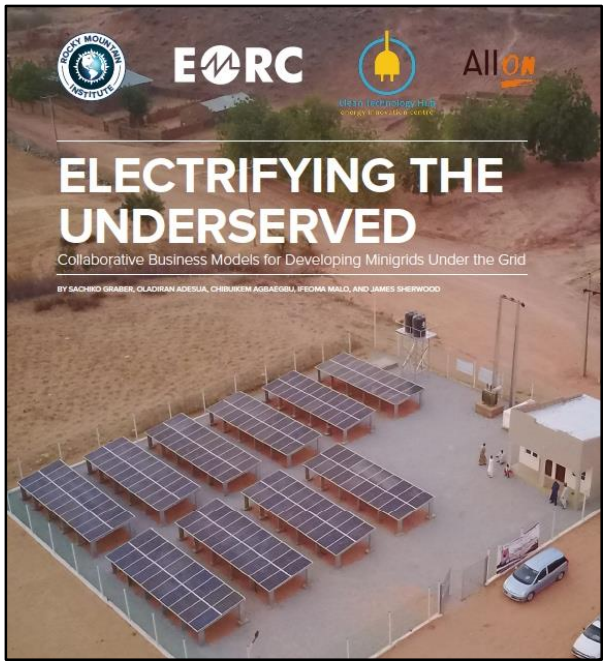
This content is largely from two reports focused on undergrid minigrids in Nigeria, but broadly applicable across Africa

Under the Grid, published by RMI and EMRC in 2018 analyzes economics of the undergrid model



rmi.org/insight/under-the-grid

Electrifying the Underserved, published in 2019 by RMI, EMRC, Cleantech Hub, and All On explores undergrid business models



rmi.org/insight/undergrid-business-models

Clean Technology Hub
energy innovation centre

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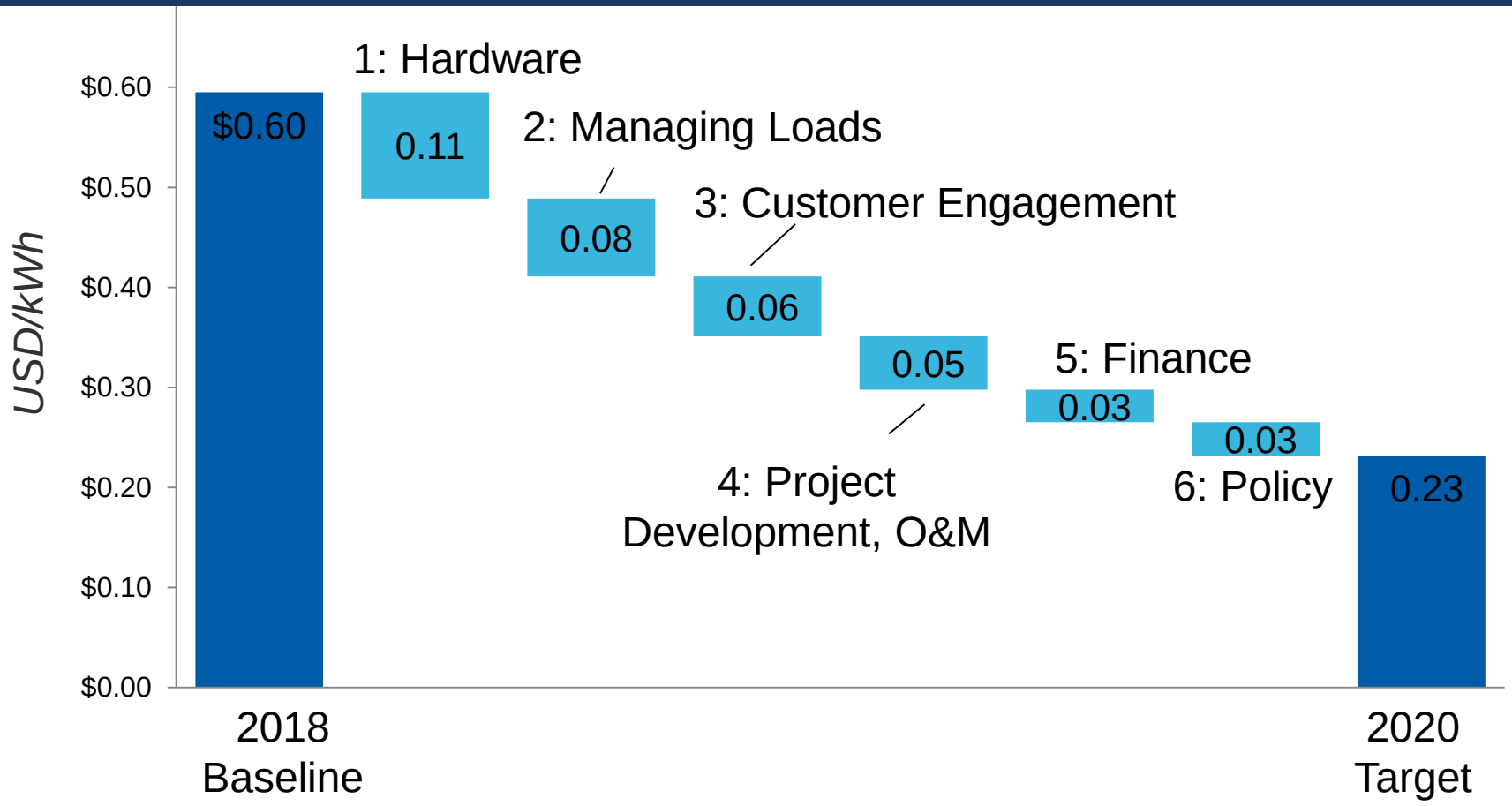
From an industry perspective, developing the undergrid minigrid market can accelerate cost reductions

Cost reduction opportunities in six categories



See RMI's report *Minigrids in the Money* for more detail: rmi.org/insight/minigrids-money/

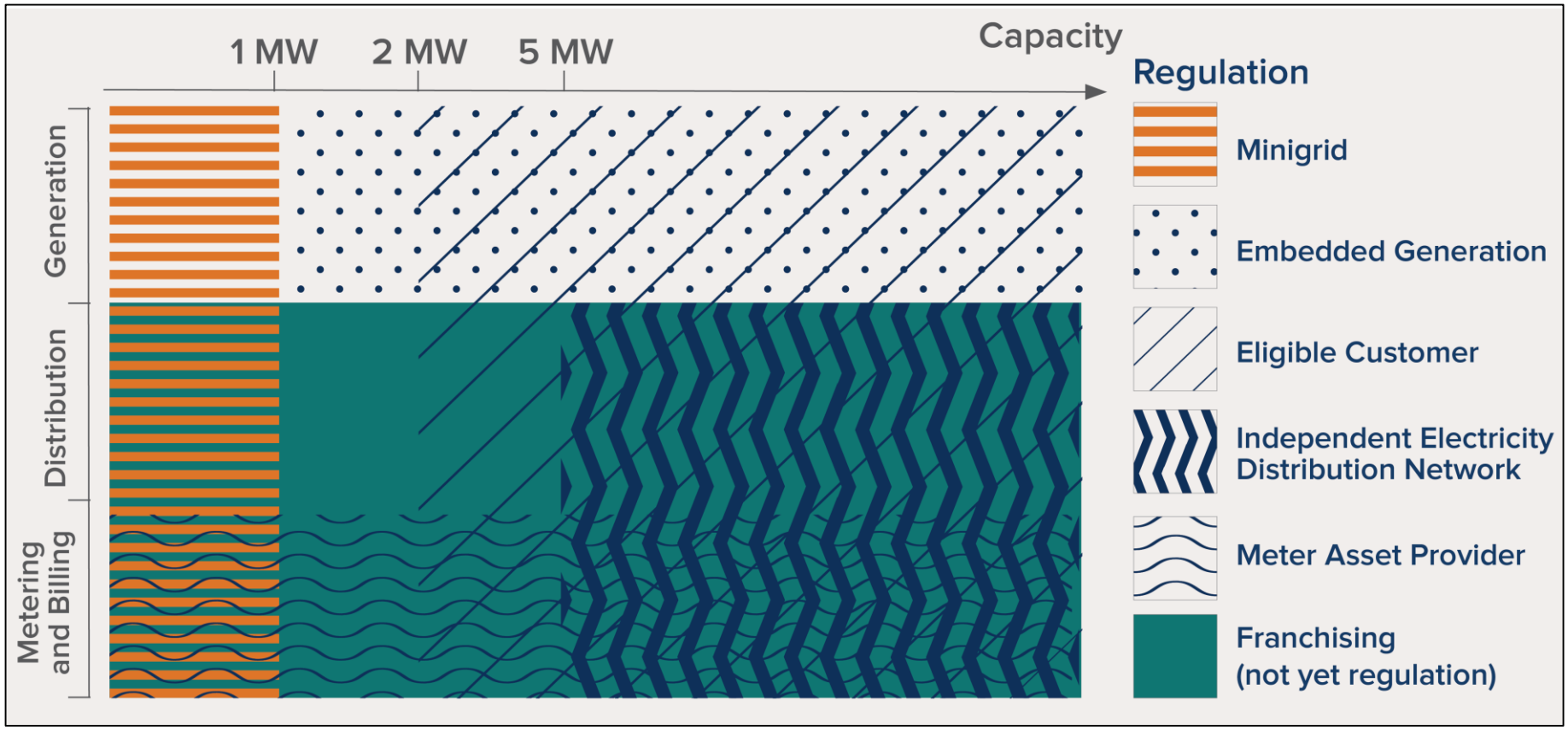
Nigeria's rural electricity customers, who compose nearly half of all consumers, are significantly un- and under-served

- **41% of rural customers are connected** to the main grid, but they often lack access to reliable service
- Nearly all rural customers rely on non-grid alternatives to meet basic energy needs, often **spending $0.60/kWh or more**
- **Options to improve electricity service** include:
  - Grid extension/improvement
  - Minigrids
  - Solar home systems
  - Diesel/petrol gensets
- Rural connections **may not be best served by the traditional grid** due to remoteness and low consumption levels

Undergrid customers today rely on expensive generators to run their businesses and homes

Sources: World Bank, 2016; *Under the Grid,* rmi.org/insight/under-the-grid/

While Nigeria has several alternative regulations available, we focus on business models that leverage the minigrid regulation



Minigrid Definition:

- **Self-contained power generation system serving multiple customers** through a distribution network
- Up to **1 MW** capacity
- **High reliability**, at least 95%

Source: *Electrifying the Underserved*, rmi.org/insight/undergrid-business-models

Minigrids are a cost-effective option for serving appropriate rural and peri-urban communities

For a minigrid in undergrid areas, which have existing grid infrastructure but unreliable or no service, **to be viable certain community factors** are needed:

- **Daytime load**. Cost effectiveness largely driven by cheap solar power; nighttime load requires expensive batteries and/or generator backup.
- **Appropriate scale**. Large enough to support a 50+ kW grid, but not so large that more than 1 MW is needed.
- **Existing diesel/petrol use**. Value proposition greatest for customers who supplement with gensets and are willing to pay.
- **Low grid reliability**. If relatively reliable, the economics are less viable.
- **High ATC&C losses**. DisCo benefit connected to lost revenue.

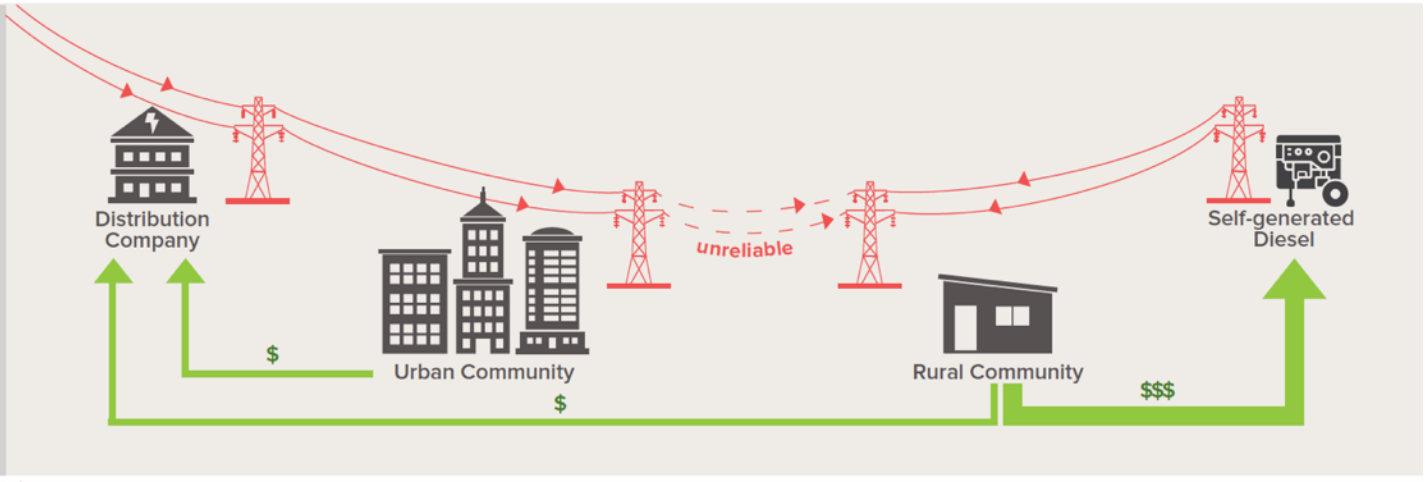
Create a 'win-win-win'

1. **Reduce DisCo losses** and allow focus on other areas
2. Provide **reliable, affordable electricity** to undergrid communities
3. Open a **new market for minigrid** developers to scale and reduce cost

Create a **bridge to the future** when the main grid becomes reliable

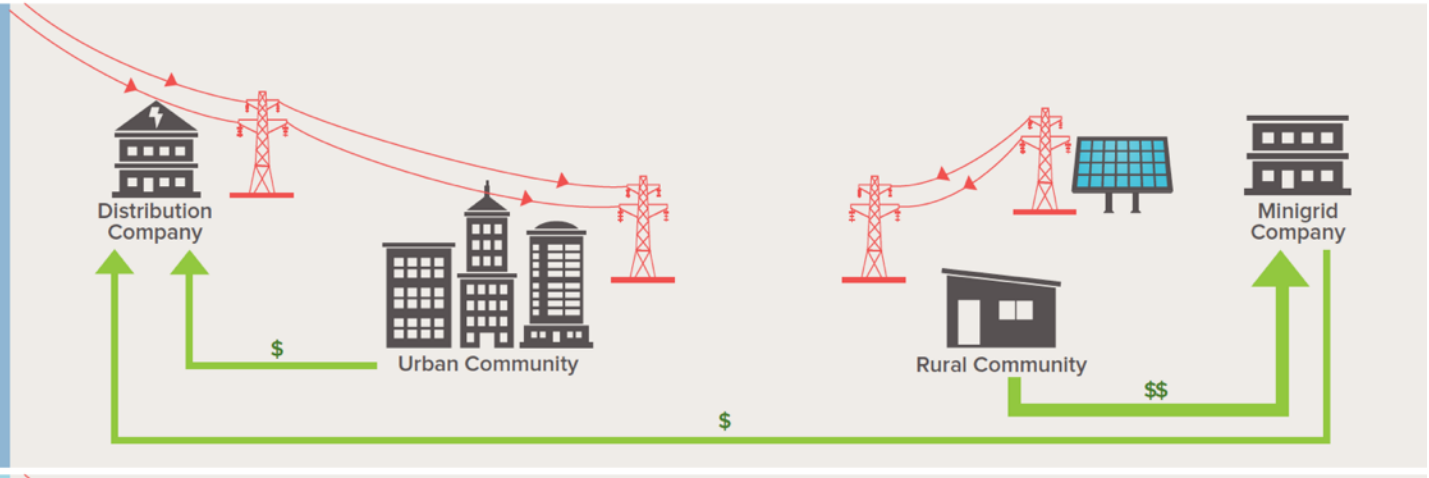
TODAY

- Rural users pay up to 10x grid costs for power



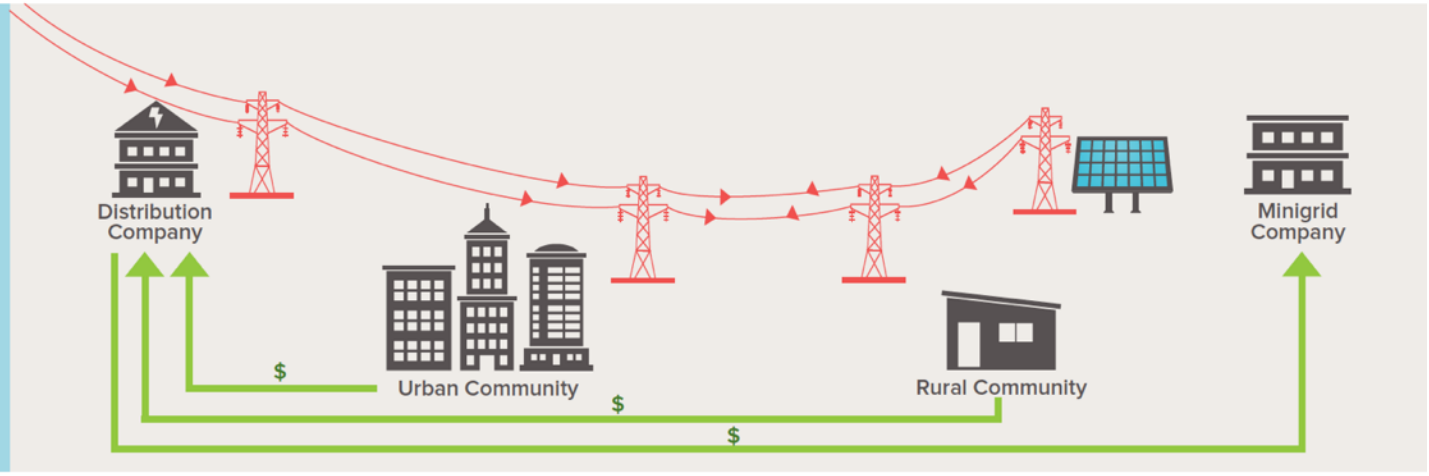
PROPOSED

- Rural community saves money
- Consistent, reliable, power



LONG TERM

- Additional cost savings
- Minigrid becomes distributed resource supporting grid



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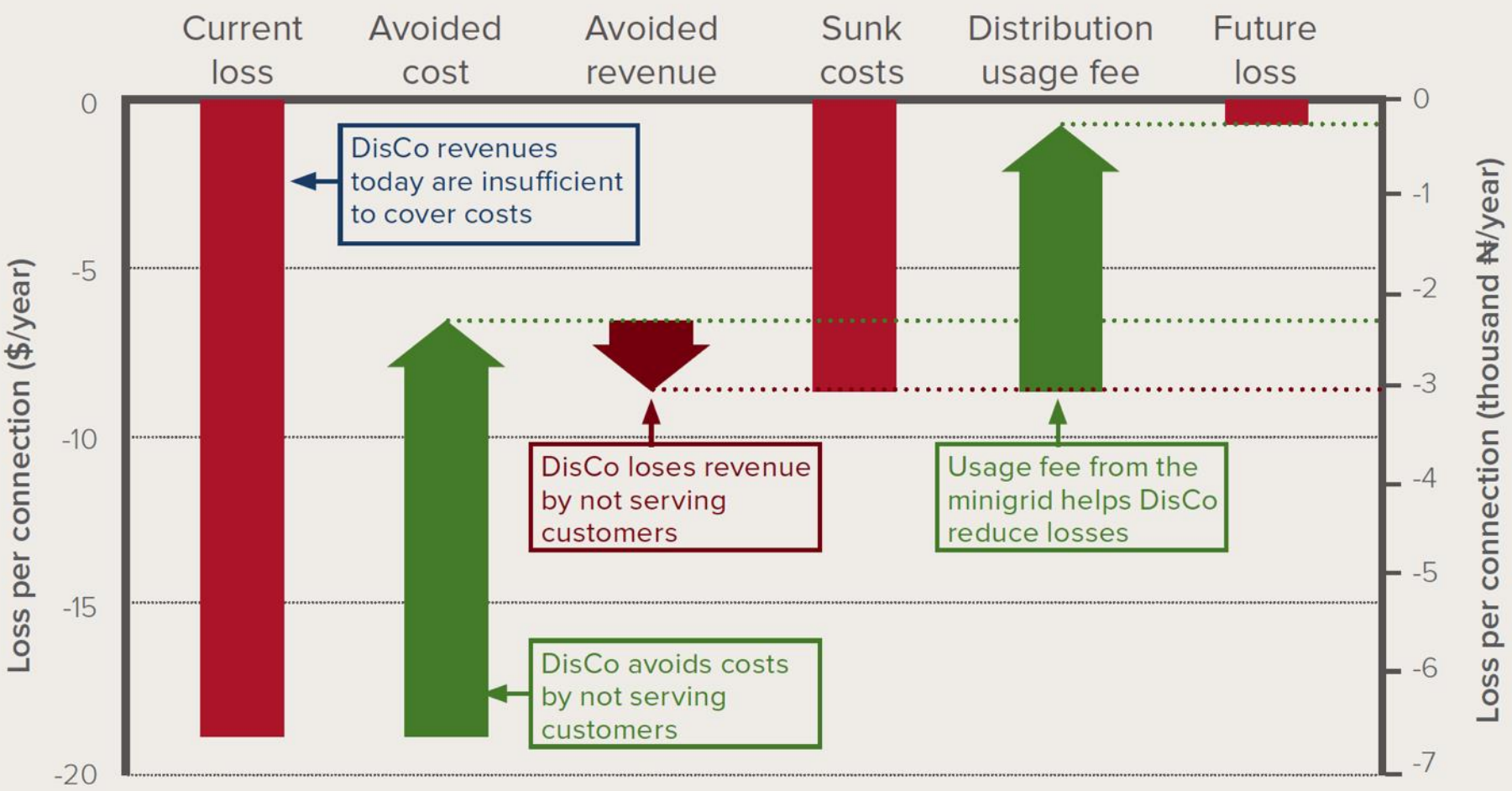
Nigeria's DisCos are losing money for every kWh they provide in typical rural underserved communities—an undergrid minigrid can reduce DisCo financial losses by 60–100%



Source: *Under the Grid*, rmi.org/insight/under-the-grid/

There are many benefits for both minigrid developers and communites, but also risks to consider

DEVELOPERS

Attractive Communities: $1 billion/year market with high potential for economic development and load growth

Capital Cost Reduction: Sharing distribution infrastructure could cut capex by 12–30%

COMMUNITIES

Cost Savings: $0.15/kWh average savings for customers, enabled by distribution sharing and daytime productive, excluding additional benefits of improved reliability

Short Contract Length: Tripartite contract may be shorter than system life—must ensure return on investment

Partnership Negotiation: Must negotiate agreeable contract terms, and implementation may be slow

Long-Term Commitment: Minigrids are more expensive than grid tariffs—need to understand tradeoffs (e.g., 10-year contract is economic with grid availability <10 hours/day for at least three years)

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3. **Implementable Business Models**

Electrifying the Underserved identifies four business models for undergrid minigrids that are viable today

- **Minigrid Operator-led –** Private minigrid operator leads development of minigrid with consultation across the DisCo and community

- **SPV-led –** Development is led by an SPV (potentially formed by a DisCo's investors) and certain specialized functions are subcontracted to a minigrid operator

- **Cooperative-led –** A cooperative formed by the community leads minigrid development

- **Collaborative SPV-led –** Ownership and operation functions are spread across the DisCo, minigrid operator, and undergrid community

Across business models, we analyze three **business model building blocks**—roles for *project development*, *asset ownership*, and *project operations*—and key **commercial terms of operation**

Source: *Electrifying the Underserved, rmi.org/insight/undergrid-business-models*

Minigrid Operator-led Model

Role	Minigrid Operator	DisCo	Undergrid Community
Invest or Attract Capital	Leading	Minimal	Minimal
Identify Project Site	Leading	Supporting	Minimal
Engage Customers	Leading	Supporting	Minimal
Obtain Regulatory Approval	Leading	Supporting	Minimal
Own Generation	Leading	Minimal	Minimal
Own Distribution	Minimal	Leading	Minimal
Manage Customer Relationships	Leading	Minimal	Minimal
Meter, Bill, and Collect	Leading	Minimal	Minimal
Operate and Maintain Generation	Leading	Minimal	Minimal
Operate and Maintain Distribution	Leading	Supporting	Minimal
Monitor, Evaluate, and Assess Impact	Supporting	Leading	Supporting

Leading role Supporting role Minimal role

Private minigrid operator leads development of minigrid with consultation across the DisCo and community

Key Benefits

- Fastest model to implement
- Limited investment required from DisCo Investors
- Customer trust can be attracted by new private minigrid operator

Key Risks

- Limited autonomy for DisCo
- Minigrid operator is solely responsible for raising capital, which may limit the ability to scale quickly to a larger portfolio of sites

Thank You

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rmi.org/insight/undergrid-business-models