How some off-grid renewable energy projects have adapted to grid arrival

14th ANNUAL MEETING
Decentralized electrification: mini-grid, to prepare for the arrival of the national grid
Cotonou – Benin

Chris Greacen
6 Dec, 2018
Mini grid options after arrival of the main grid

- Small Power Distributor (SPD)
- Small Power Producer (SPP)
- Both SPD and SPP
- Separate systems in the same village
- Buyout by utility
- Assets abandoned
Arrival of the main grid

Key: \[
\begin{align*}
\rightarrow \text{ = power from utility} \\
\text{ = power from SPP} \\
M \text{ = meter}
\end{align*}
\]
Arrival of the main grid

Key: = power from utility = power from SPP M = meter
Small Power Distributor (SPD)

Key: \[\text{utility} \rightarrow \text{SPP} \rightarrow \text{meter}\]

Customers

National Grid

Large Plants

Mini-Grid

Small Power Producer
Cambodia: from isolated mini-grid to SPD

+ >250 mini-grids became SPDs
+ Electricity Authority of Cambodia (EAC) put in place a comprehensive program:
  - Long-term distribution licenses required...
    To acquire one a mini-grid must:
    - Invest in utility-quality distribution network
    - Extend network thru service territory
  - Grants and loans
  - Retail tariffs standardized and cross-subsidized for distribution franchisees.

Key: = power from utility = power from SPP = meter
Small Power Producer (SPP)

Key:  = power from utility  = power from SPP  = meter

Customers

National Grid

Large Plants

Mini-Grid

Small Power Producer

Customers
Sri Lanka: from isolated mini-grid to SPP (sometimes)

+ >250 isolated community-owned hydropower built with financial support from GoSL, GEF and World Bank

+ With arrival of national grid >100 mini-grids abandoned

+ Three projects: 12 to 45 kW converted to SPPs
  - Five more in pipeline
  - No longer provide retail sales to village

Key: = power from utility = power from SPP = meter
Both SPP and SPD
Indonesia: SPD + SPP

+ Of 200 community-owned mini-grids where national grid has arrived...
  - 150 abandoned, PLN takes over.
  - 9 have become SPPs/SPDs.
    - Sell all or some electricity to national grid
Buyout

Key: 

- = power from utility
- = power from SPP
M = meter

Customers

Large Plants

National Grid

Small Power Producer (may operate as emergency backup plant)

Mini-Grid

Small Power Producer

Customers
Assets abandoned

Customers

Extension of National Grid

National Grid

Large Plants

Small Power Producer
Lessons

+ Viable examples of formerly isolated village mini-grids connecting to main-grid exist...
  • Hydropower able to remain financially viable selling wholesale to utility (Sri Lanka & Indonesia)
  • Mini-grids with utility-grade distribution networks transitioning to small power distributors (Cambodia)

+ ... but are rare
  • Most mini-grids abandoned when utility arrives

+ Cost of interconnection depends on business model
  • e.g. SPP interconnection more costly than SPD
A Guidebook on Grid Interconnection and Isolated Operation of Mini-Grid Power Systems Up to 200 kW

Chris Greacen
Richard Engel
Thomas Quetchenbach

April 2013

Mini-Grids and Arrival of the Main Grid
Lessons from Cambodia, Sri Lanka, and Indonesia

From the Bottom Up
How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa

Bernard Tenenbaum, Chris Greacen, Tilak Sivaramakrishna, and James Knuckles

The World Bank
Thank you

https://palangthai.wordpress.com/docs/