CORNERSTONE OF MYANMAR’S SELF-FINANCED MINI-GRIDS SUCCESS: PRODUCTIVE END USE OF ELECTRICITY

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July 2017, HPNET Webinar: Productive End Use of Mini-Grids using Micro/Mini Hydro – Three Examples of How to Make it Happen
National Electrification Plan (NEP)
- 30% to 100% by 2030
- $400M World Bank IDA loan

Gap to address: Mini-Grid Integration

Rural electrification policy
- ‘Business as Usual’ vs. RE Mini-Grids
  - Solar home lighting systems
  - Clean coal and large hydropower
Mini-Grids in Myanmar

~30-years of Experience

Data Sources: Department of Rural Development 2015; World Bank NEP PAD 2015; Consultant Analysis

Myanmar’s Unique Progress (success)

Lessons for Int’l Development Practitioners

- International development programs aim to design programs that can scale and self-replicate.

- How did Myanmar’s 3500+ mini-grids (biomass gassifiers and micro/mini hydro) happen?
  - No technology training
  - No international funding
  - No scaled government program or policy
  - Yet, more mini-grids than any funded program!

- Opportunity for development partners to learn from Myanmar how mini-grids can be scaled and sustainable.
Source of Myanmar’s Mini-Grid Success

Mini-Grid Social Entrepreneurs

- 20 – 30 years experience
- 3500+ mini-grids
- Self-Financed, Community-Owned
- Self-Engineered Technology
- Productive End Use built-in
Closer Look at Locally-Financed Projects

Naung Pein Project, Northern Shan State

- Developer: Sai Htun Hla & Brothers Hydropower Company
- Output capacity: 200kW
- Construction: 2009 – 2012
  - Done in phases – electricity supplied since 2010
  - Head and Design Flow: 274m and 142 lps
  - Turbine: Pelton; Generator: 300kW
  - Consumers: 550 in 14-villages (out of 2000 households)
- Transmission and Distribution
  - 45km total of 11kV, 230V, and 400V
  - 15 transformers
- National grid arrived: 2017
Closer Look at Locally-Financed Projects

Naung Pein Project, Northern Shan State
Ownership and Financing

**Hybrid: Developer + Cooperative**

- **Total Cost:** $430,000 (as in 2009) or $2150/kW

- **Financing**
  - 29% Equity (24 village-based shareholders, plus developer)
  - 52% Community contribution through connection charge
  - 19% Short-term debt, repaid in 10-months
  - Ownership: 25 shareholders organized as a cooperative, as per 1992 revision of Cooperatives Law.

- **Monthly income**
  - Before grid arrival: $5500 - $7500
  - After grid arrival: $1,100 (as in 2017)

- **REAM and Hydro Empowerment Network friends**
  - Working diligently → grid-interconnection pilot project
**Connection Fees and Tariff Customized to Community’s Strengths**

- **Connection Fees:** $230 - $385 (as in 2017)

<table>
<thead>
<tr>
<th>No. of Villages</th>
<th>Single-Phase</th>
<th>Additional 3-Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest Demand</td>
<td>7</td>
<td>230 USD</td>
</tr>
<tr>
<td>Medium Demand</td>
<td>4</td>
<td>307 USD</td>
</tr>
<tr>
<td>Highest Demand</td>
<td>3</td>
<td>385 USD</td>
</tr>
</tbody>
</table>

- **Mini Hydro Tariff:** $0.15 - $0.31 per kWh (as in 2017)

<table>
<thead>
<tr>
<th>Types of Consumers</th>
<th>Single-Phase</th>
<th>Additional 3-phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>&lt; 30 units</td>
<td>&gt; 30 units</td>
</tr>
<tr>
<td></td>
<td>0.23 USD/unit</td>
<td>0.15 USD/unit</td>
</tr>
<tr>
<td>Commercial Use</td>
<td>&lt; 30 units</td>
<td>&gt; 30 units</td>
</tr>
<tr>
<td></td>
<td>0.23 USD/unit</td>
<td>0.15 USD/unit</td>
</tr>
<tr>
<td>Temporary</td>
<td></td>
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</tbody>
</table>

Main Grid Tariff: $0.06 <200 kWh; $0.08 >200 kWh, plus connection fee (as in 2017); Main grid has poor voltage.
Management Body (same staff for 7-yrs)

Naung Pein Mini Hydropower Utility

- Staff Salaries: Total $825/month (as in 2017)
  - Manager
  - Cashier
  - Powerhouse Operators
  - Intake Operator
  - Linesmen

- Management Issues
  - Minimal, e.g. late payments
  - Peak Load – no issues
    - Social awareness
    - Volt meters in enterprises
Cornerstone of Financial Viability

Productive End Use

With exception of a few shops, all use Mini-Hydro instead of Main Grid, due to voltage issues.

<table>
<thead>
<tr>
<th>Changed from Diesel Powered</th>
<th>After Arrival of Mini Hydro Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn milling 4 units</td>
<td>Air compressors for micro water utilities 12 units, 1.5kW each</td>
</tr>
<tr>
<td>Corn drying 1 unit, 10-hp</td>
<td>Cement Brick Making (mixer and molder) 3-units</td>
</tr>
<tr>
<td></td>
<td>Telecom Station 1 unit, 2kW</td>
</tr>
<tr>
<td></td>
<td>Patrol Pump Stations 2 units, 3hp each</td>
</tr>
<tr>
<td></td>
<td>Restaurants, Shops ~50 enterprises</td>
</tr>
<tr>
<td></td>
<td>Peanut Oil Press 1 unit, 18kW</td>
</tr>
</tbody>
</table>
Cornerstone of Financial Viability

Productive End Use
Financing for Productive End Use

Depends on Socio-Economic Factors

- Depends on Family Income and Skills
  - Distance to main road
  - Family members working abroad
  - Agriculture assets

- Cooperatives
  - Savings group within the community

- Developer’s Role
  - Identifying villages with existing end uses and new potential
  - Machinery for productive end use can be made locally
  - Supporting village share-holders to be exposed to new industry
    - e.g. 18kW Oil Mill given on installment basis by Mandalay company
Arrival of Main Grid

What Changed?

- Main Grid Reliability
  - Poor voltage during peak load
- Number of connections
  - Same number of permanent connections
  - Temporary connections dropped from 300 to 100
- Productive End Use loads on the Mini-Hydro
  - Nearly no change, with the exception of a few small shops.
- Tariff / Connection Fees of Mini-Hydro
  - No change
- MHP Utility Income
  - Dropped from $5500-$7500 to $1100
Integrating Productive End Use

Key Conclusions from Naung Pein

- Productive end use is absolutely required for
  - Mini-grid sustainability: **PEUs still use MHP over main grid.**
  - Socio-economic benefits: **All PEU owners are villagers.**

- Challenge: PEU in economic poor, more rural communities
  - No access to entrepreneurial skillsets
  - No access to financing
  - NEP mini-grids program mandates PEU for NEP mini-grid subsidy. **Yet, no financial support provided for PEU.**

- How can Donors support PEU?
  - Encourage inter-ministerial and multi-stakeholder cooperation
    - JICA 2-step loan for SMEs → How to access for PEU of mini-grids?
  - Soft loans to developers and communities for PEU
Acknowledgements

This project will soon be featured in a case study by REAM and Winrock International. Please contact hydroempowerment@gmail.com for details.

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