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

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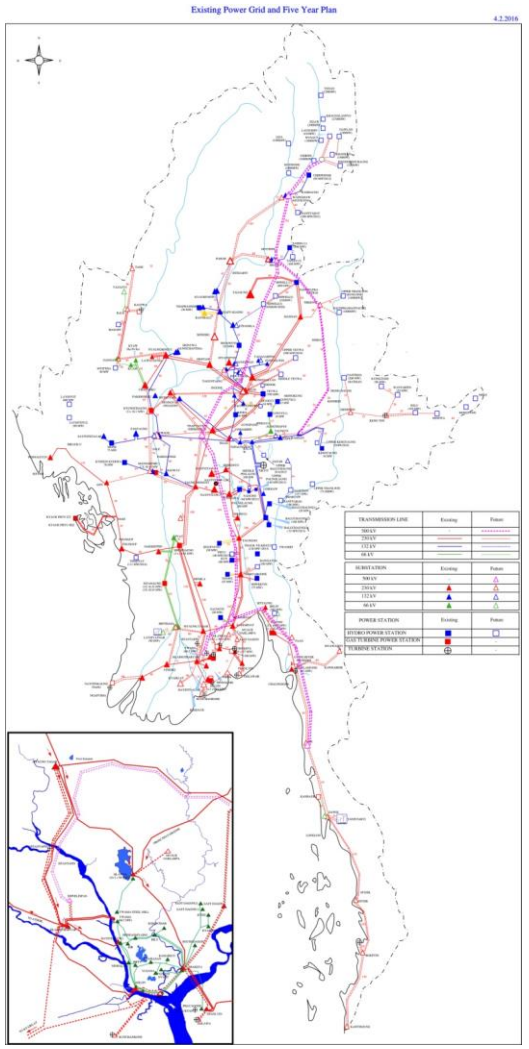
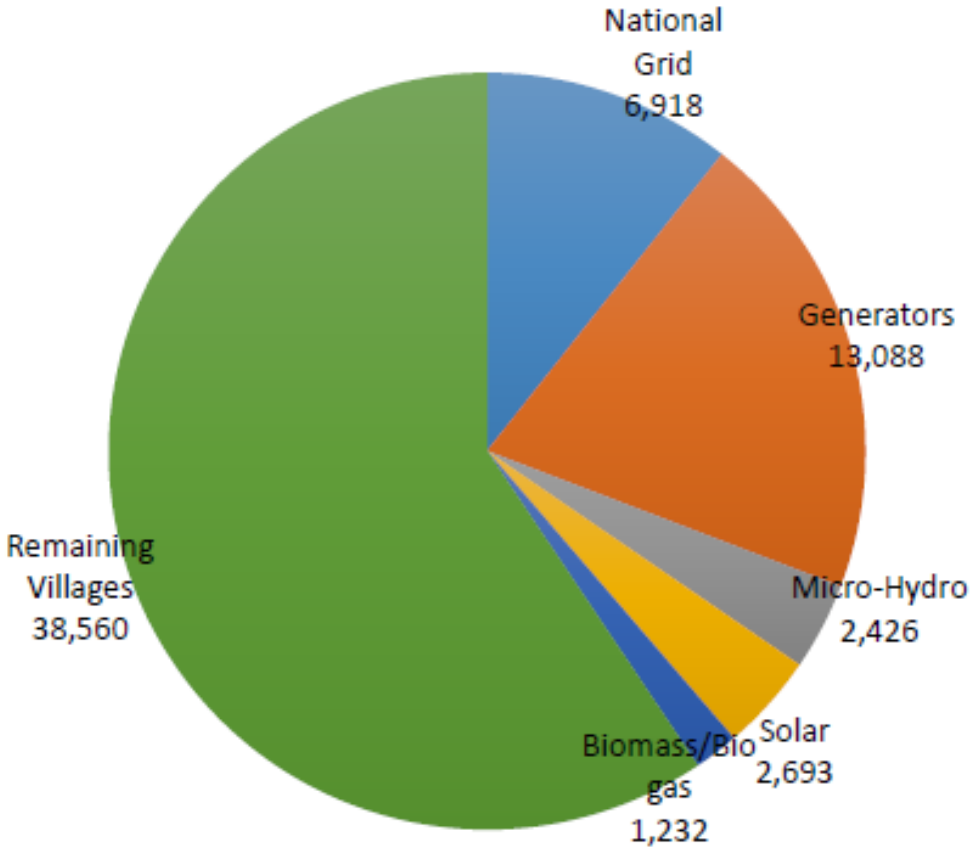
My Fulbright Public Policy Fellowship

Policy Situation Overview

- National Electrification Plan (NEP)
  - 30% to 100% by 2030
  - $400M World Bank IDA loan
- Gap to address: Mini-Grid Integration
  - "Least Cost" analysis overlooked RE mini-grids, yet 3500+ RE mini-grids exist.
  - 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

Source: Witoon Permpongsacharoen, Mekong Ecology and Energy Net (MEE Net), "Putting Green Energy Vision into reality in Myanmar," Presentation, March 2017.

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 of experience
- 3500+ mini-grids
- Self-Financed, Community-Owned
- Self-Engineered Technology
- Productive End Use built-in

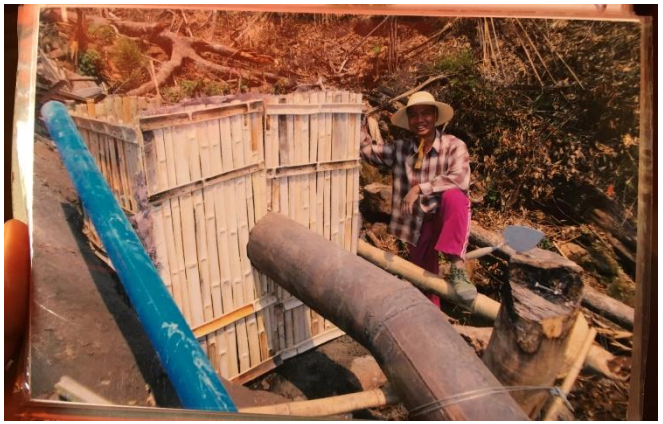
Closer Look at Locally-Financed Projects

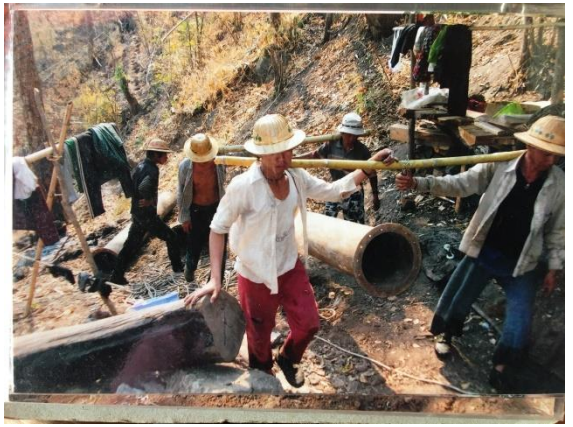
Naung Pein Project, Northern Shan State

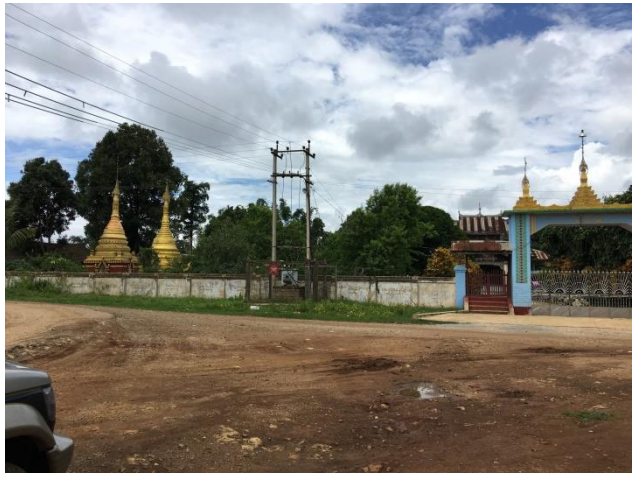
- Output capacity: 200kW
- Construction: 2009 – 2012
  - Done in phases – electricity supplied since 2010
  - Head and Design Flow: 274m and 142 lps
  - Turbine: Pelton; Generator: 300kW
  - Consumers: 550 in 14-villages (out of 2000 households)
- Transmission and Distribution
  - 45km total of 11kV, 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)

	No. of Villages	Single-Phase	Additional 3-Phase
Lowest Demand	7	230 USD	No connection charge
Medium Demand	4	307 USD	No connection charge
Highest Demand (near to highway)	3	385 USD	No connection charge

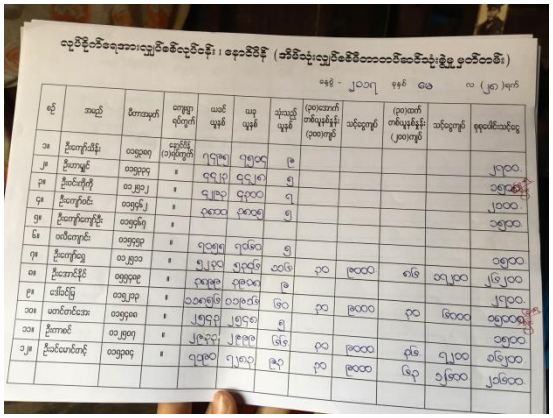
- Mini Hydro Tariff: $0.15 - $0.31 per kWh (as in 2017)

	Single-Phase		Additional 3-phase
Types of Consumers	< 30 units	> 30 units	Regardless of consumption
Residential	0.23 USD/unit	0.15 USD/unit	0.31 USD/unit
Commercial Use	0.23 USD/unit	0.15 USD/unit	0.31 USD/unit
Temporary	0.62 USD/unit, plus 77 USD advance		

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

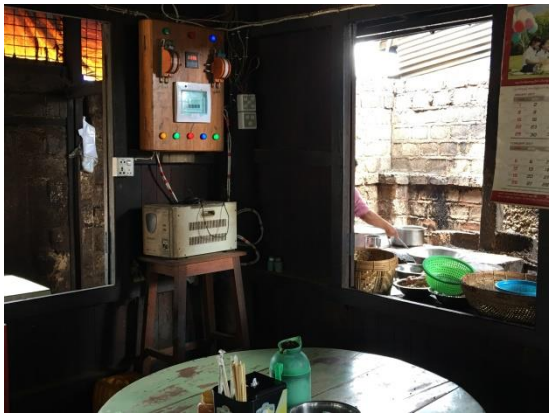
Cornerstone of Financial Viability
Productive End Use

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

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

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

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