

Private Sector led solar micro-grids in remote and rural Nepal



Anjal Niraula
GM, Gham Power

Gham Power: Solar Project Developer, Social Enterprise



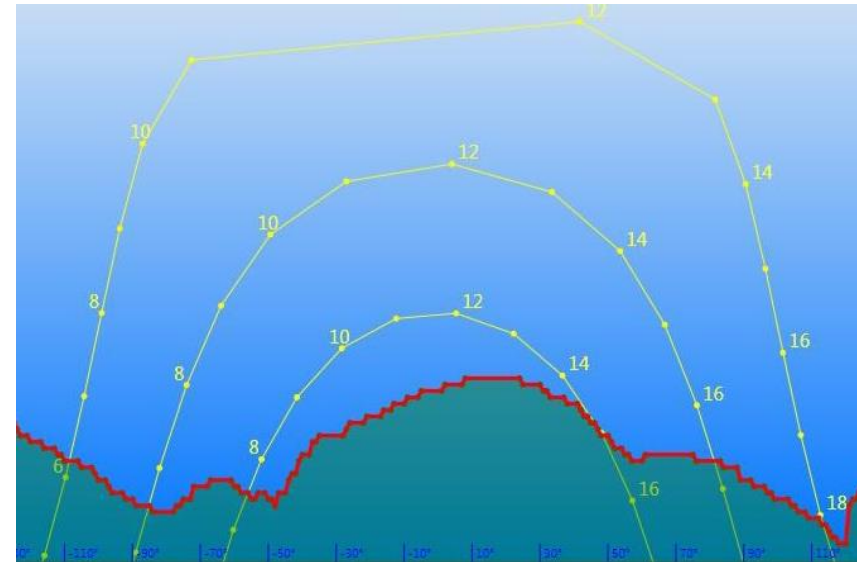
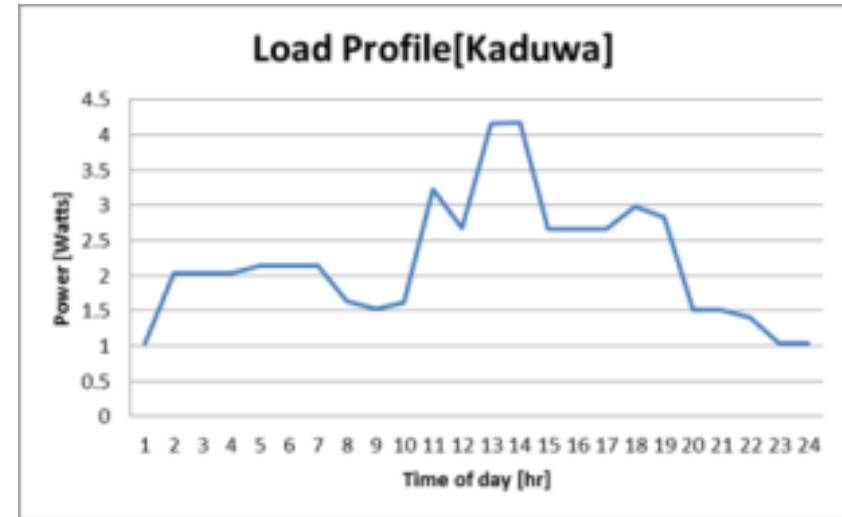
- Started in 2010
 - Provide Solar PV systems at costs below diesel
 - Focus on businesses and productive use
- 1.2 mw installed; 832 Projects:
 - Possible Health Bayalpata Hospital (12 KW)
 - Maiti Nepal Shelter for Trafficked Girls (8 KW)
 - EVK2 Lab @ Mt Everest base camp (10 KW)
 - US Embassy for Nepal (23 KW)
 - UNICEF (42 KW)
- 2016 target pipeline: 4 mW

Rural microgrid project: 3 Pilot Sites (ADB Assistance)

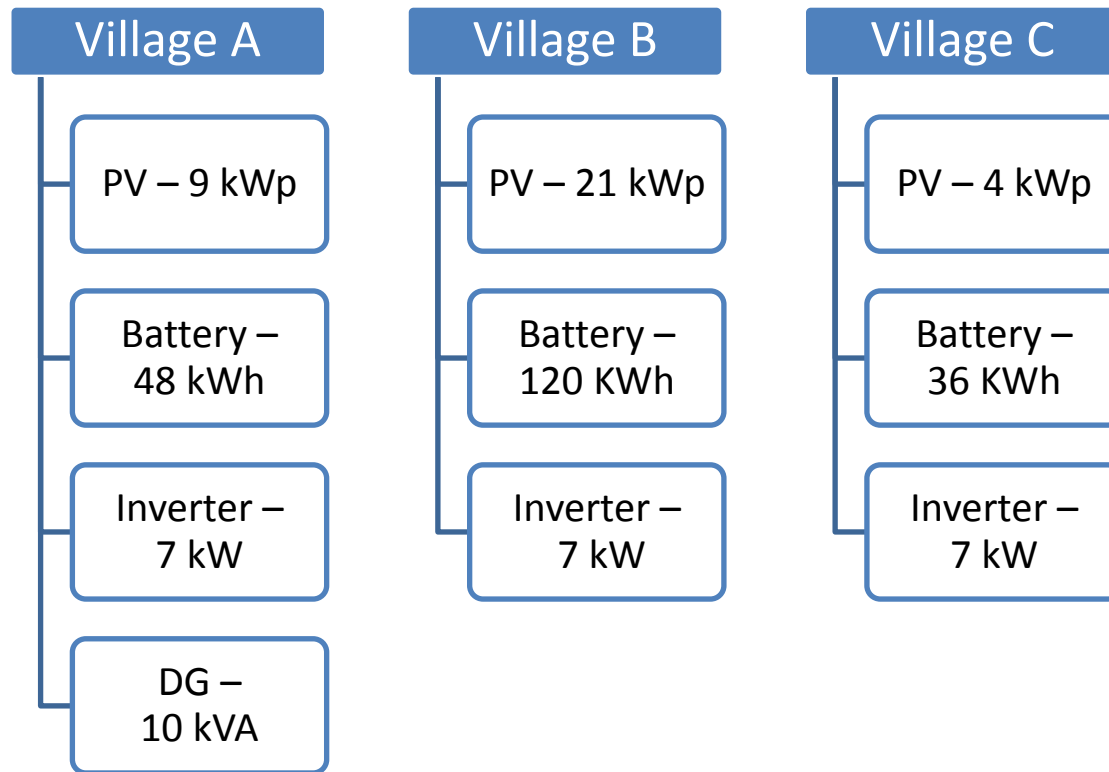
- Pilot developed for 3 villages(Okhaldhunga & Khotang district)
 - Total size: 35 kw initially; increased to 72 kW in phase 2
 - 25 businesses, 83 households
 - Technical assistance from Asian Development Bank (ADB)
- Funding Sources:
 - Equity investment from Community and Gham Power
 - Debt financing from NMB Bank
 - Financial and technical assistance from ADB, AEPC and Winrock
- Implementation Model:
 - Project owned by a SPV with community representation
 - Gham Power provides EPC + O&M services for 10 years
 - After 10 years, project ownership transferred to community

Rural microgrid: Site selection criteria

- Services necessary in target areas
- Current energy consumption
- Ability to pay for the services
- Grid Extension possibilities
- Availability of Road network
- Sun path/shading issues
- GPS information of the load centers



Rural microgrid project : Technical components



- Top quality components, expandable design
 - Grade A components
 - Smart meters to control usage
 - Mobile money to facilitate payment
 - Internet connection to facilitate monitoring
 - NEA grade transmission: can integrate with national grid in future

Rural microgrid project : Sustainability

- For HH's → energy costs < displaced kerosene costs
- Optimum utilization of produced energy
 - Higher capacity factor through productive end use (PEU) loads
 - Greater revenue generation
- Mobile Pay-as-you-go (PAYG) option enables new businesses (recharge cards, mobile banking, etc.) and connects markets
- Regular O&M
 - Internet connectivity facilitates remote monitoring
 - Trained technicians and Microgrid managers at each site
 - Sense of ownership ensures accountability

Rural microgrid project : Financial Viability

- Total Investment: \$231k
 - Aggregation of projects helped lower the transaction cost
- Funding Sources:
 - Local Community: \$35,000
 - Gham Power: 10% of installation costs
 - Assistance / Grants: ADB + DOEN foundation
 - Debt Financing from a local commercial bank
- Pilot project is viable with some assistance
 - Without assistance, projects losses over 10 years = \$(108,803)
 - With a 46% assistance, total project profits = \$70,732
 - Investor IRR = 12%
 - EPC margin = 10%

Rural microgrid project : Productive end use(PEU) loads



Grinding Mill – 1.8 kW



Computer Center – 2.5 kW



Petrol Pump – 3.5 kW



BTS tower – 0.8 kW

Rural microgrid project : Phase 2

- Phase 2: Add 37 kW to power mobile towers + add'l load
 - Availability of power incentivized tower operator
 - Partnership with NCell (Nepal's leading private telecom)
 - 2 mobile towers + ~146 households + ~20 businesses
 - GSMA M4D Grant award
 - Enhance connectivity and power
 - Mobile signal to 5 VDC's (population > 20,000)

*VDC = Village Development Committees

Benefits

To telecom operators:

- Access rural market with lower operational costs
- Fixed PPA + Service Level Agreement (SLA) more desirable compared to owning/maintaining power backup options (solar + diesel)
- Electricity at homes to charge mobile phones
- People will use mobile data to access Internet

To microgrids:

- Fixed monthly PPA with Ncell provides financial stability to Microgrid (“Anchor Client”)
- Telecom more “bankable” off taker to raise project financing

Rural microgrid project: Future Directions

- What do we hope to learn from the pilot?
 - Practical ways to cut system costs and increase project revenue
 - Impacts on community: economy, environment, and access to energy
 - Alternate options for debt and equity financing
 - Optimal mix of debt, equity, and assistance for sustainable projects
 - Policies and implementation mechanisms needed to provide assistance
- Attract other developers and EPC's to develop RMG projects
 - More than 3000 telecom towers
- Gham Power's focus: develop larger RMG portfolios and invite other EPC's for implementation
 - 2017 Goal: 305 kW
 - 1 mW in next 3 years

Thanks!



Anjal Niraula
anjal@ghampower.com