Grid Interconnection of Off-grid Community-based Projects

What happened when the Grid Arrived - Sri Lankan Experience

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Sri Lanka

- Island nation; 65,600 sq km; 21 m population

- The WB & GEF-assisted Renewable Energy Program:

- Access to grid: 40% of households (1996)
  - over 96% of households at present
Policy – mid 1990s

• Private investments in the power sector were encouraged to address:
  ✓ Growth in demand
  ✓ Development of small hydros being administratively difficult to the Utility

• Utility willing to buy energy from small hydros consistent with its least cost generation plan

• Off-grid solutions to complement the grid or as ‘pre-electrification’ measures
ESD & RERED Projects
Key Programme Components

• Grid-connected
  Hydro / Wind / Biomass

• Off-grid Community-based
  Hydro / Wind / Biomass

• Off-grid Household-based
  Solar / Wind

• Widely implemented technologies/components:
  grid-connected & off-grid hydros and SHS
• Demand driven, market based approach

• Create an enabling environment:
  ✓ Address information, institutional, legal/regulatory and financial barriers in an integrated manner
  ✓ Loans on standard commercial criteria
  ✓ Output based subsidies for off-grid projects
  ✓ Technical assistance and capacity building

• Program management by an Administrative Unit set up within DFCC Bank
Off-grid Community-based Projects
Design

• Run-of-the-river schemes providing electricity through an independent mini grid: a typical 10kW scheme serves 40 HH within a 2km radius

• Built, owned and operated by the community through an Electricity Consumer Society (ECS)

• Technical specifications defined by Project

• Technical assistance and grant through GEF

• Loans on market terms, based on independent credit assessment and access to long-term funds
• Registration of the ECS

• All consumers obtaining membership of the ECS
  ✓ Members to appoint a working Committee including President, Secretary & Treasurer, who will liaise with all external agencies/consultants
  ✓ Committee members elected annually at an annul general meeting

• Obtaining necessary Statutory approvals, including;
  ✓ Central Environmental Authority
  ✓ Local/District/Provincial authorities
• Working Committee of the ECS to regulate usage and collect tariff

• Design & implementation by a registered project preparation consultant

• Turbines tested at a well-equipped lab

• Conformity to technical standards by verification at design, installation and post-installation stages by qualified engineers

• Service and warranty arrangements
• Needs based training for consultants and equipment suppliers

• Assistance to ECSs on management aspects
  ✓ Model constitution and organization structure
  ✓ Basic finance and administration
  ✓ Participatory approach

• Awareness on consumer protection
  ✓ Clarify stakeholder roles & responsibilities
  ✓ Complaint investigation scheme
  ✓ Basic O&M

• Innovation Solicitation - Promote cottage level industries using electricity
Financing

• All members to pay a fixed monthly membership fee (site specific) irrespective of consumption

• Membership fee to cover debt servicing and O&M

• Loan is structured such that part of membership fee is adequate to service the loan
  ✓ Approximately USD 9 per month during servicing of the loan
  ✓ Approximately USD 2 per month once the loan is fully settled (@ 1 USD : LKR 112)

• Cross guarantees (among members)
When the Grid Arrives
Available Options

• Operate parallel to the grid electricity
  ✓ Financial benefit of continuing to using the already developed resource
  ✓ As a back-up in the event of a breakdown

• Sold to a mini hydro developer (> 100 kW) to enhance the capacity of an existing/proposed grid-connected mini hydro project

• To develop as a small scale grid-connected project
Connection of Community-based Projects to the National Grid
• ECS to be converted to a limited liability company
• Energy permit by Sustainable Energy Authority
• Letter of Intent / Standard Power Purchase Agreement by the Utility
• Environmental and Local/District/Provincial approvals
  ✓ Approvals obtained for community hydro project by the ESC are valid if the grid-connected project is of the same capacity
  ✓ New approvals are required if the capacity is enhanced
• Projects to be > 10 kW
• Eligible for the same tariff as any other grid-connected mini hydros (> 100 kW)
• Utility to make payment on a monthly/quarterly basis
Design

- Same civil structures to be used with repairs/modifications as required
- Repairs/replacement of electrometrical equipment
- Low voltage connection to the nearest transformer (< 50 kW)
• Initiated by an individual/group of the ECS

• An entrepreneur in the locality or Federation of Electricity Consumer Societies to acquire the site from the community as an investment

• 100% acquisition by an investor is not permitted

• Purchase consideration
  
  ✓ Cash payment to the community
    
    Approximately USD 120 per HH (@ 1 USD : LKR 150)
    
    95% ownership to the investor & balance 5% to the community
  
  ✓ No cash payment
    
    25% to 30% of ownership to the community and balance to the investor
• All households of the former ECS to be shareholders of the company

• A community representative to be appointed as a director

• A community member to be assigned for O&M for a fee (same as the previous off-grid model)

• An amount of the income to be reserved for O&M (same as the previous off-grid model)

• Share of community profit to be distributed equally among all households, who are shareholders of the new company
Financial

• Cost of conversion
  ✓ USD 13,350 approx. (@ 1 USD : LKR 150)
    highly site specific and also vary depending on the condition of the project assets
  ✓ May increase further if major repairs are required on civil structures

• Investor to obtain a loan if necessary on commercial terms based on the viability of the project
Progress to date

- 3 projects connected to the national grid (12 kW, 21 kW & 45 kW)
- 2 more projects under implementation (27 kW & 30 kW)
- Applications received for 10 more projects (all > 20 kW)
- Further potential – approximately 30 more projects
• 45 kW project connected to the national grid in 2015

• 21 kW project connected to the national grid in 2012
## Performance to-date

<table>
<thead>
<tr>
<th>Project</th>
<th>Kudawan Dola</th>
<th>Malpel Dola</th>
<th>Kudawa Lunugalahena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of connection</td>
<td>2012</td>
<td>2013</td>
<td>2015</td>
</tr>
<tr>
<td>Capacity (kW)</td>
<td>21</td>
<td>12</td>
<td>45</td>
</tr>
<tr>
<td>New components</td>
<td>Panel Board, Induction Motor, grid connection cable and accessories</td>
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</tr>
<tr>
<td>Supplier</td>
<td>Fentons Ltd.</td>
<td>Fentons Ltd.</td>
<td>Fentons Ltd.</td>
</tr>
<tr>
<td>Total cost (USD) - @ 1 USD : LKR 150 (includes cost of household connection to national grid)</td>
<td>18,033</td>
<td>14,403</td>
<td>25,250</td>
</tr>
<tr>
<td>Cost per kW (USD) - @ 1 USD : LKR 150</td>
<td>859</td>
<td>1,200</td>
<td>561</td>
</tr>
<tr>
<td>Estimated Plant factor</td>
<td>70%</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>Tariff (USD) - @ 1 USD : LKR 150</td>
<td>0.1002</td>
<td>0.0994</td>
<td>0.1177</td>
</tr>
<tr>
<td>Estimated Income p.a. (USD approx.) @ 1 USD : LKR 150</td>
<td>12,903</td>
<td>7,314</td>
<td>32,478</td>
</tr>
<tr>
<td>Estimated Income p.a. per kW (USD approx.) - @ 1 USD : LKR 150</td>
<td>614</td>
<td>610</td>
<td>722</td>
</tr>
</tbody>
</table>

*Source: Energy Forum*
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