Pico Hydro Project Presentation

MASCHINEN & TECHNIK, INC.
Since 1979
COUNTRYSIDE SITUATION

Future leaders study with kerosene lamp
KEROSENE STREETLAMP
# Renewable Energy Sources and Technologies

## Renewable Energy

- Refer to energy sources that can be obtained from continuously recurring energy processes and cycles in the natural environment including energy sources from waste materials and the technologies that utilize these energy sources.

<table>
<thead>
<tr>
<th>Solar Energy</th>
<th>Biomass Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Energy</td>
<td>Geothermal Energy</td>
</tr>
<tr>
<td>Hydropower</td>
<td></td>
</tr>
</tbody>
</table>
Renewable Energy Sources and Technologies

Why utilize renewable energy?

- Relatively environmentally benign
- Fosters national energy independence and security
- Enhances the fuel diversity
Energy Resource (Hydro)

**TYPE ACCORDING TO SIZE**
- Large (over 50MW)
- Small (10MW to 50MW)
- Mini (100kW to 10MW)
- Micro (under 100kW)
- Pico (under 10kW)

**TYPE ACCORDING TO DEVELOPMENT**
- Run-of-river
- Pondage (Dam)
- Pumped-Storage
Rural Electrification

Challenges to New and Renewable Energy Technologies

- Relatively new technologies
- Limited market
- High capital costs

“AFFORDABILITY”
Barriers to Renewable Energy for Rural Electrification

- Limited information and expertise
- Limited awareness
- Lack of effective policies and programs to encourage investment in renewable energy
- Lack of appropriate financing mechanisms
- Lack of sustainable commercial delivery mechanisms
- Lack of maintenance services
Market Status
(Rural Electrification)

20% High Income
Can afford high-cost solutions without assistance

29% Middle Income
Could afford reasonably priced solutions with good markets and financing

51% Low Income
Dependent on traditional options and heavily assisted new options
“It is ironic that those who need renewable energy most are those who could least afford it.”
OPTIONS FOR RURAL ELECTRIFICATION

- Grid Extension
- Diesel Generators
- Solar PV
- Hydro (Micro and Pico)
- Wind
- Hybrids (Multiple-sources combined)
The Pico Hydro Advantage

- Relatively the cheapest source of electricity per kWh
- Requires lesser investment cost compared to micro hydro installations
- Faster to construct and install
- Easier to maintain and repair
- Can be locally manufactured
OBJECTIVES

1. To provide clean, affordable (low-cost) electricity to rural households/communities;
2. To replace sooty kerosene lamps/candle with energy-efficient lamps; compact fluorescent lamp (CFL) or LED;
3. To contribute to sustainable development in beneficiary rural villages;
4. To reduce CO2 emissions thru displacement of other fossil-fuel options for off-grid energy service;
5. To install about 4,400 pico-hydro systems with a total capacity of 2.7 MW in a period of 7 years;
6. To develop in-country manufacture of pico-hydro turbine in the medium term;
7. To develop and increase awareness in caring for and preserving the watershed to sustain the pico-hydro installation.
EQUIPMENT

Low Head Application

3 models
- PHEG200W
- PHEG500W
- PHEG1000W

“low-head” pico-hydro turbines

<table>
<thead>
<tr>
<th>TYPE</th>
<th>PHEG-200W</th>
<th>PHEG-500W</th>
<th>PHEG-1000W</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate Power</td>
<td>200W</td>
<td>500W</td>
<td>1000W</td>
</tr>
<tr>
<td>Water Head</td>
<td>1.5 m</td>
<td>1.5 m</td>
<td>1.5 m</td>
</tr>
<tr>
<td>Water Flow</td>
<td>35 liters/sec.</td>
<td>70 Liters/sec.</td>
<td>130 Liters/sec.</td>
</tr>
<tr>
<td>Net Weight</td>
<td>25 kg</td>
<td>45 kg</td>
<td>75 kg</td>
</tr>
<tr>
<td>Generator Output</td>
<td>.220 VAC, 60 HZ single-phase permanent-magnet alternator.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
EQUIPMENT

High Head Application
2 models

- PHEG200W
- PHEG500W
- Low water flow rate 6.3 ltrs/sec
  Head: 6-13 mtrs
- Easy to install
- Environment friendly
- Inexpensive
- Portable
COMPONENTS

1. Turbine/generator – for electricity generation; propeller-type turbine, single-phase permanent magnet generator, 220 VAC, 60Hz.
2. Water channel – fabricated canal for easy assurance of adequate water flow, with gate block to stop water flow and screen to filter-out debris.
3. Draft tube – tapered tube for calculated water column/head to rotate turbine propeller; made of GI sheet.
4. Load controller – to control generator speed, voltage and frequency depending on connected load; can be manual or automatic.
SITE SELECTION

1. Water source (river, creek, irrigation canal) with flow of more than 35 LPS
2. Water vertical drop of 1.5 m
3. Site proximity to the use of the electric output

1. Water Fall
2. Dam
3. Side Channel
INSTALLATION

1. Build the diversion canal
2. Construct the support structure for the water channel and draft tube
3. Mount the turbine and generator
4. Install the distribution line and regulator
5. Connect the electrical loads
1. Clean the water canal to maintain the flow
2. Grease the two bearings of the turbine through the nipples
3. Clear the distribution lines from branches
4. Protect the water shed
Experiences

- Individual households
- Cluster of households
- Small village
- Remote field stations
Pico Hydro Installations (Lagawe, Ifugao)
Pico Hydro Installations
(LISP Light Industry and Science Park-Cabuyao, Laguna)
Pico Hydro Installation (Igputoy, Antique)
Pico Hydro Installations (La Trinidad, Benguet)
Pico Hydro Installation (Nestle-Lipa, Batangas)
BUSINESS OPPORTUNITIES

A. Range
B. Costs
C. Cost recovery
D. Potential Market/Applications
RANGE

PHEG 200 - 5 to 7 households
PHEG 500 - 13 to 18 households
PHEG 1000- 25 to 40 households

Line losses dependent on:
1. Distance of PHEG to distribution pole
2. Distance of houses from distribution pole
# SYSTEM COSTS

## 1. Equipment-Low Head

<table>
<thead>
<tr>
<th>Power</th>
<th>Type</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>200W</td>
<td>Turbine/Generator with controller</td>
<td>P20, 800</td>
</tr>
<tr>
<td>500W</td>
<td></td>
<td>P38, 040</td>
</tr>
<tr>
<td>1000W</td>
<td></td>
<td>P63, 920</td>
</tr>
</tbody>
</table>

- **Accessories**
  - Water Channel: Optional according to requirements
  - Draft Tube: Optional according to requirements

## 2. Equipment –High Head

<table>
<thead>
<tr>
<th>Power</th>
<th>Type</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>200W</td>
<td>no stock</td>
<td></td>
</tr>
<tr>
<td>500W</td>
<td></td>
<td>P40, 840</td>
</tr>
</tbody>
</table>
SYSTEM COSTS

3. Wiring
   Royal Cord #12
   Royal Cord #10
   Royal Cord #8

4. Infrastructure (Civil)
   Diversion canal
   Support structure

5. Housewiring (~ P3,000 to P5,000)
   including 2 CFL lamps, switches and outlet
   (to be borne by each household)
## COST RECOVERY

<table>
<thead>
<tr>
<th>FUNDING</th>
<th>COST RECOVERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Grant/Donation</td>
<td>None</td>
</tr>
<tr>
<td>2. Subsidy</td>
<td>Partial or Full</td>
</tr>
<tr>
<td>3. Investment</td>
<td>Full</td>
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</table>
POTENTIAL MARKET/APPLICATIONS

1. Electric loads along irrigation canals
2. Remote villages along rivers
3. Remote stations in water shed areas

Livelihood applications
- Poultry lighting
- Battery charging
- Drying
1. Clean, better-quality, convenient, reliable and affordable (low-cost) electricity;

2. Improved lighting for household/community work and school assignments;

3. Access to information, remote-education and entertainment thru TV and radio;

4. No more pollution from sooty kerosene lamps and candles which can cause respiratory illness;

5. Extended working hours for community and household activities (social, livelihood and entertainment);

6. Better security with brighter surroundings; no fire hazards from unattended kerosene, lamps and candles;
7. Convenient charging for cell phones and lead storage batteries (for lighting of more distant households);
8. Reliable electric power for livelihood opportunities; cottage industry;
9. Increased environmental awareness in caring for and preserving the watershed;
10. Incentives from the Gold Standard for Voluntary Emission Reductions;
11. Improved gender equality as women will be trained on the maintenance of the units. In addition, they will be the beneficiaries of micro-credit schemes;
12. Creation of new employment opportunities for marketing, installation and maintenance of the units.
RECOMMENDATIONS

The high initial cost of equipment and installation is a significant deterrent to the extensive deployment of renewable energy to rural impoverished villages. It is necessary therefore to provide:

- Incentives to encourage investors in renewable energy
- Affordable financing thru micro-credit
- Project development assistance/subsidy
- Gold Standard Voluntary Emission Credits to contribute to more feasible RE projects for those who need them most.