Northern Power Systems, Inc.  
Waitsfield, Vermont USA

Hybrid Power for Village Applications

Examples of Medium-Sized Systems:
Joanes, Brazil
Lime Village, Alaska
St. Paul Island, Alaska

Presented At Village Power '98  
World Bank, Washington, DC

Northern Power Systems

- Manufacturer of renewable & hybrid power systems since 1975
- Telecom & village installations in over 30 countries & on all 7 continents
- Integrated power systems engineered for specific applications or sites
- Northern Power components include:
  ◦ Hybrid System Controllers  
  ◦ Monitoring Systems  
  ◦ Wind Turbines  
  ◦ Controlled Environment Shelters  
  ◦ Photovoltaic Array Frames & Trackers  
  ◦ Rotary DC/AC Power Converters
Hybrid Village Power System  
Joanes, Brazil

<table>
<thead>
<tr>
<th>Type of System</th>
<th>50 kW; grid interconnect; wind/PV, battery storage</th>
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<tbody>
<tr>
<td>Application</td>
<td>Support of a weak diesel grid to deliver energy and stabilize power quality during hours of peak demand</td>
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<td>Location</td>
<td>Island of Marajo in the Amazon/Toncontins delta</td>
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<td>Population</td>
<td>2000</td>
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<td>Peak Loads</td>
<td>&gt;75 kW</td>
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<tr>
<td>Funding</td>
<td>NREL; CEPEL (Brazilian renewable energy organization); CELPA (Utility of the state of Para)</td>
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<tr>
<td>Project Status</td>
<td>Commissioned in 1997; being operated by CELPA; satellite link provides access to data</td>
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Configuration
NPS Controller/Monitor
Utility Interconnect Switchgear
228 kWh Battery Bank

4 Bergey Excel-R Wind Turbines
10 kW Photovoltaic Array
NPS 50 kW DC/AC Rotary Converter
w/o Engine

[Diagram of system configuration]
Hybrid Village Power System
Lime Village, Alaska

**Type of System**: 50 kW; Stand-alone grid; PV/diesel, battery storage

**Application**: Village electrification; power previously available only from small individual generators

**Location**: Roadless interior, approx. 250 air miles from Anchorage

**Population**: 45

**Peak Loads**: Undetermined

**Funding**: Alaska Science & Technology Foundation; Lime Village; Univ. of Alaska; State of Alaska

**Project Status**: Installed in 1998; waiting for generation permit; will be maintained by McGrath Light & Power; phone link provides remote access to operating data
Configuration
NPS Controller/Monitor
NPS 50 kW DC/AC Rotary Power Converter w/ Engine
4 kW Photovoltaic Array
100 kWh Battery Bank
Auxiliary 35kW Diesel AC Genset

Lime Village Remote Monitoring Screen:
Hybrid Village Power System
St. Paul, Alaska

**Type of System**
300 kW; stand-alone; wind/diesel; heat storage

**Application**
High penetration wind/diesel system to provide electricity and space heat for village industrial facility

**Location**
Pribilof Islands in the Bering Sea

**Peak Loads**
160 kW

**Funding**
Tanadgusix Corporation (TDX)

**Project Status**
Equipment shipped from NPS for installation in late 1998; to be maintained by TDX; phone link provides remote access to operating data

**Cost of Energy**
≈ $0.20/kWh; current diesel grid cost is $0.32/kWh
Configuration
NPS System Controller/Monitor
Vestas V-27 225 kW Wind Turbine
2 x Volvo 150 kW Diesel Gensets
HydroQuebec Dump Load Regulator

NPS Integrated Shelter/Container
NPS Heating & Thermal Storage
NPS Synchronous Condenser
Encorp Engine Controls

TDX Wind Diesel System - Simplified One Line Diagram

Diagram showing components and connections of the TDX Wind Diesel System.

Photo of a container with a generator inside, labeled with various labels and connections.