

# **Small Wind Systems for Village Power: An Update**

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**Village Power '98**

**Washington, DC    Oct. 6-8, 1998**

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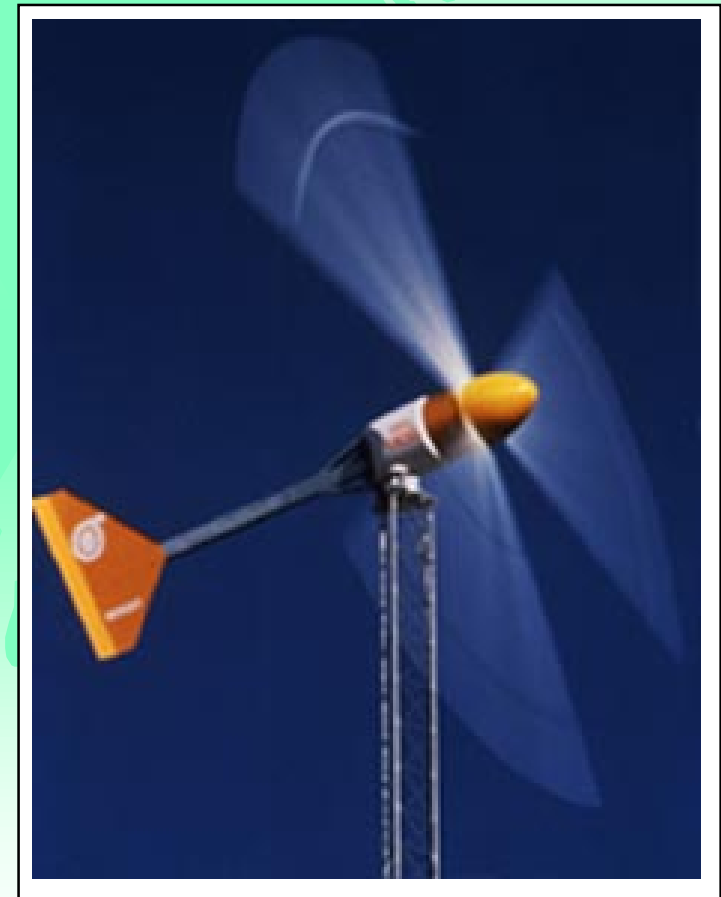
**Michael Bergey**  
**Bergey Windpower Co.**  
< [mbergey@bergey.com](mailto:mbergey@bergey.com) >

# Modern Small Wind Turbines:

## High Tech, High Reliability, Low Maintenance

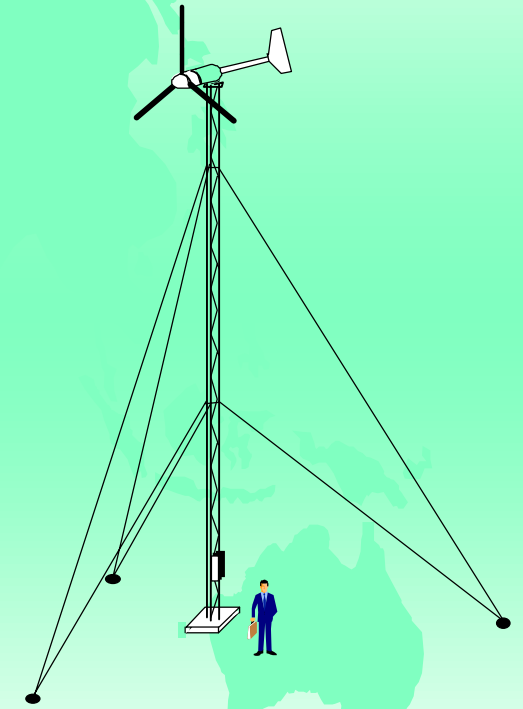
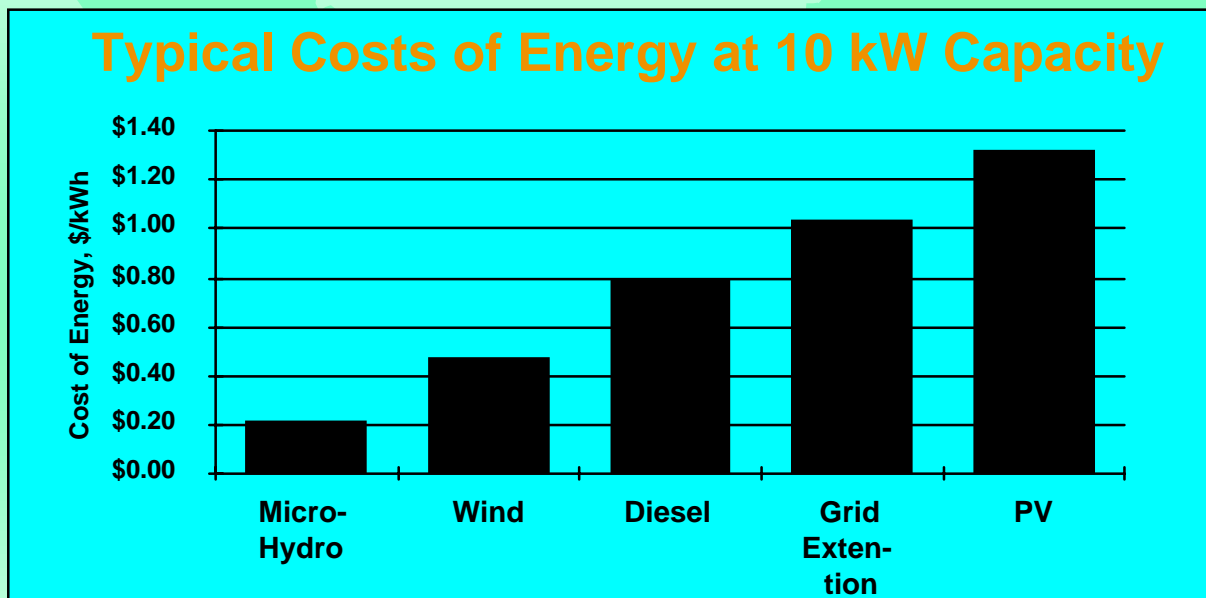
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- ◆ 50 W - 50 kW Capacity
- ◆ Aerospace Technology
- ◆ Mechanically Simple: 3 Moving Parts
- ◆ No Regular Maintenance Required
- ◆ Low Costs: \$ 1 - 3 / Watt
- ◆ Proven: ~200,000 Installed, Over a Billion Operational Hours



10 kW Unit (Bergey)

# Modern Small Wind Turbines: A Least-Cost Option for Small Power



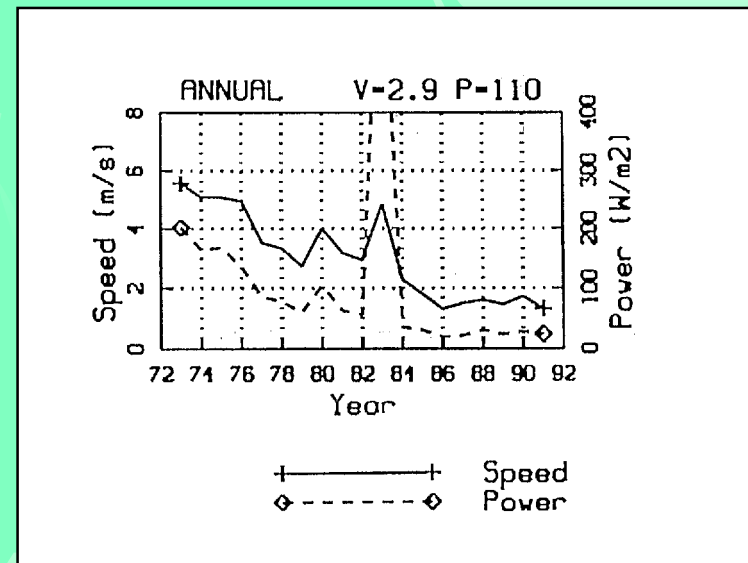
***" With reasonable assumptions concerning discount rates, capacity factors, and fuel costs, micro-hydro and wind turbines can have the lowest life cycle costs in locations where the resource is sufficient."***

***Fueling Development: Energy Technologies for  
Developing Countries, April, 1992  
U.S. Office of Technology Assessment***

# Existing Wind Maps

## The Curse of Meteorological Data

- ◆ Sheltered Wind Sensors
  - Below Trees, Buildings, Etc.
  - Roof Mounted
- ◆ Worn Bearings, No Calibrations, Etc.
- ◆ “Disappearing Wind”
- ◆ Power  $\sim (\text{Velocity})^3$  ; So 20% Error in Wind Speeds Means ~50% Error in Available Energy

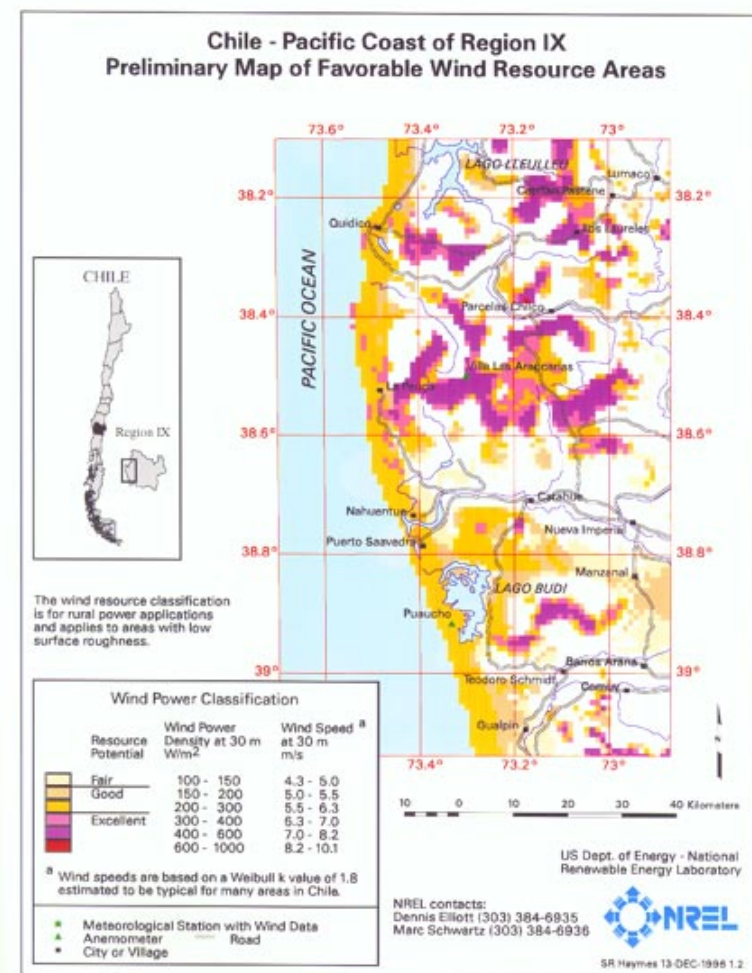
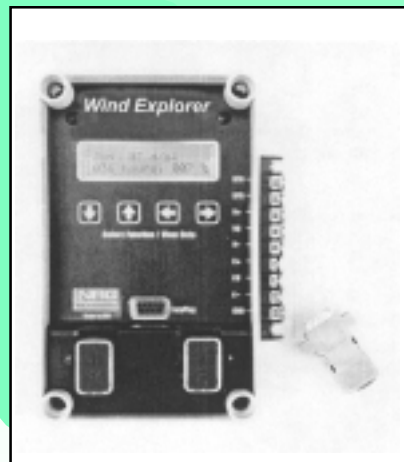


Case of “Disappearing Wind”  
Kupang, Indonesia

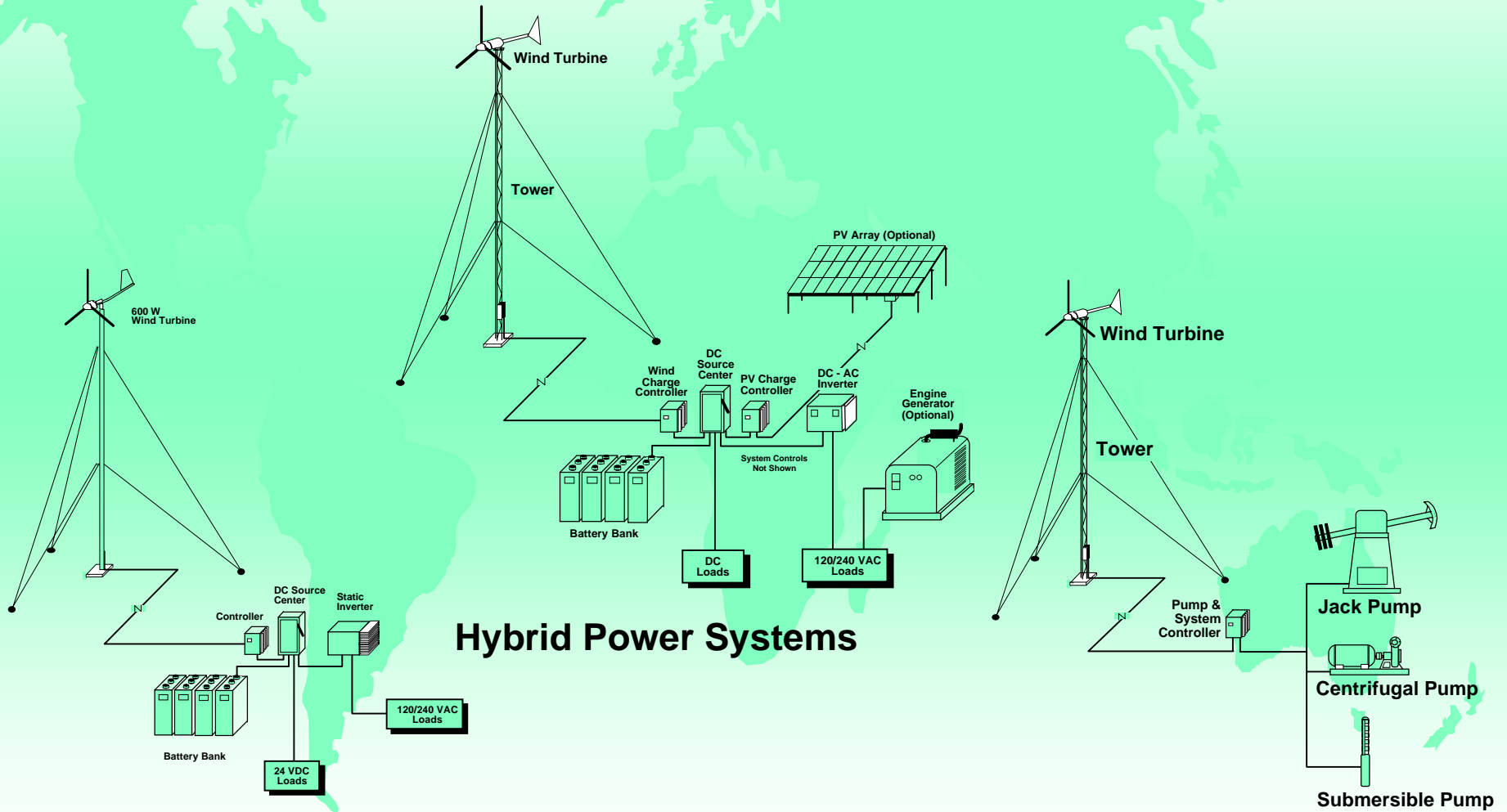
**Most National Wind Maps Radically Under-Estimate Available Wind Energy Resources !**

# Finding the True Wind Resource

- ◆ NREL Wind Mapping with Additional Data Sources: Satellite, Ex-Military Data, Etc.
- ◆ Low Cost Wind Loggers Specifically Designed for Small Wind Applications



# Small Wind Applications

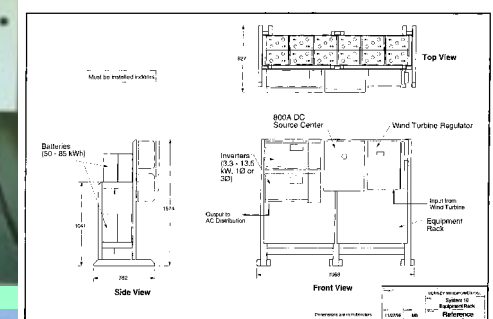


Wind Home Systems

Wind-Electric Systems

# Industry Trends

- ◆ Remote Power Markets are Expanding, Companies are Growing Nicely
- ◆ Small Wind/PV Hybrids & Wind Home Systems Entering Mainstream of Rural Electrification
- ◆ Package Standardization: Lower Costs & Easier Operational Support
- ◆ Growing Evidence of Significant Battery Life Extension Due to Charging from Wind



# China Rural Electrification

## World's Largest Market for Small Wind

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- ◆ 140,000 Existing Systems
- ◆ Wind/PV Hybrid Home Systems ... SETC / World Bank Project: 30,000 New Hybrid Systems
- ◆ SDPC “Brightness Engineering” Village Power Program ... ~ 35,000 5-10 kW Wind/Diesel Systems
- ◆ Foreign Cooperation to Improve Technology ... Hua De (donor-aid) & Xiangtan Bergey Windpower Ltd (private sector JV)





# Chile Region X Electrification

## Wind/Diesel Favored Over Diesel-Only

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- ◆ Collaboration Between CNE, Regional Governments, NREL, and NRECA
- ◆ 1997: Region IX Pilot Projects
- ◆ 1998: Region X Pilot Projects
- ◆ 1999: Regional Implementation: Isla de Chiloe
  - ~ Thirty 3-40 kW Wind/Diesel Systems

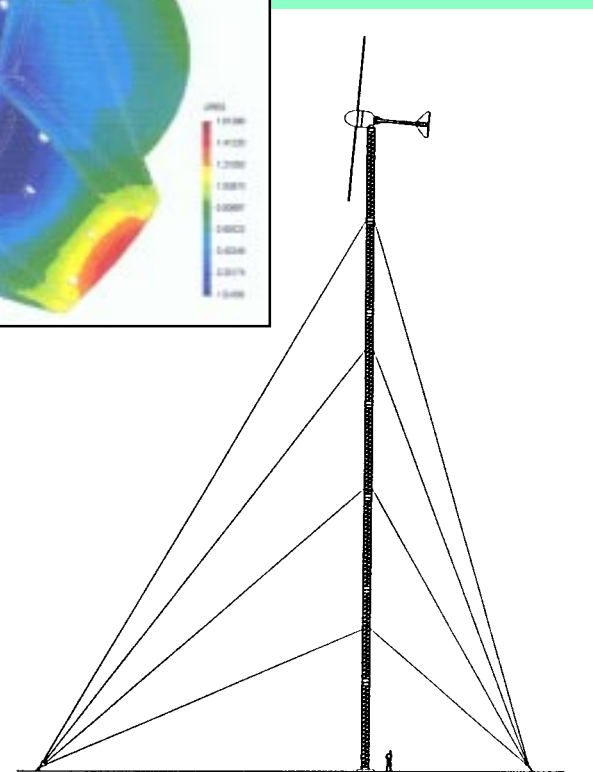
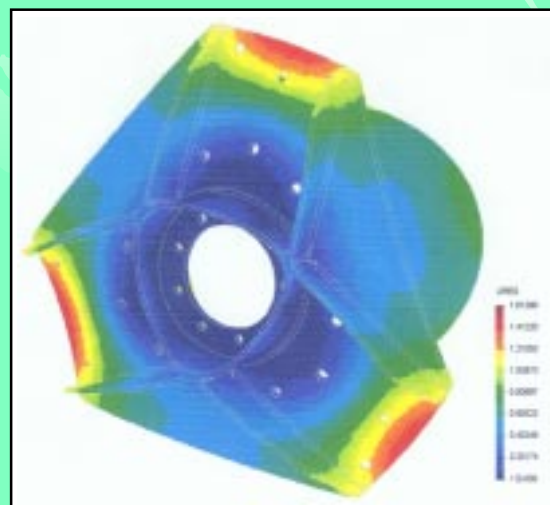


Villa Las Araucarias, Region IX

# Advanced Small Wind Turbines

## Technology on the Move

- ◆ US-DOE Advanced Small Wind Turbine Program ... 8, 16, & 40 kW
- ◆ Injection-Molded & Pultruded Blades
- ◆ Special Low Wind Rotors
- ◆ 10 Year Preventive Maintenance Interval; 50 Year Operating Life
- ◆ Very Tall Towers, up to 82 meters (270 ft)
- ◆ Many Other Private Sector R&D Programs



# **Request: Let the Markets Work**

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- ◆ **PV / SHS is Not a Silver Bullet for Rural Electrification ... Consumers Often Want More Than ~ 200 Wh/Day, Direct Current**
- ◆ **Consumers are Technology Neutral**
- ◆ **Small Wind Turbines have Attractive Cost Reduction and Technology Transfer Potential**
- ◆ **Goal of Bilateral and Multilateral Finance and Market Stimulation Programs Should be Best Service at Least Cost**
- ◆ **Industry Seeks New Public-Private Partnerships to Provide Market Transformation Opportunities in Village Power**