Small Wind Systems for Village Power: An Update

Village Power '98

Washington, DC Oct. 6-8, 1998

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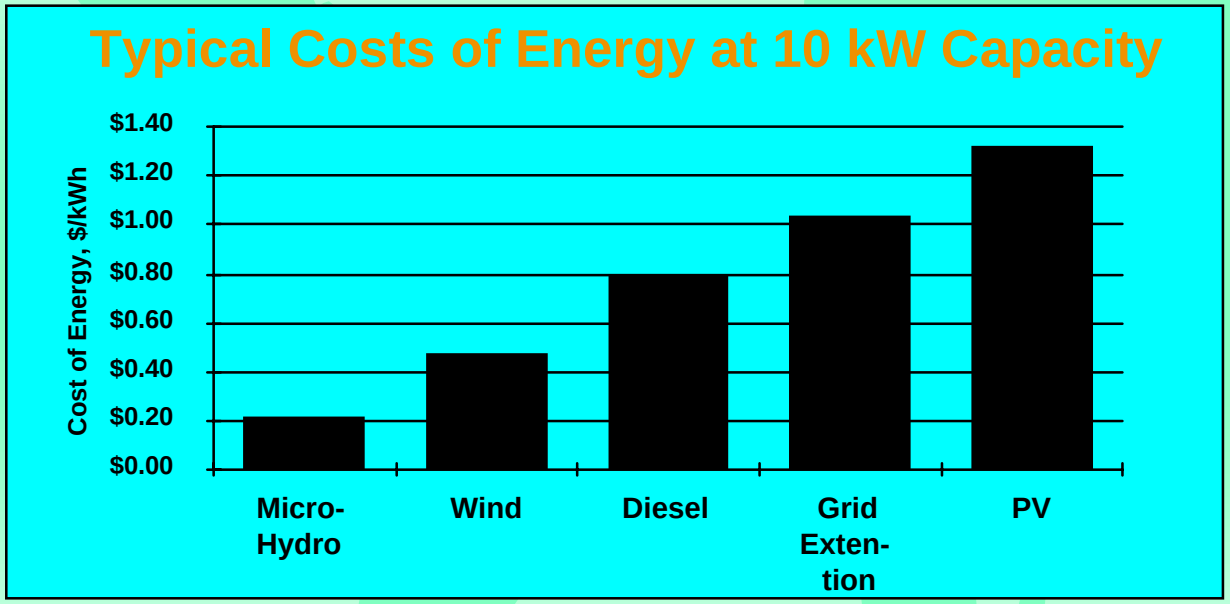
Modern Small Wind Turbines:

High Tech, High Reliability, Low Maintenance

- 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



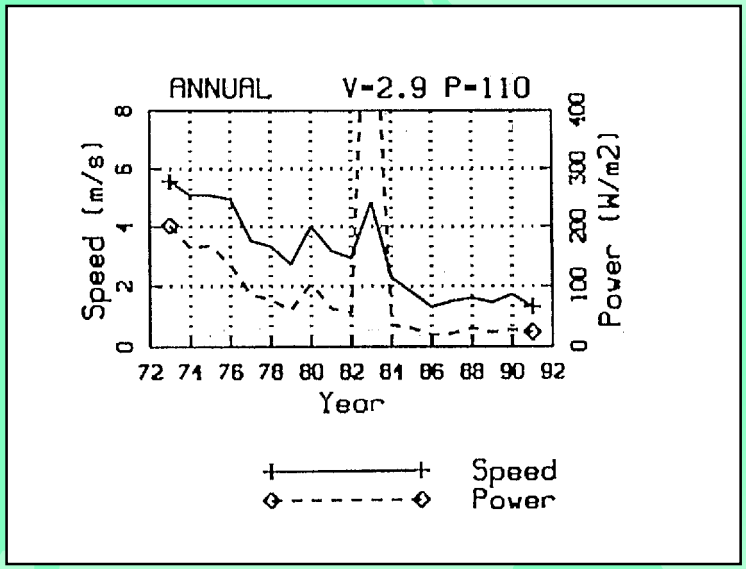
" With reasonable assumptions concerning discount rates, capacity factors, and fuel costs, micro-hydro and wind turbines can have the lowest life cycle costs in locations where the resource is sufficient."

***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 ~ (Velocity)^3 ; So 20% Error in Wind Speeds Means ~50% Error in Available Energy**

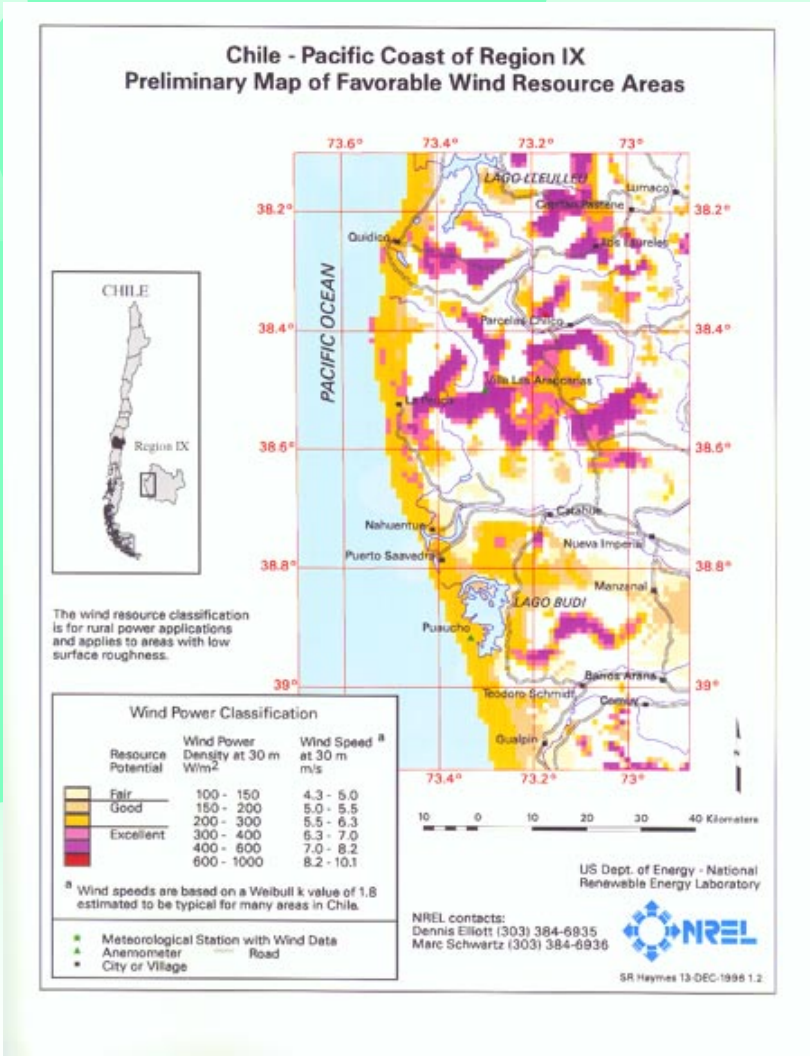


Case of “Disappearing Wind”
Kupang, Indonesia

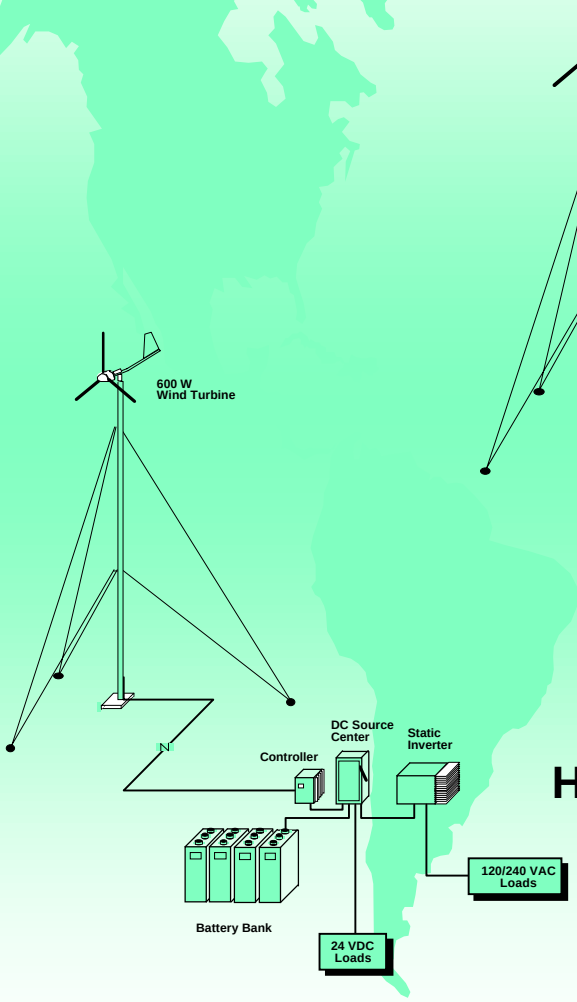
Most National Wind Maps Radically Under-Estimate Available Wind Energy Resources !

Finding the True Wind Resource

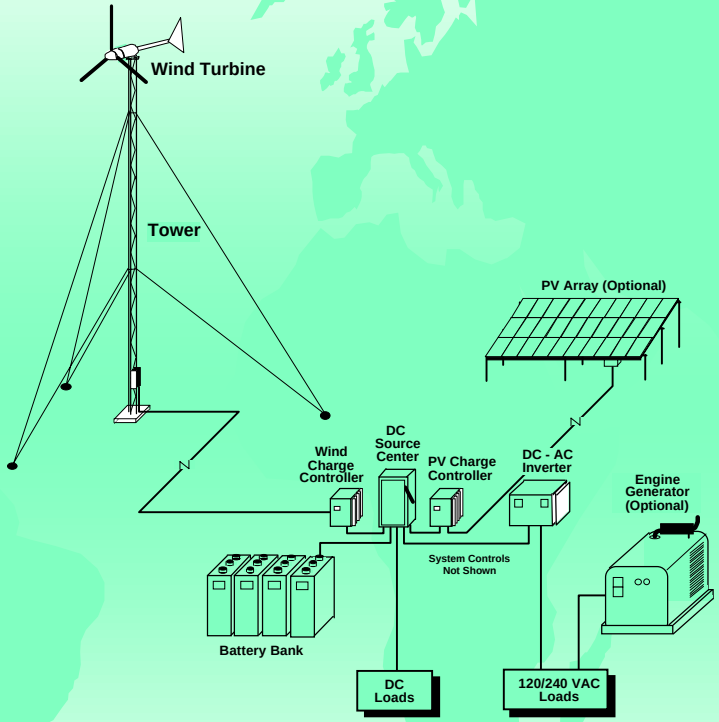
- **NREL Wind Mapping with Additional Data Sources: Satellite, Ex-Military Data, Etc.**
- **Low Cost Wind Loggers Specifically Designed for Small Wind Applications**



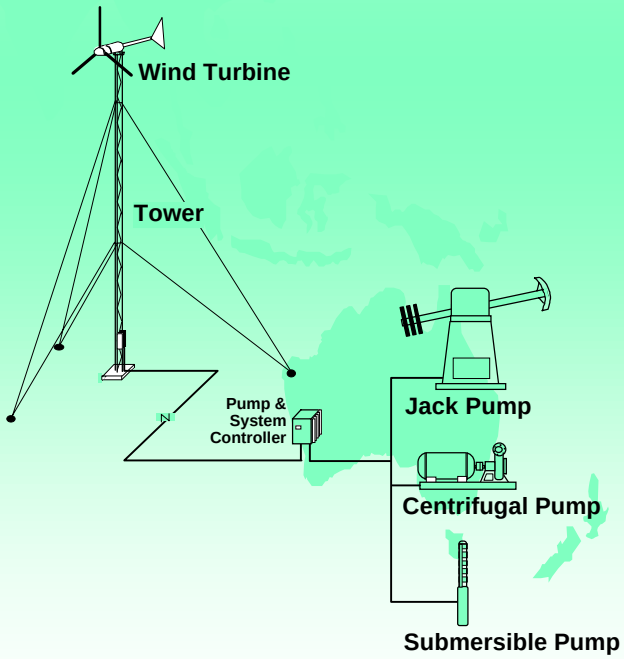
Small Wind Applications



Wind Home Systems



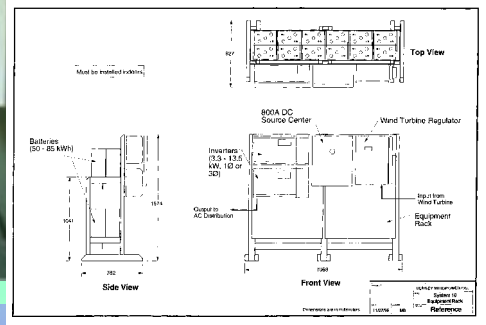
Hybrid Power Systems



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

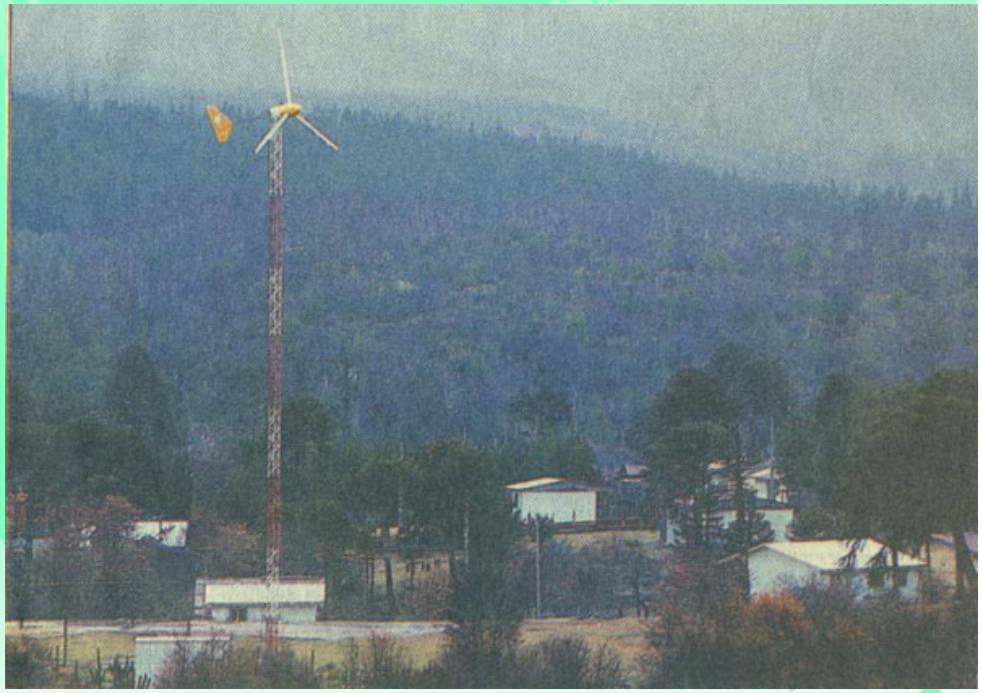
World's Largest Market for Small Wind

- 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

- **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**

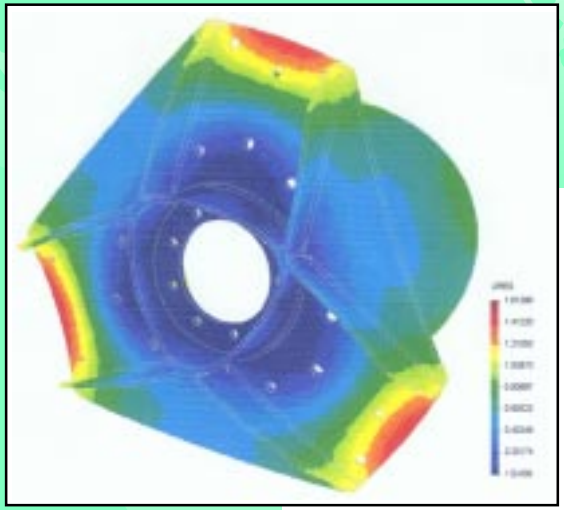


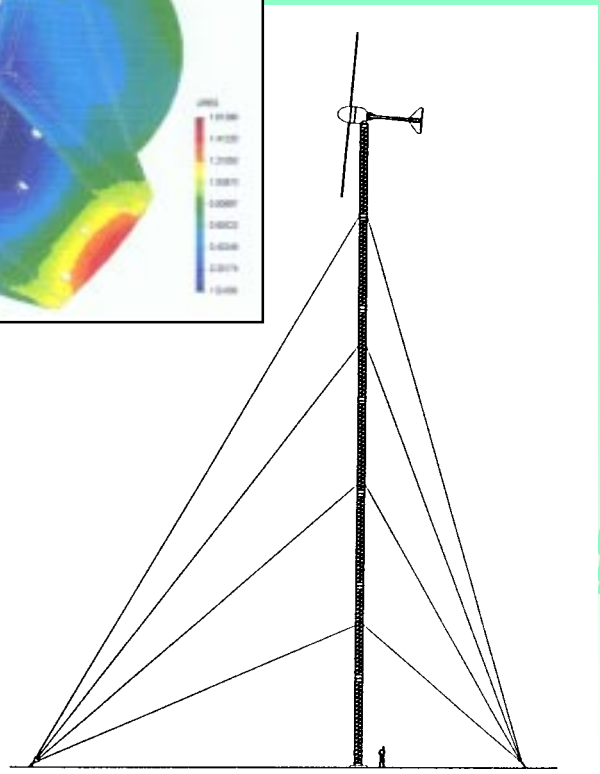
Villa Las Araucarias, Region IX

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

- 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