Applications
Interconnected Operation
Battery Charging
Lessons Learned
Nomenclature

- Mid-80s HAWT
- Internal Ladder
- w/ Fall Restraint
- Work Platform
- Tip Brakes
- “Rocket” Tower
Applications - Telecom

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Applications-Yurt Power

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Applications-Marine

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Applications-Cathodic Protection
Applications-Fence Charging

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Applications--Off-the-Grid

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Applications--Homes

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Electric Vehicle Charging
Applications--Farms
Small Groups or Clusters
Applications--Wind Power Plants

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Off-shore

Vestas, Tuno Knøb, Denmark

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2 MW, Thybøren, Denmark
2 MW, Middelgrunden, Denmark
Interconnected Wind Turbines

- 110,000 units worldwide--160 TWh/yr
- 750 TWh cumulative generation
- 8,500 million operating hours
- 75% induction (asynchronous) generators
- 25% AC-DC-AC with inverters
Single Turbine Interconnection
Arrays
Wind Plant Arrays
Rectilinear

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Typical California Spacing

3 RD

6 RD

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Wind Plant Arrays--Rectilinear

160-250 kW: Mojave, California

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750 kW: Lake Benton, Minnesota
750 kW: Lake Benton, Minnesota
640 kW: Woodstock, Minnesota
Wind Plant Arrays
Linear

Dikes, Breakwaters, Canals

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Wind Plant Arrays
Linear

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1 MW: White Deer, Texas
Wind Plant Arrays
Ridgetops

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Wind Plant Arrays
Ridgetops

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Zond Windwall, Tehachapi, CA
Wind Plant Arrays
Wind Walls

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Zond Windwall, Tehachapi, CA
Tehachapi Pass, California
Wind Plant Arrays Clusters

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Cluster
Off-the-Grid (Battery Charging)

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Small Turbine Manufacturers

- Bergey
- Southwest Windpower
- Vergnet (FR)
- Proven (GB)
- AOC, Entegrity
- Ampair (GB)
- LVM (GB)
- Marlec (GB)
- Juan Bornay (ES)
Marlec 910
Southwest Windpower

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LVM, Ampair, Marlec

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Proven

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Household-Size Wind

Pointe-au-Pere, Quebec

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Lessons
From 30+ Years of Experience

• No Panaceas
• No Cheap Solutions
• No Breakthroughs--No Miracles
• Numbers Matter
• Experience Matters
• Size Matters

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Lessons

• Always Check the Numbers
  Vortec: The Numbers Didn’t Add Up

• Always Check the References
  Vortec: References Discredited in the USA

• Always Google
  Vortec: Ducted Turbine Critics on the Web

• Always Go to the Library
  . . . Or to Your Neighborhood Bookstore!
    Lots of Wind Books Now Available

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Lessons

• Always Be Wary of “New” Designs

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Scams, Frauds, & Flakes
Tell-Tale Signs

• Hype High--Experience Low
• New Design-- “Not Like Those Others”
• “New” Patents
• “Works @ 2 m/s!
• Drag Devices (Squirrels in a Cage)
• Ducted Turbines!
• Pyramid Schemes
  “Get in on the Ground Floor Now”
• Fancy Web Sites
  Cheaper than Hardware