INTRO TO DISTRIBUTED WIND

Lisa DiFrancisco, North Coast Energy Systems
DWEA/NACo Webinar, January 12, 2012
WHAT IS DISTRIBUTED WIND?

*Distributed wind*, which is commonly referred to as small and community wind, is the use of typically smaller wind turbines at homes, farms, businesses, and public facilities to off-set all or a portion of on-site energy consumption.
How Do Small Wind Turbines Work

- Wind turns blades & rotor
- Electricity produced in the alternator
- Electricity (VAC or DC) sent down wiring
- BoS components rectify to usable household AC
- Synchronized to run in parallel with existing utility power
- Switching between wind & utility is automatic
- Off-grid applications may have additional BoS components
Distributed Wind Basics

- Distributed Wind, defined
  - Small Wind (100kW & under)
  - Community (mid-sized) wind
  - Towers typically 80’ – 160’
  - Rotors typically 3’ – 70’ diameter
  - Intended to off-set on-site usage
  - Often installed near building being powered
  - Does not feed directly into the grid for public use (may back-feed excess)
  - Generally installed in small numbers, not farms
Utility Scale Basics

- Utility Scale
  - Usually over 1MW
  - May include community (mid-sized) wind
  - Towers typically 300’ – 400’
  - Rotor Diameter typically 200’ – 300’+
  - Installed in groups (“farms”)
  - Spaced thousands of feet apart from each other
  - Intended to feed directly into the grid for public use
  - Regulated like a utility
  - Typically on monopole towers
**Vestas NM82 1,650 kW**  
This turbine could generate power for about 475 homes at a good wind site. It is among the largest turbines available today. Installed cost is about $1,600,000.

**Zond Z-40-FS 500 kW**  
This turbine could produce electricity for about 150 homes at a good wind site. Turbines in this size range were cutting edge technology in the mid-1990s. Installed cost is about $500,000.

**Bergey Excel 10kW**  
At a good wind site, this turbine could generate enough electricity for one average household. Installed cost is about $35,000.
Small Wind Turbines are Different

Large Turbines (500-2500 kW)

- ~ $1,300/kW
- Designed for Low Cost of Energy
- Requires 6 m/s (13 mph) average sites
Small Wind Turbines are Different

Small Turbines (0.2-100 kW)

- Installed in “Rural Residential”
- On-Grid and Off-Grid
- ~ $4,000-6,000/kW
- Designed for Reliability/Low Maintenance
- Requires 4 m/s (9 mph) average sites
HOW IS DISTRIBUTED WIND USED?

Homes & Business

- Reduce all or a portion of utility-provided electricity
HOW IS DISTRIBUTED WIND USED?

Farms

- Reduce operating costs
- Aggregate net metering
HOW IS DISTRIBUTED WIND USED?

State Parks

- Save taxpayer money
- Educational benefits
- Demonstration projects
HOW IS DISTRIBUTED WIND USED?

Municipalities
- Save on energy costs (taxpayer dollars)
- Apply savings to other programs & services
- Support small wind
HOW IS DISTRIBUTED WIND USED?

Education

- Schools, Colleges, Universities, State Parks & Others
Project Example:
10 kW, Liberty County, Chester, MT

- 10 kW Bergey, 80 ft Guyed Tower installed at county maintenance facility
- Installed Dec. 2003
- Cost ~ $50,000, but US-DOE project and state grants paid for ~ 90%
- Produces ~ 10,000 kWh per year
Project Example: 50 kW, City of Perry, IA

- 50 kW Endurance, 140 ft Self-Supporting Lattice Tower installed at wastewater treatment plant
- Cost ~ $400,000, but is being leased to city
- Produces ~ 165,000 kWh per year
TYPES OF TURBINÉS

- Horizontal Axis Wind Turbine ("HAWT")
  - Name reflects horizontal axis of rotor orientation
  - Most common for both DG and Utility Scale wind
  - Many have proven track records/field tested
  - kWh productivity data available
  - 3 blades most common, but others used as well
TYPES OF TURBINES

- **Vertical Axis Wind Turbine ("VAWT")**
  - Reflects the vertical axis of rotor orientation
  - Less common
  - Often do not make it past prototype phase
  - Reliability/productivity issues
  - Actual kWh production data often unavailable
  - Still in the R&D/"emerging technologies" category
EXAMPLES OF VAWTS
Basics on Towers

- **Tower** – supporting structure, engineered for unique load-handling
  - Wind loads on turbine
  - Turbine loads on tower
  - Icing and other loads on tower & turbine
  - Non-static loads
Tower Types

- Guyed Lattice
- Freestanding Lattice
- Tilt-up Pipe
- Monopole
System-Types

- **Grid-tied/Grid-direct**
  - Works in parallel with existing utility service

- **Off-grid/Stand-alone**
  - Is not tied with existing utility service
  - Requires batteries or other means of storing energy

- **Grid-tie w/battery backup**
  - Uses grid and has storage
  - Requires additional BoS components