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Distributed Wind Energy 101

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What is Distributed Wind?

- The use of one or a few wind turbines at homes, farms, businesses, or public facilities to off-set on-site energy consumption (behind-the meter). Lowering operating costs.
- Wind energy produced first serves the local load and any excess is sold to the utility
- No back-up Power during utility outages (w/o storage & special electronics)

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Benefits of Distributed Wind

- Least-cost renewable technology in areas with good wind resources
- Leverages America's technology and manufacturing strengths
- Complements solar; reduces need for storage and back-up
- Small footprint compared to solar

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Benefits of Distributed Wind

- Strengthens the grid and promotes resilience
- Ramps faster than some other clean energy technologies
- Provides branding for environmental stewardship

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More Expensive, but also More Valuable

Windfarm Turbines

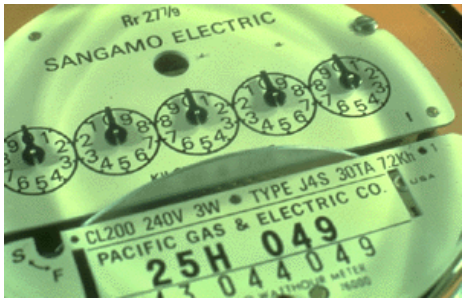
- ~ $1,500 / kW
- Providing Wholesale Power, sold at:

2 - 4¢/kWh

Distributed Turbines

- ~ $3-9,000 / kW
- Providing Retail Power, sold at:

8 - 42¢/kWh



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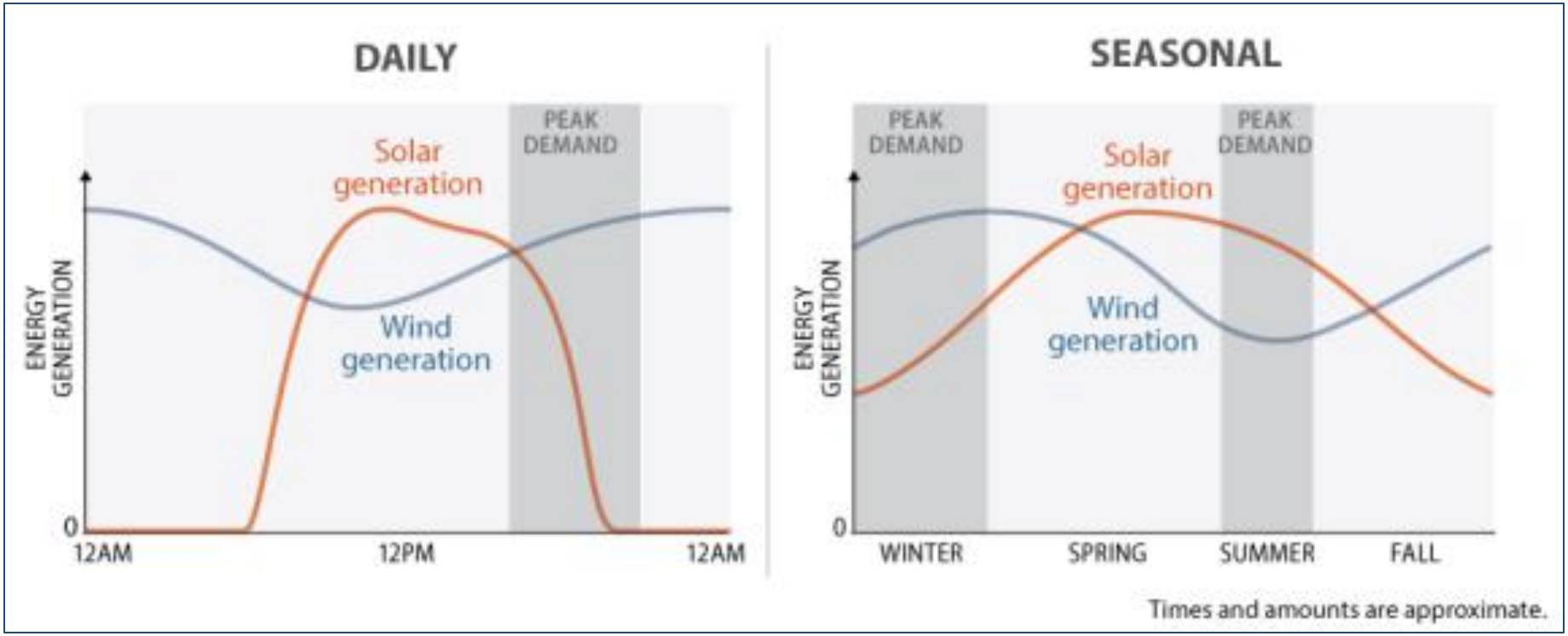
Wind and Solar are Complementary Energy Sources



Source: Congressional Research Service

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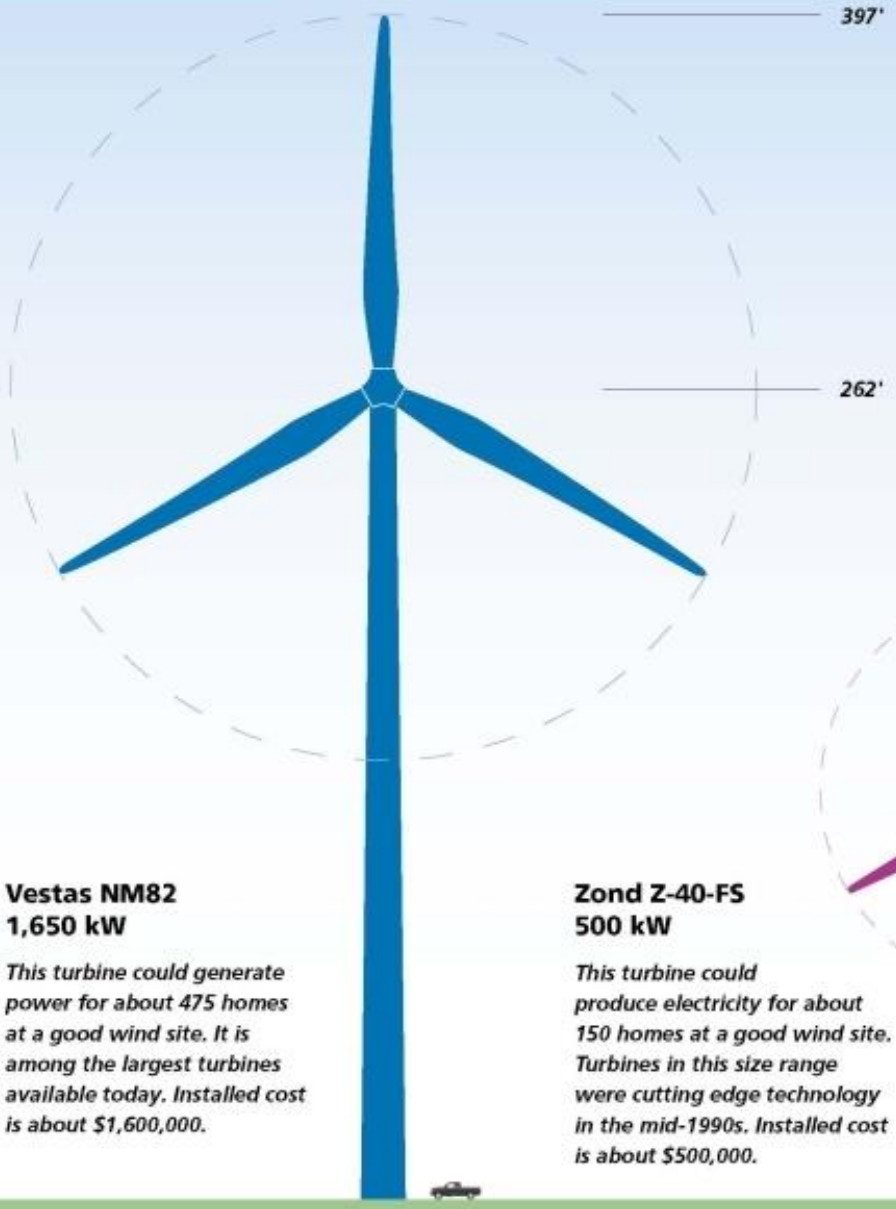
Distributed Wind, with Less Automation, is a "Jobs Machine"





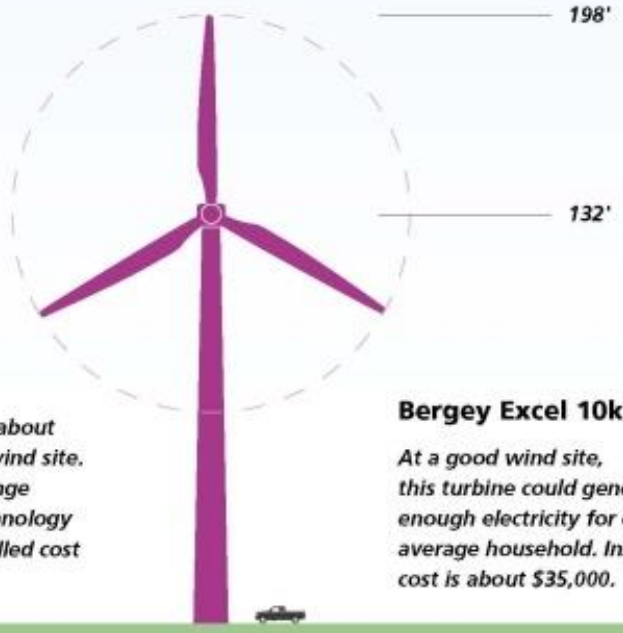

WINDUSTRY

THE SCALE OF WIND POWER



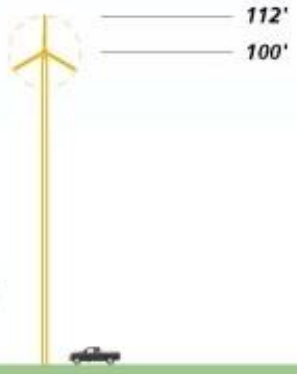
Vestas NM82
1,650 kW

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.

Turbine Size Classifications

- **Small:** 0 – 100 kW
  - Manufacturers: Bergey, Eocycle, Northern Power, Ryse, Kodair, Pecos, QED, Xflow, Primo, Sonsight, SD Wind
- **Mid-Size:** 101 – 1,000 kW
  - Manufacturers: Siva, Carter, Leitwind, EWT
- **Large:** > 1,000 kW (> 1MW)
  - Manufacturers: GE, Vestas, Siemens

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FTS Enterprises

Juniata, NE

Installed by:

AMERICAN Windpower

- 15 kW turbine on 100’ tower
- Installed March 2022
- Produces ~ 35,000 kWh per year
- $100,000 installed; USDA grant + Tax Credit + Bonus Depreciation = 3 year payback

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Heritage Dairy Farm

Yuma, CO

Installed by: HOSS

- 2 x 100 kW turbines on 100’ towers
- Installed October 2016
- Turbines produce 480,000 kWh/yr – 60% of dairies’ annual energy
- Utility: Y-W Electric Association (REC)

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Anhueser-Busch Brewery

Fairfield, CA

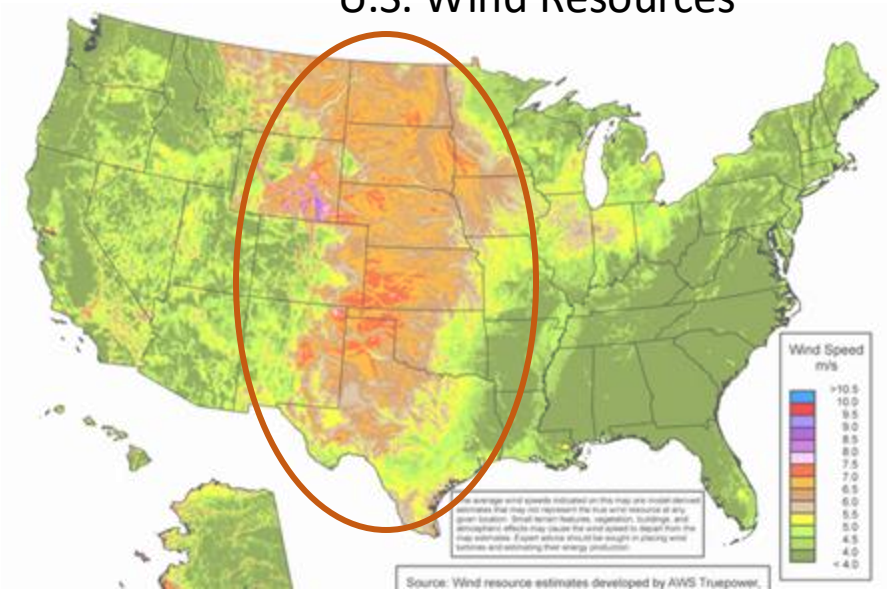
Installed by:

FOUNDATION WINDPOWER

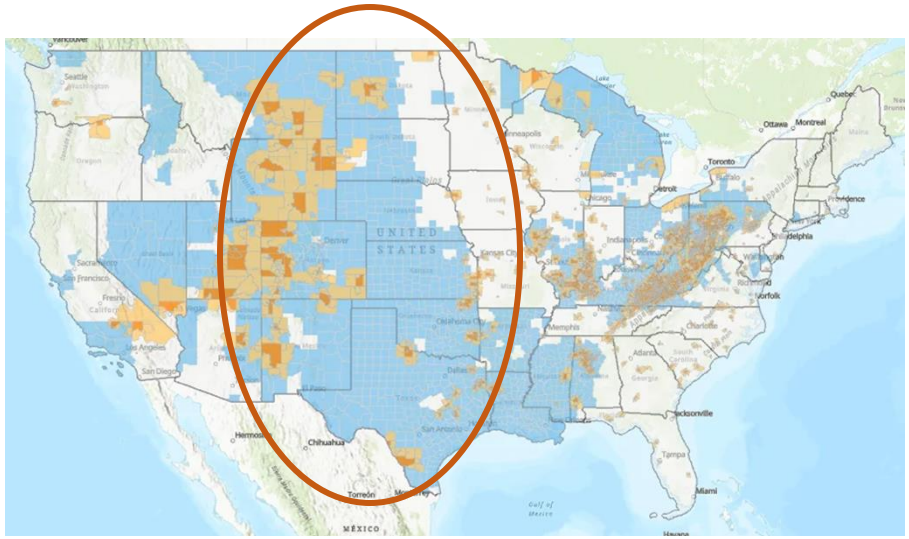
- 1,850 kW turbine, “Bud Light”, on 260’ tower installed August 2014
- Brewery’s second turbine: 1,500 kW turbine installed in 2011
- Two turbines provide 30% of energy demand (equal to 33,000 cases of beer per day)
- Installed under Power Purchase Agreement (PPA)

DW Potential: Comparable and Complementary to Offshore Wind

U.S. Wind Resources



Energy Communities Map, April 2023



2016 & 2022 NREL Reports:

- Technical feasibility: **49.5 million residential, commercial, industrial and public sites**
- Economic feasibility in 2022: **1,400 GW**
- Economic feasibility in 2035: **6,000 GW**

Offshore Wind serves larger coastal communities. **Distributed Wind serves smaller interior, transitional and more disadvantaged communities.** Both have large supply chain opportunities, but DW is far less developed.

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2035 DW Potential: 1,000 GW

Market Segment	2014 Size, Units	Data Source	2035 Size, Units	Percent Suitable	2035 Potential Installed Units	Average Size (kW)	Potential (MW)
Buildings	8,900,000	Census, 2008	14,300,000	15%	2,145,000	350	750,750
Rural Residences	24,900,000	AHS, 2013	34,200,000	25%	8,550,000	10	85,500
Farms	2,100,000	USDA, 2012	2,000,000	35%	700,000	150	105,000
Public Buildings	750,000	DWEA Estimate	875,000	10%	87,500	300	26,250
Schools	140,000	NCES, 2010	165,000	25%	41,250	500	20,625
						Total Potential (MW):	**988,125**

DWEA 2035 DW Goal: 35 GW

Major Cost Reduction Potential

Turbine Size	Recommended Height	Typical User	2016 LCOE (¢/kWh)	2035 LCOE Target (¢/kWh)
1 – 3 kW	60 ft.	Off-Grid, Residential	28	11
4 – 15 kW	120 ft.	Residential, Small Farm	20	6.5
16 – 100 kW	150 ft.	Farm, Commercial, Public Facility	16	5.7
101 – 1,000 kW	180 ft.	Commercial, Industrial, Public Facility	12	5.4
1 - 4 MW	240 ft.	Industrial, Institutional	10	4.6

Source: DWEA Vision Report, 2016

LCOE: Levelized Cost of Energy

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Advanced Distributed Wind Technology

2010 Technology
9 kW, 19,000 kWh/yr
LCOE: 21¢/kWh

2020 Technology
16 kW, 45,000 kWh/yr
LCOE: 9¢/kWh

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Federal Policies Supporting Distributed Wind

- 30% Investment Tax Credits for Residences (through 2032)
- 30% Investment Tax Credits for Businesses & Non-Profits (lower requirements for projects under 1 MW) through 2032
  - 10% Bonus for Domestic Content
  - 10% Bonus for being in an Energy Community zone (mapped annually)
  - Transferability for For-Profits
  - Elective Pay (rebate) for Non-Profits
- 1 (Sec. 179) or 5-Year depreciation for businesses
- Manufacturing Tax Credits for Domestic Production, with limited Direct Pay
- USDA REAP Grants up to 50% for Ag Sector and Rural Small Businesses
  - “Underutilized Technologies” set-aside for wind projects

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For further information, please contact DWEA at info@distributedwind.org