Opportunities for Wind Power in Distributed Generation Applications

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Mid-Sized Wind Turbines for Distributed Generation Applications

Fuhrländer FL 250 at Harbec Plastics in Ontario, New York

- Located at facility “after the meter” where retail power can be displaced
- Reduces facility monthly utility energy bill
- Sells excess power back to utility during off-shift and/or during windy periods.
- May provide additional benefits: Visual evidence that the facility generates and uses green power

Why does Wind Power make sense for Distributed Generation applications?

- Technology improvements have dramatically lowered costs and increased reliability
- US State and Federal incentive programs are making wind projects economically attractive
- Much more economic than other renewable technologies in most places
- Increasingly positive public perception is making siting and permitting easier
- Other benefits of clean energy technology is increasingly in demand by Corporations, Schools, Governments, and other end users.

Barriers to Implementing Wind Power for Distributed Generation

- Suitable Sites
  - Good Wind Resource
  - High Utility Power Cost
  - State Incentive Program
  - Permitable (allowed with zoning variance)
  - Utility Interconnection Agreement
- Mid-Size Wind Turbine Availability
  - Mid-Sized wind turbine production in decline
  - Manufacturers are too busy with large projects

Examples of Small-Mid Size Wind Turbines for Distributed Generation

Fuhrlaender FL 30

Office or School Use
30,000 - 75,000 kWh/yr
27 meter tower
Typical $120,000 cost ($4.00 a watt)
Typical 20 year payback
(12 years with incentives)

Fuhrländer FL 100

150,000 – 250,000 kWh/ yr
35 – 40 meter tower
Factory, Farm, School
Typical $275,000 cost ($ 2.75 a watt)
Typical 14 year payback
(8 years with incentives)

Examples of Mid-Size Wind Turbines for Distributed Generation

Fuhrländer FL 250

Factory, Farm, School Use
350,000 – 550,000 kWh/ yr
40-50 meter tower
Typical $450,000 cost ($ 1.76 a watt)
Typical 9 year payback
(5 years with incentives)

Fuhrländer FL 600

Factory or Water Treatment Plant
1.0 - 1.75 million kWh/yr
50-60 meter tower
Typical $1,000,000 cost (1.25 a watt)
Typical 7 yr payback
(4 years with incentives)

Examples of Large Size Wind Turbines for Distributed Generation

Fuhrländer 54/1000 kW

Large School, Factory, Water Treatment Plant
1.7 – 2.5 million kWh/ yr
70 meter tower
Typical $1,175,000 cost ($ 1.17 a watt)
Typical 6 year payback
(3.5 years with incentives)

Fuhrländer 58/1000PLUS

Large School, Factory, Water Treatment Plant
2 – 2.75 million kWh/ yr
70 meter tower
Typical $1,275,000 cost ($ 1.27 a watt)
Typical 6 year payback
(3.5 years with incentives)

Inside a Mid Size Wind Turbine

Inside a Megawatt Size Wind Turbine

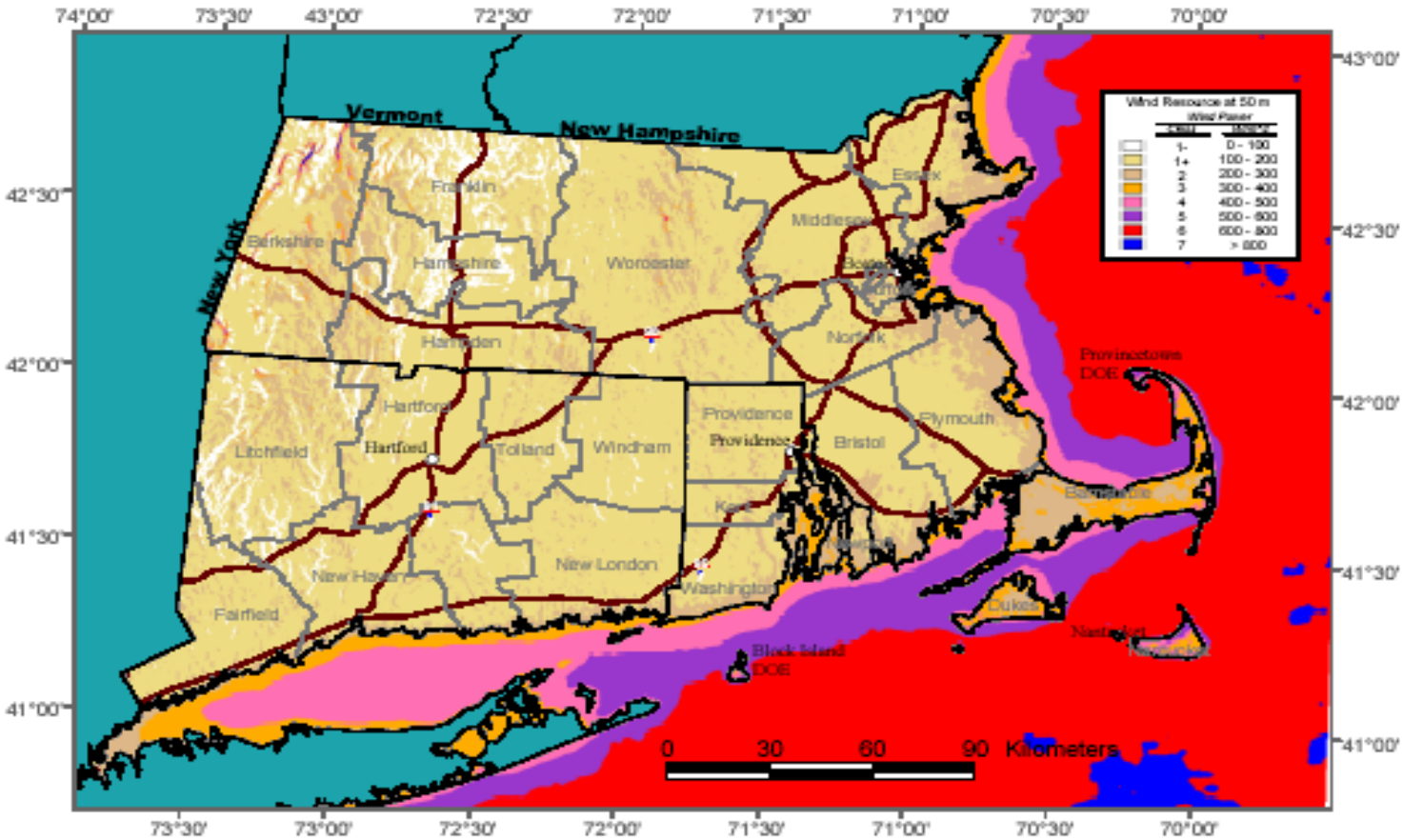
Mid-Sized Wind Turbine Can Provide Benefits When Placed at Appropriate Sites

- Qualifying Factors to Consider
  - Wind Resource Availability
    Is there enough wind to make it work?
  - Location Suitability
    Is my site a good site for a wind turbine?
  - Economic Viability
    Will the wind turbine save me money?

Local Wind Resource Assessment

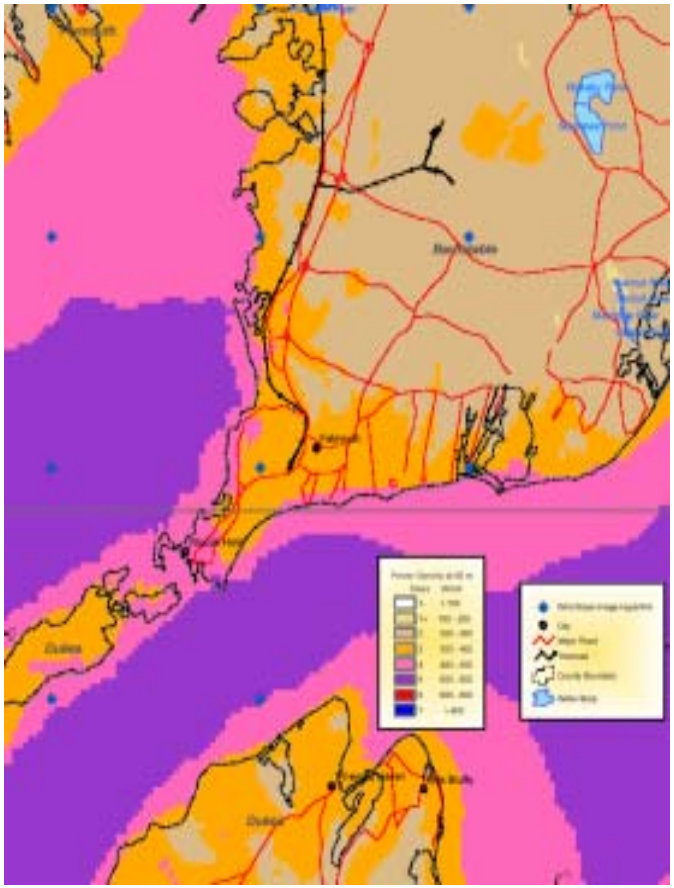
- Wind Maps
  - Available for many US states.
  - Available from Resources Canada soon
- National Weather Service Data
  - From the Web or for purchase
- Anecdotal Evidence
- On Site Wind Measurements
  - Wind Monitoring Equipment
  - DOE Anemometer Loan Program

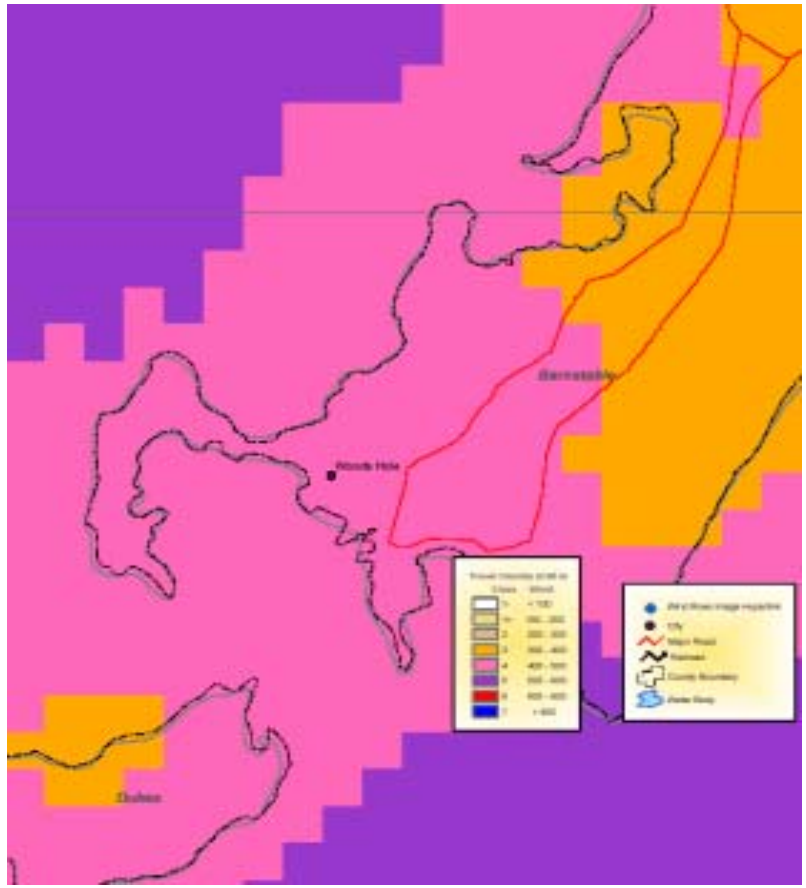
Available Resources: Wind Power Map for Southern NE



New England Wind Resource Map

Wind Power Density at 50 meters (Woods Hole Mass.)
Showing Wind Power Map Resolution (400 meter squares)





Location Suitability

Is my site a good site for a wind turbine ?

- Site Evaluation
  - Obstructions to wind resource
  - Set backs from neighbors
  - Suitable soils for foundation
  - Access for crane and lay down area

Potential Obstacles

- Permitting Issues
  - Variances needed for City, Town, or County Ordinances for height or requiring minimum setbacks
  - State Wetlands Permits
  - FAA Obstruction Lighting may be required if within 2 miles of an airport
- Environmental Issues Which Must be Addressed:
  - Visual impacts
  - Noise impacts
  - Shading (blade shadow flicker across buildings)
  - Radio Frequency Interference
  - Public Health and Safety

Effectiveness of Various US State Incentives and Green Tag Sales

- System Benefit Charge Funded Programs
  - Capital Cost Buy Down (up to 75%)
  - Production Credit (by solicitation, up to 3 cents kWh)
- State Tax Incentives
  - State tax Credits (up to 35%)
  - State Sales Tax exemption (up to 7+%)
- Other State Indirect Incentives
  - Net Metering (depends on size and use, offers protection against adverse standby charges)
  - Renewable Portfolio Standard
  - Local Property Tax exemption
- Green Energy Certificates Sales (from 1 to 4 cents / kWh!)

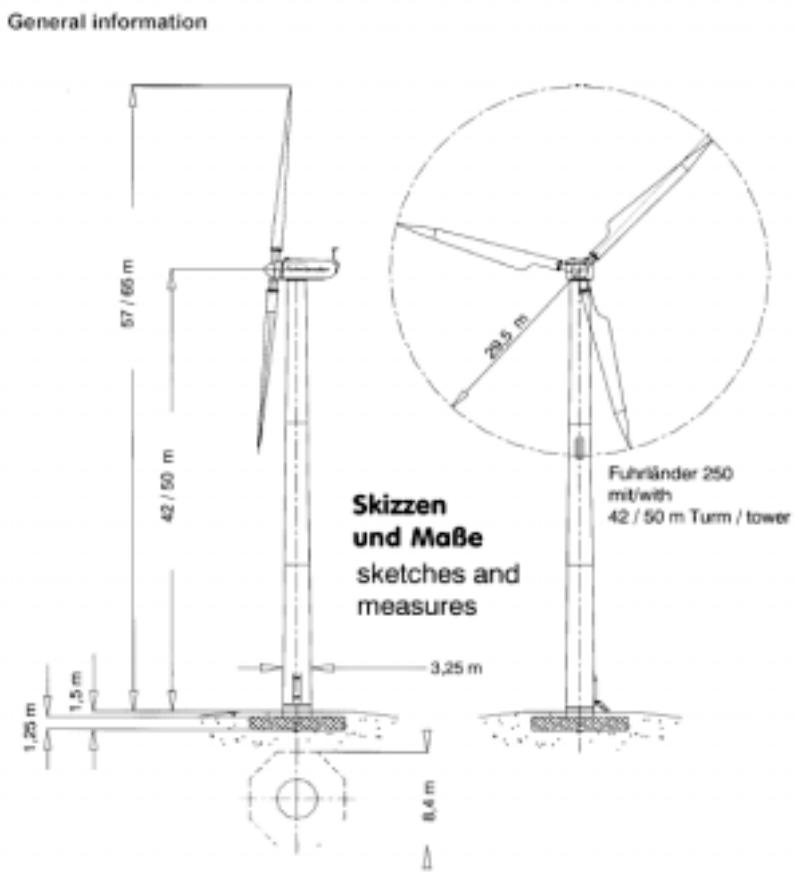
States with Favorable Incentives for DG Wind Turbines in the United States

State	Funds	Buy Down	Income Tax Credit	Sales Tax Ex	Net Metering	Production Credit	RPS
CA	$20 M 2003	50%	7.5% up to 200 kW	Yes	**CO Metering < 1 Meg**	No	Yes
IL	**Yes**	60%	No	No	40 kW	No	No
NJ	**120MA**	30%	No	Yes	100 kW↑	B/S	Yes
OR	Yes	No	35%	No	25 kW	No	No
MA	150M	**Green Schools**	Yes	Yes	60 kW	No	Yes
RI	Yes	B/S	Yes	Yes	25 kW	$.03 B/S	No
NY	Yes	**15-50%**	No	No	No	No	No

Prospective Wind Power Project Used to Demonstrate Typical Economics

- Facility: Seafood Products Processing Plant
  - Uses 1.5 M kWh per year, Electricity Cost $160 k
  - Energy charge $ 0.075 per kWh
  - Green Energy Credits available: $.02 per kWh
  - Peak Load 400 kW, Min Load 200 kW
  - Some Load Management possible (Ice Making)
- Wind Turbine: Fuhrlander 250 kW Machine
  - Class 3+ power output 500,000 kWh annually
  - Total Installed Cost $400,000
  - Value of Electricity Displaced: $47,500 (first year)
  - 20 year Cumulative Savings: $895,000

Prospective Wind Power Project Used to Demonstrate Typical Economics



Simulated Photo of FL 250 at Seafood Plant

Prospective Mid-Size Wind Power Project Used to Demonstrate Typical Economics

Wind Tubine Simple Payback Analysis		
		Fuhrlaender
20 Year Averages, No Incentives		250 kW
[1]	Capital Cost of Wind Turbine Generator	$450,000
[2]	Annual System Power Generation (kWh)	503,700
[3]	Annual Power Displaced from Electric Company	$56,247
[4]	Annual Renewable Energy Credit	$10,074
[5]	Annual Operating Costs for Wind Turbine	-$11,250
[6]	Annual System Savings [3]+[4]-[5]	$55,071
[7]	Simple Payback (Years) [1]/[6]	8.2
[8]	20 Year Power Generated Cost ($/kWh)	$0.067

NOTES:

[1] Capital cost is estimated from best available preliminary information.

[2] Annual Power Generation is calculated using a 23% capacity factor.

[3] Annual Electric power costs calculated using a $.075 cost increasing at 4% a year

[4] Annual Renewable energy credit at $.02 per kWh

[4] Annual operating costs are estimated to be 2.5 % of capital

Prospective Mid-Size Wind Power Project Used to Show Savings by Turbine Size

Wind Tubine Simple Payback Analysis, by Size Without State Incentives						
	20 Year Averages	30 kW	100 kW	250 kW	600 kW	1000 kW
		No Incentives	No Incentives	No Incentives	No Incentives	No Incentives
[1]	Capital Cost of Wind Turbine Generator	$120,000	$300,000	$450,000	$825,000	$1,175,000
[2]	Annual System Power Generation (kWh)	60,444	201,480	503,700	1,208,880	2,014,800
[3]	Annual Power Displaced from Electric Company	$6,750	$22,499	$56,247	$171,259	$224,988
[4]	Annual Value of Green Tag Sales	$1,209	$4,030	$10,074	$24,178	$40,296
[5]	Annual Operating Costs for Wind Turbine	-$3,000	-$7,500	-$11,250	-$12,375	-$17,625
[6]	Annual System Savings [3]+[4]-[5]	$4,959	$19,028	$55,071	$183,062	$247,659
[7]	Simple Payback (Years) [1]/[6]	24.2	15.8	8.2	4.5	4.7
[8]	20 Year Power Generated Cost ($/kWh)	$0.149	$0.112	$0.067	$0.044	$0.038
NOTES:						
	[1] Capital cost is estimated from best available preliminary information.					
	[2] Annual Power Generation is calculated using a 23% capacity factor.					
	[3] Annual Electric power costs calculated using a $.075 cost increasing at 4% a year					
	[4] Annual Renewable Energy Credits at $.02 per kWh					
	[5] Annual operating costs are estimated to be 2.5 percent of capital (1.5% for FL 600 and FL 1000)					

Prospective Mid-Size Wind Power Project Used to Show Savings by Turbine Size

Wind Tubine Simple Payback Analysis, by Size with Incentives

	20 Year Averages		30 kW	100 kW	250 kW	600 kW	1000 kW
			30% buy down	30% buy down	30% buy down	30% buy down	30% buy down
[1]	Capital Cost of Wind Turbine Generator		$120,000	$300,000	$450,000	$825,000	$1,175,000
	NJ State Program Rebate	30%	$36,000	$90,000	$135,000	$247,500	$352,500
	New Capital Cost of Wind Turbine Generator		$84,000	$210,000	$315,000	$577,500	$822,500
[2]	Annual System Power Generation (kWh)		60,444	201,480	503,700	1,208,880	2,014,800
[3]	Annual Power Displaced from Electric Company		$6,750	$31,837	$79,591	$134,993	$224,988
[4]	Annual Renewable Energy Credit		$1,209	$4,030	$10,074	$24,178	$40,296
[5]	Annual Operating Costs for Wind Turbine		-$3,000	-$7,500	-$11,250	-$12,375	-$17,625
[6]	Annual System Savings [3]+[4]-[5]		$4,959	$28,366	$78,415	$146,796	$247,659
[7]	Simple Payback (Years) [1]/[6]		16.9	7.4	4.0	3.9	3.3
[8]	20 Year Power Generated Cost ($/kWh)		$0.149	$0.112	$0.067	$0.044	$0.038

NOTES:

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[4] Annual Renewable Energy Credit at $.02 per kWh

[5] Annual operating costs are estimated to be 2.5 percent of capital (1.5% for FL 600 and FL 1000)

In Summary:

- **Mid-Sized wind turbines can be economic in distributed generation applications given the right combination of factors**:
  - Windy Location
  - State and / or Federal Economic Incentives
  - High Power Cost
  - Good Load Match with the Host Site
- **Other benefits may be available as well**

Mid-Sized Wind Turbine Resources

- American Wind Energy Association
  - www.awea.org
- Wind Powering America
  - www.eren.doe.gov/windpoweringamerica/
- US DOE National Wind Technology Center
  - www.nrel.gov/wind
- Danish Wind Industry Page
  - www.windpower.dk
- New Jersey DEP Clean Energy Program
  - www.state.nj.us/dep/dsr/gcc/gcc.htm
- Massachusetts Technology Collaborative
  - www.masstec.org
- Database of US State Renewable Energy Incentives
  - http://www.dsireusa.org/