



The Wind: A Sustainable Source of Energy

April, 2005

www.NYSERDA.org

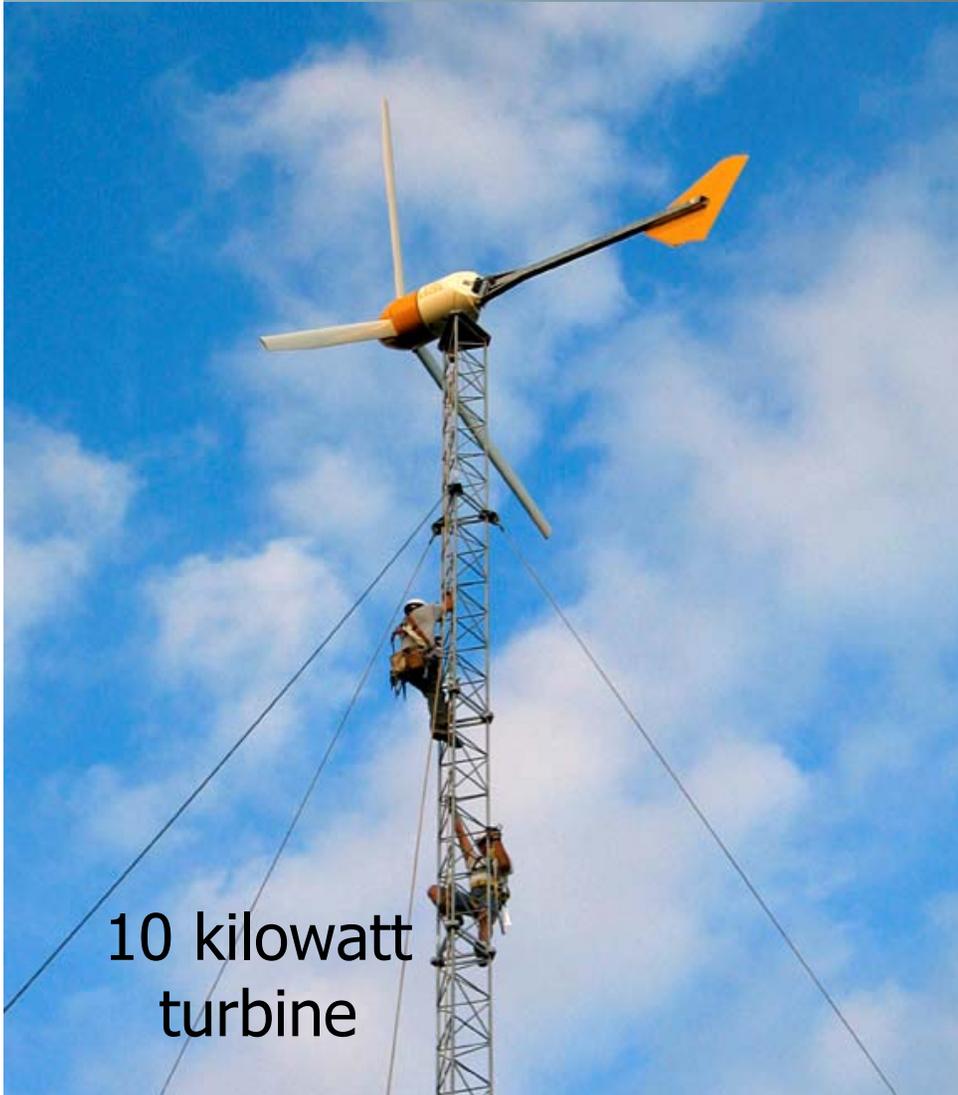
NYSERDA Snapshot

- Public Benefit Corporation
 - Energy, Environment, Economy
 - Market Driven
 - Risk Reduction Investments
- Research & Development, Energy Analysis, Energy Efficiency Services Deployment
- Steward of the New York State Systems Benefit Charge and Renewable Portfolio Standards Programs

Why are We Interested in Wind Energy?

- Helps us achieve a cleaner and healthier environment
- Increases energy diversity:
 - Reduces use of imported fossil fuels
 - Helps ease fuel availability problems in winter
 - Helps protect against fossil fuel price increases
- There is significant wind potential
- Costs of wind power have declined

Large vs Small (or End-Use) Wind Turbines?

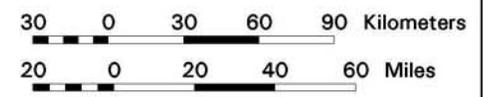
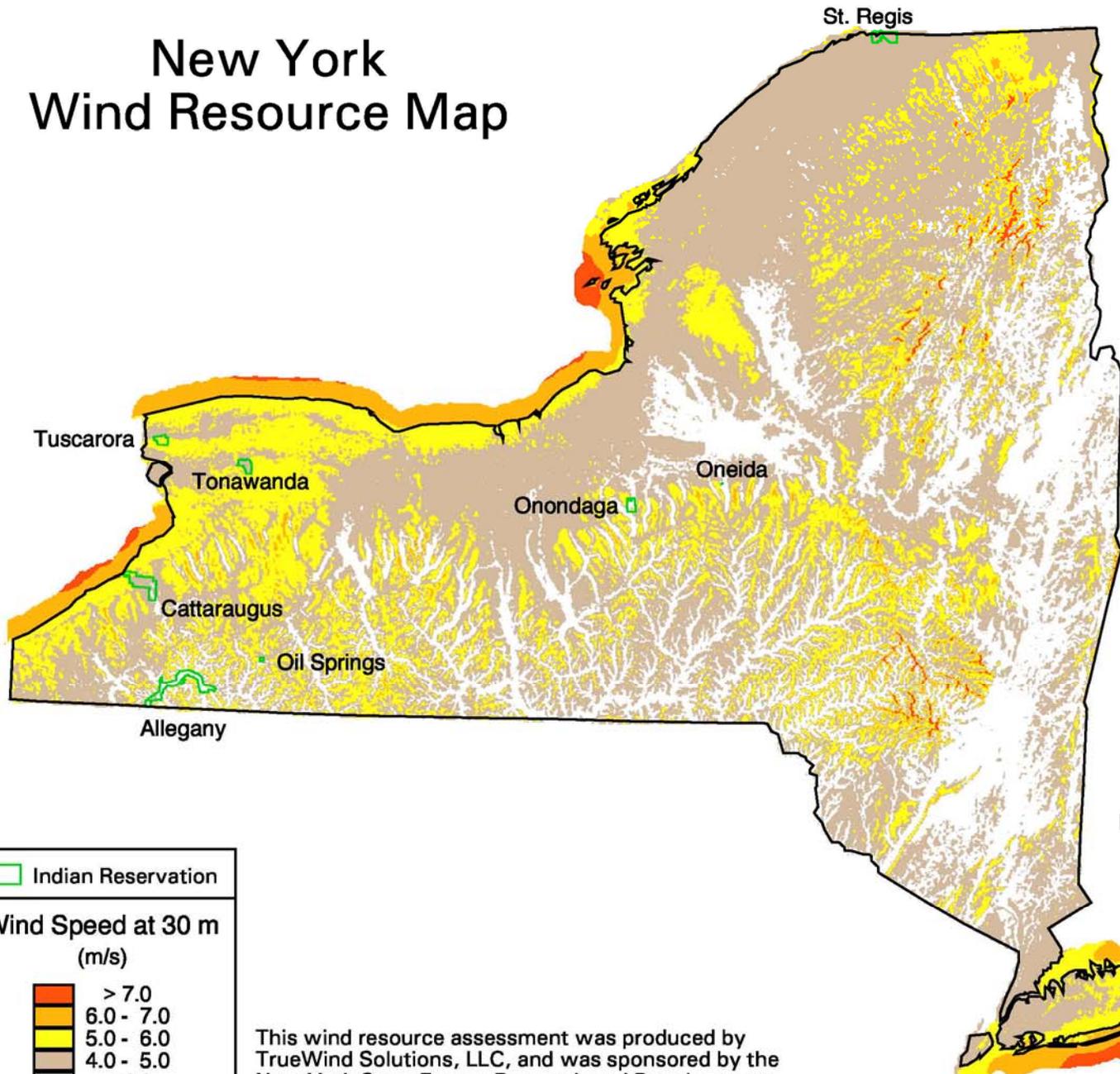


10 kilowatt turbine



1.5 megawatt turbine

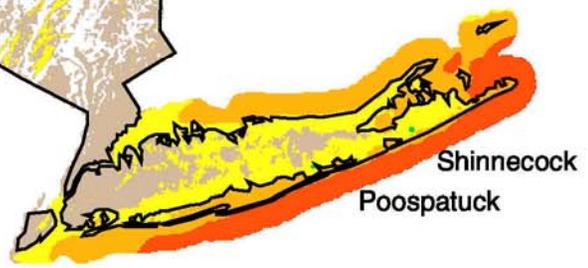
New York Wind Resource Map



U.S. Department of Energy
National Renewable Energy Laboratory

| | |
|---------------------------------|--------------------|
| | Indian Reservation |
| Wind Speed at 30 m (m/s) | |
| | > 7.0 |
| | 6.0 - 7.0 |
| | 5.0 - 6.0 |
| | 4.0 - 5.0 |
| | < 4.0 |

This wind resource assessment was produced by TrueWind Solutions, LLC, and was sponsored by the New York State Energy Research and Development Authority (NYSERDA).





Small or End-Use Wind Turbines

- Usually under 100kW but can be larger; most in NYSERDA's program are 10 kW
- Designed to off-set customer's purchases of utility electricity
- Adaptable to multiple applications
 - Distributed generation
 - Agricultural, residential, commercial, municipal
 - On-grid or off-grid

Small or End-Use Wind Turbines, cont



Olde Chautauqua Farm

- Minimum wind speed around 4.5 m/s or 10 miles per hour; economics improve as wind speed increases
- Tower heights usually 120 ft or less
 - 80 to 120 foot towers typical for 10 kW turbines
- Towers can be free-standing or have guy wires

Small or End-Use Wind Turbines, cont

- Simple design
 - 3 to 4 moving parts means low maintenance
- 20 to 40 year design life
- Proven technology
 - 150,000+ installed
 - Over a billion operational hours
- Designed for reliability and low maintenance
- All turbines under 10kW available today require batteries



Alfred University

Off-Grid Wind

To serve remote areas

Black Mountain



- 400 watts to over 50kW
- Provides power where utility power is not available
- Systems often include batteries or other sources of generation such as solar or propane-fuelled generator if electricity is needed when it isn't windy
- Examples include: water pumping, remote telecommunications, cabins, etc.

Off-Grid Wind

Case Study

- Cathead Mountain
- State Police radio repeater site
- 1 kW wind turbine; 2kW PV system; batteries; generator
- Generator fuel flown in via helicopter
- Combination of wind and PV provided 100% of power needs, avoiding need for propane deliveries





Issues and Challenges: Small or End-Use Wind Turbines

- When siting, consider visual, noise, set-backs, length of wire run
- Guy wires can limit land usage in turbine area
- Cost: a 10 kW turbine costs about \$45,000 to over \$60,000 installed

NYSERDA End-Use Wind Program

- \$2.5 million available
- Easy application process
- First come-first served
- Funding for 15 – 70% of system cost
- Must be grid-connected
- Must be installed by eligible installer
- See:
www.PowerNaturally.org





Fenner Wind Plant

Large Wind Turbines

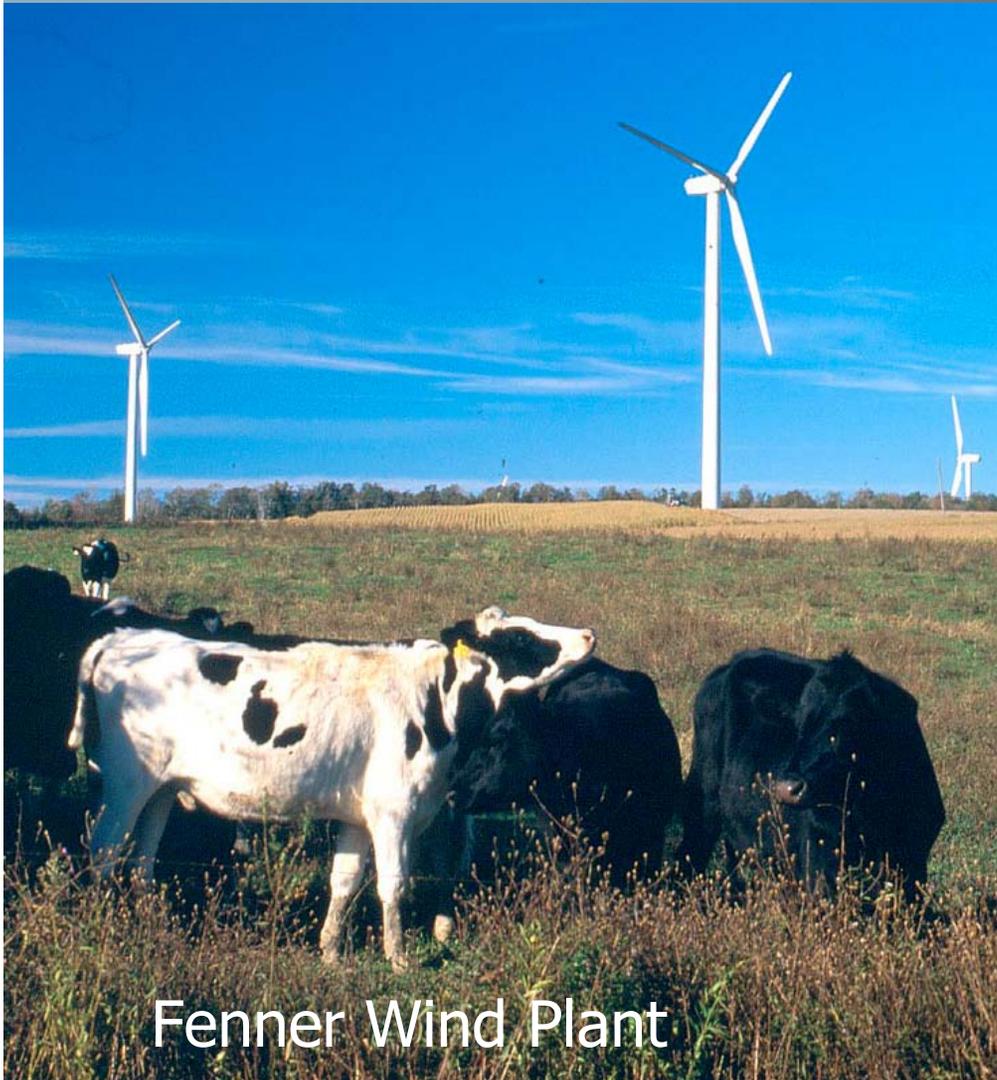
- Over 600kW; typically 1.5 to 1.8 MW
- Tower heights usually between 200 and 260 ft
- Electricity sold through wholesale markets
- Usually sited in groups
- Installed by a developer
- Minimum wind speed around 7 m/s or 15.75 miles per hour



Large Wind Turbines, cont

- One 1.5MW turbine produces as much electricity as about 600 homes use.
- One 1.5MW turbine displaces about 2,500 tons of CO₂ and 24 tons of noxious pollutants per year

Issues and Challenges: Large Wind Turbines



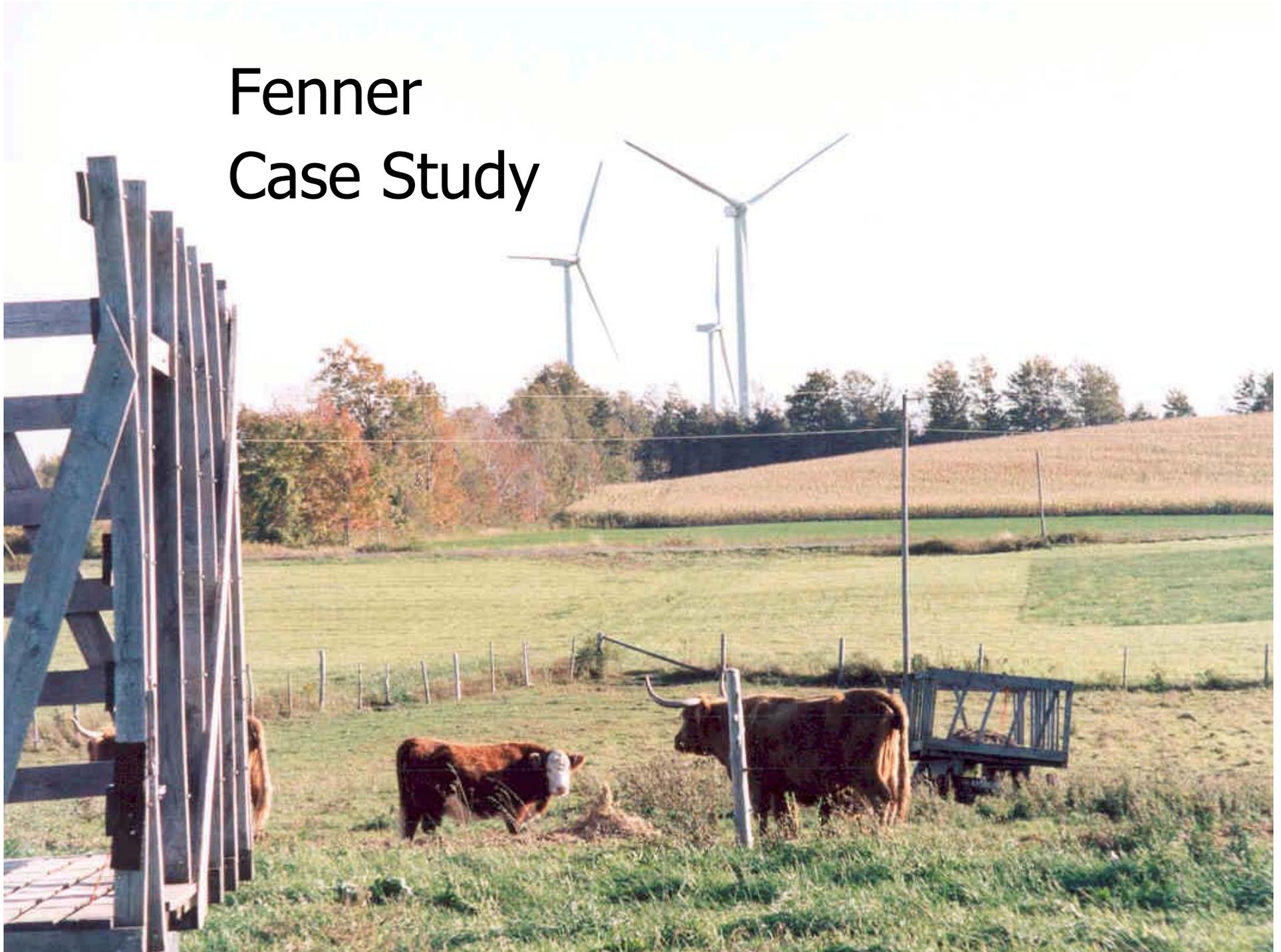
- Site needed with:
 - No significant environmental impacts, strong wind resource, access to transmission, community support
- Issues to consider:
 - Impacts on birds and other animals, visual and noise impacts, impacts on historic buildings, and more

How Noisy Are They?

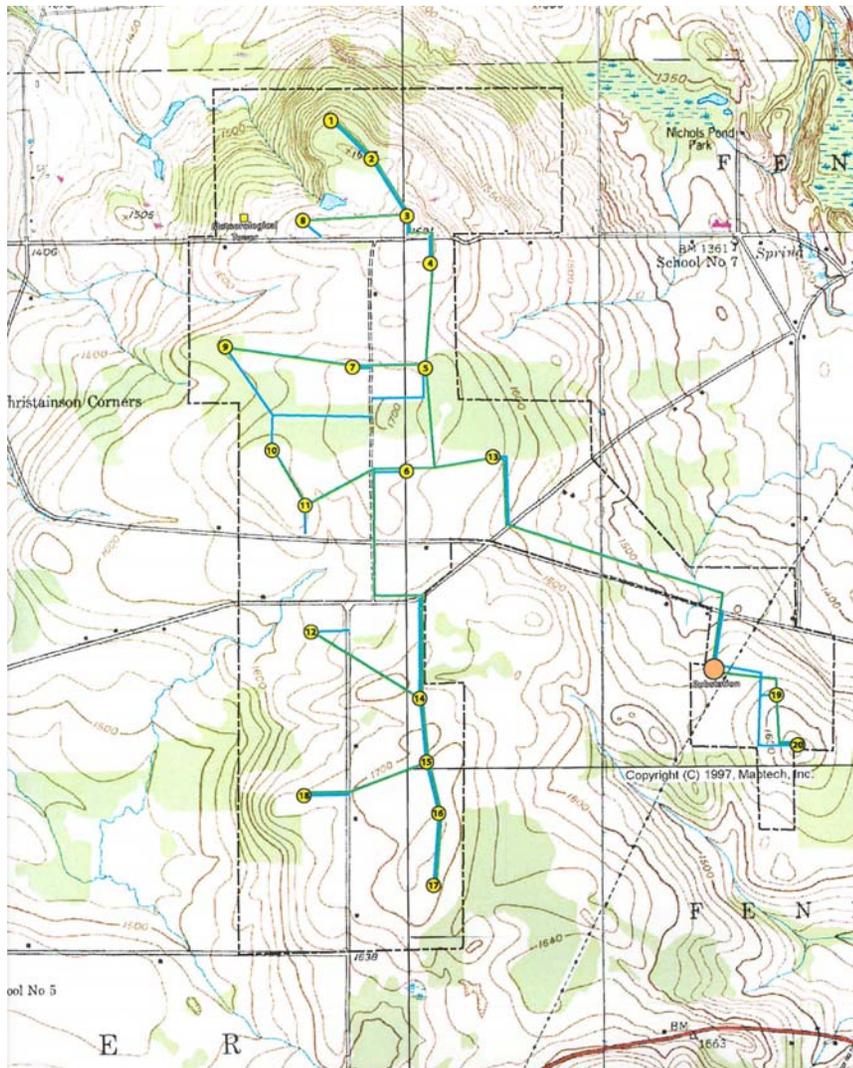


- Early turbines produced in the 1980s were very noisy.
- Noise depends on wind speed and other factors. High winds often mask any noise from a wind turbine.
- At 1/5 mile away, the noise level is typically 35 – 45dB
- For reference, a quiet room is about 35 - 40dB, a busy office is about 60dB, and a conversation is about 60dB.

Fenner Case Study



Fenner Pre-Construction:



- Select prospective site
- **Arrange leases with landowner to measure wind**
- Permit and install tall tower(s)(150 ft) and measure wind for 12 months
- Analyze wind resource strength, design project
- Arrange for long term leases with the landowner to erect and operate turbines

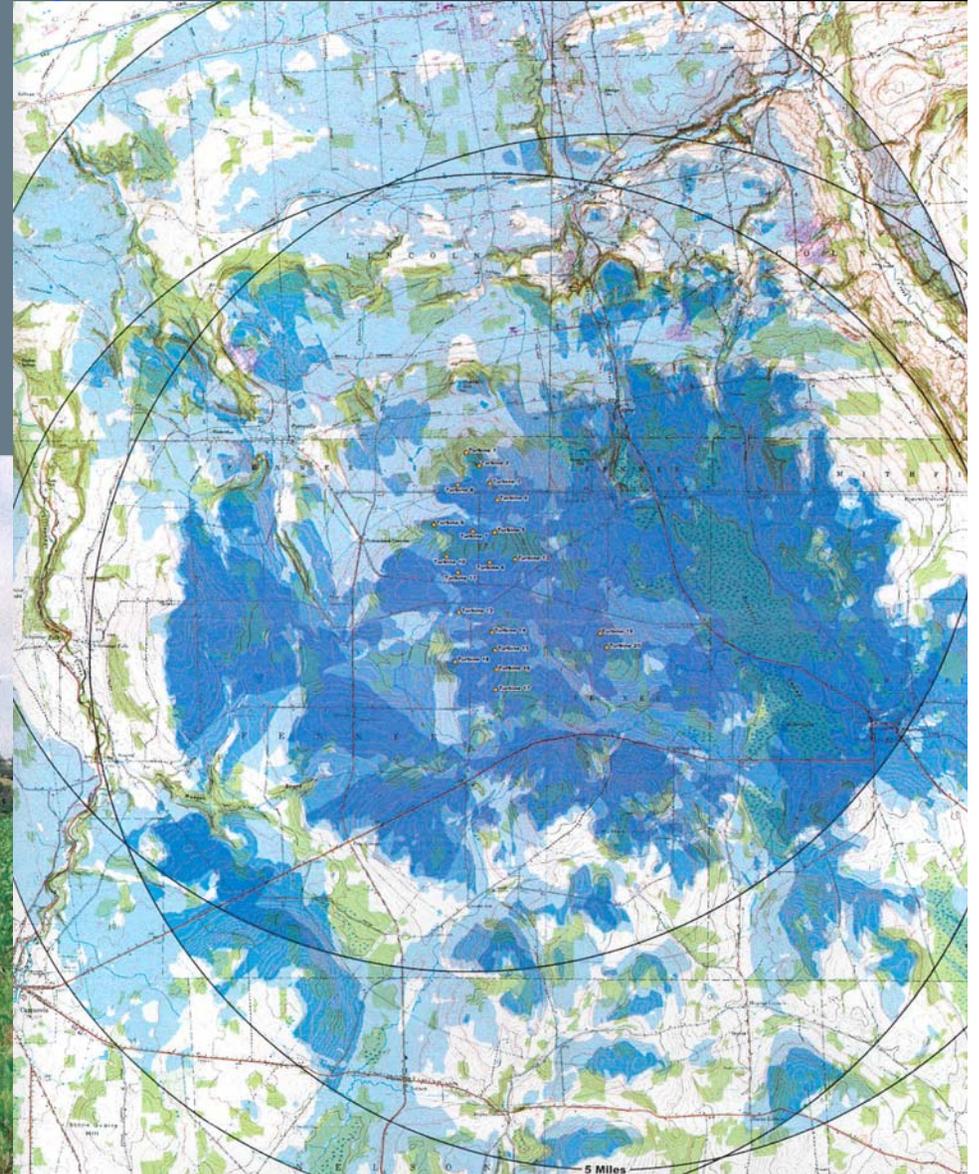
Anemometer



Fenner Environmental Analysis

View shed analysis →

Visual simulation



Fenner Construction





FENNER
Green Fields, Green Power

Status of Wind Development in NY

- Large Wind:
 - 37 turbines totaling over 48 MW installed in NY
 - NYSERDA currently working with 3 developers on 4 projects totaling 425 MW
 - 2,200 MW of wind in NY forecasted through 2013 as a result of the RPS
- End-Use Wind:
 - 6, 10 kW turbines installed so far under NYSERDA's program; 7 more projects under development
 - 11 eligible wind installers
 - Biggest barriers: lack of product, high costs, permitting takes time

For More Information on Wind:

- NYSERDA's Renewables Programs
 - www.PowerNaturally.org
- American Wind Energy Association
 - www.awea.org
- Wind Power New York
 - www.awea.org/wpny/index.html
- New York Wind Map
 - www.truewind.com
- Windustry
 - www.windustry.org