Wind Energy Technology Overview

Presented to the Delaware County Planning Department
and the Towns of
Hancock, Masonville, Tompkins

November 29, 2006

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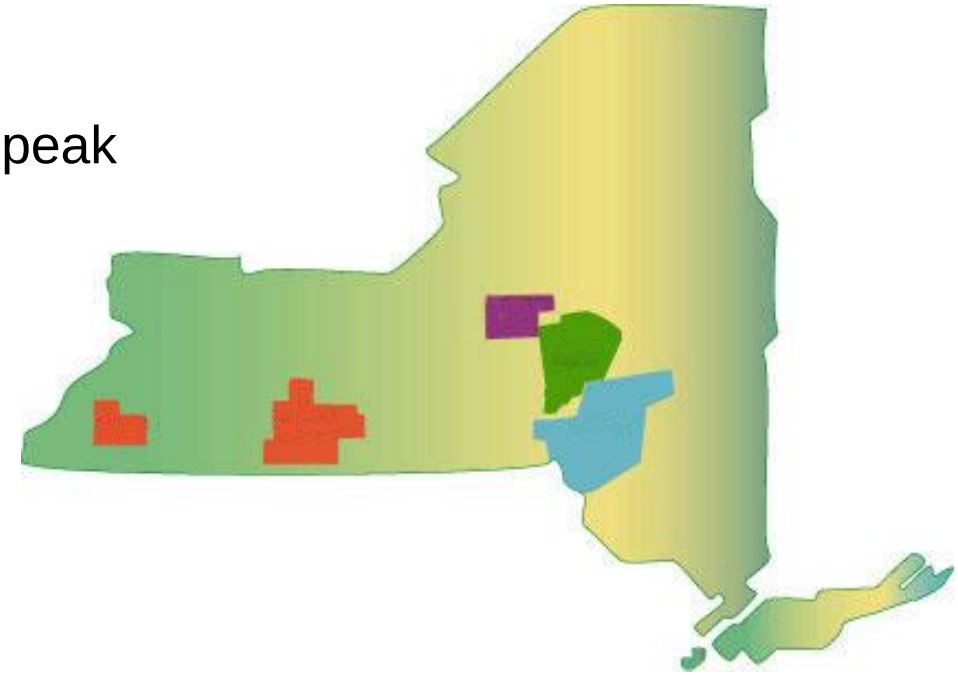
The Co-op at a Glance

- Headquarters: Delhi, NY
- Geographic Area Served:
  - Counties: Delaware, Schoharie, Otsego, Chenango
- 800 miles of distribution lines
- 5,100 member/customers
- 30 Employees
- System Load: ~15 MW peak



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Co-op View of Wind

- Wind may be a good addition to our power supply portfolio.
- The economics look promising with the outlook for the energy market and the tax incentives.
- Each town will make up their own mind on how to regulate wind.
- The Co-op is a resource to assist towns in any way possible.

Disclosures

- Delaware County Electric Cooperative, Inc. has created a joint venture company with wind development experts Wind Works LLC.
- Jointly owned company is called Delaware Wind Energy LLC
- Delaware Wind Energy LLC is actively investigating wind resources in Tompkins

What do Turbines Look Like?

Category	**"small wind"**	**"small commercial wind"**	**"utility scale wind"**
Application	•Home & farm use •Power to remote sites •Net metering	•Supplements commercial or industrial loads, or diesel generation at remote sites •Net metering	•Connects to power grid
Power Rating (max. kilowatts)	•0.5 – 50 kW	•50 kW to 500 kW	•500 kW – 3,000 kW+
Blade rotor rpm	•Up to 300 rpm	•30 – 50 rpm	•10 – 20 rpm

Photos: NREL

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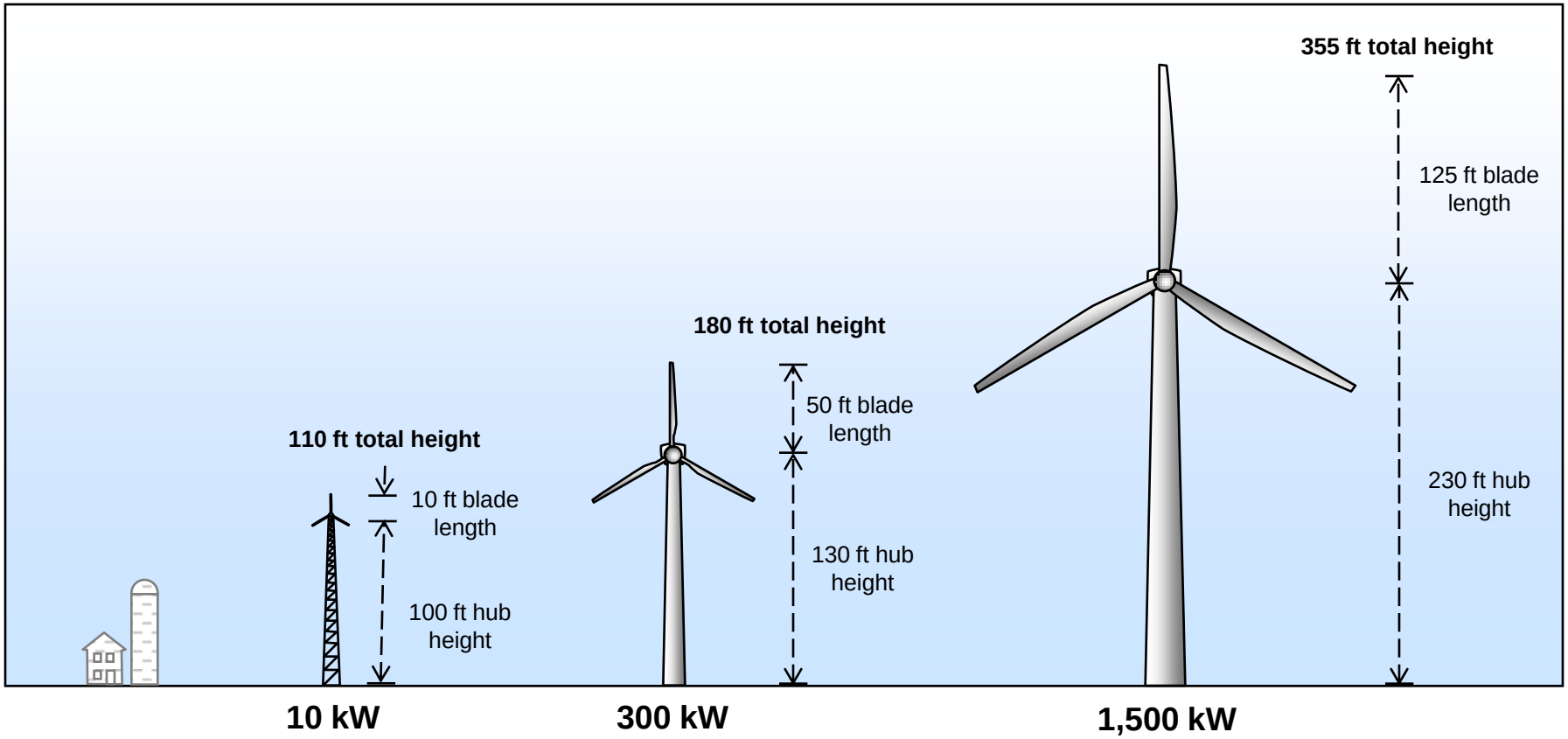
How Tall are the Turbines?



Equivalent number of homes served (typical):

1-3	80 - 90	600 - 700

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Wind Turbine Performance

Energy produced from a wind turbine depends on:

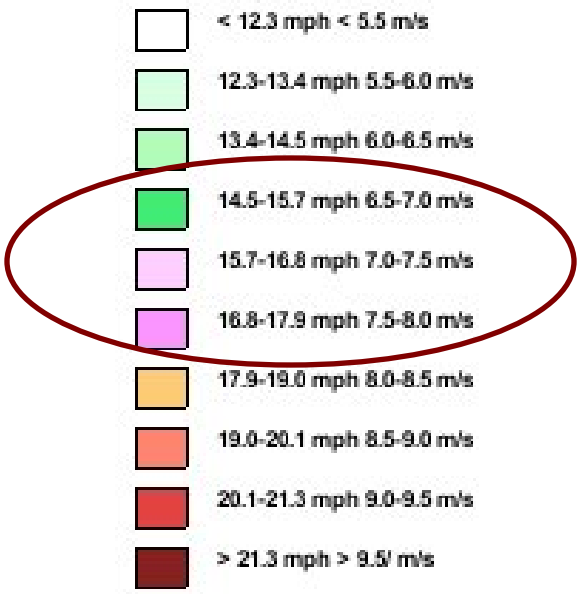
- The **wind resource** at the site
- The **length** of the turbine blade
- The **height** of the blades above the ground

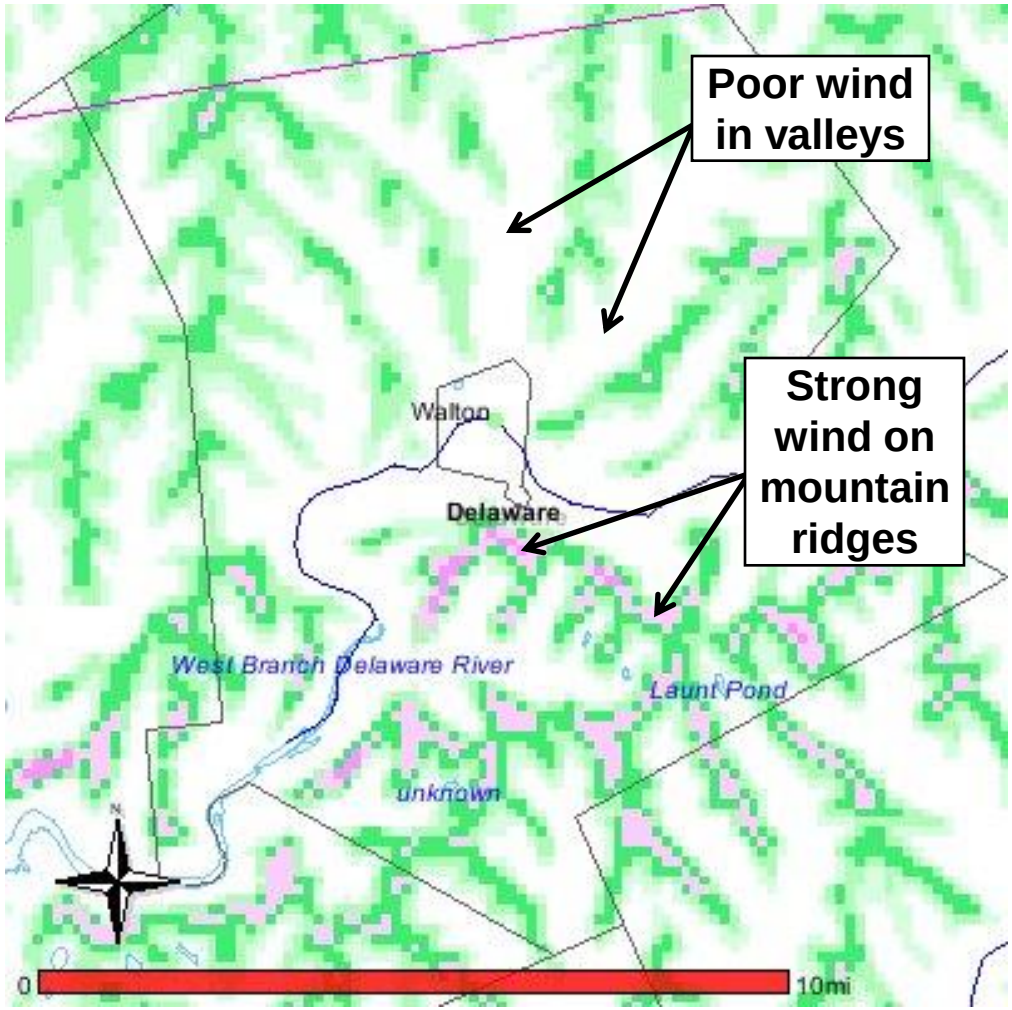
To a lesser degree:

- The design efficiency of blades, gears, & generator
- The reliability of turbine components

Wind Resource

The #1 factor for a viable wind project is the wind resource.





Source: www.awstruewind.com

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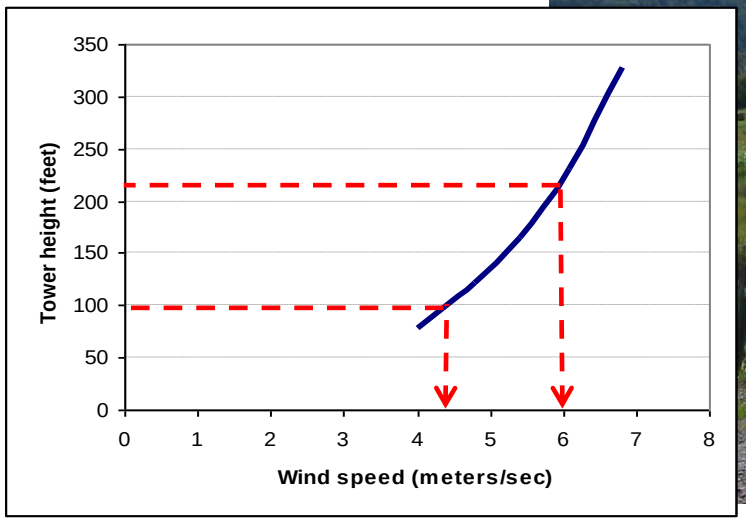
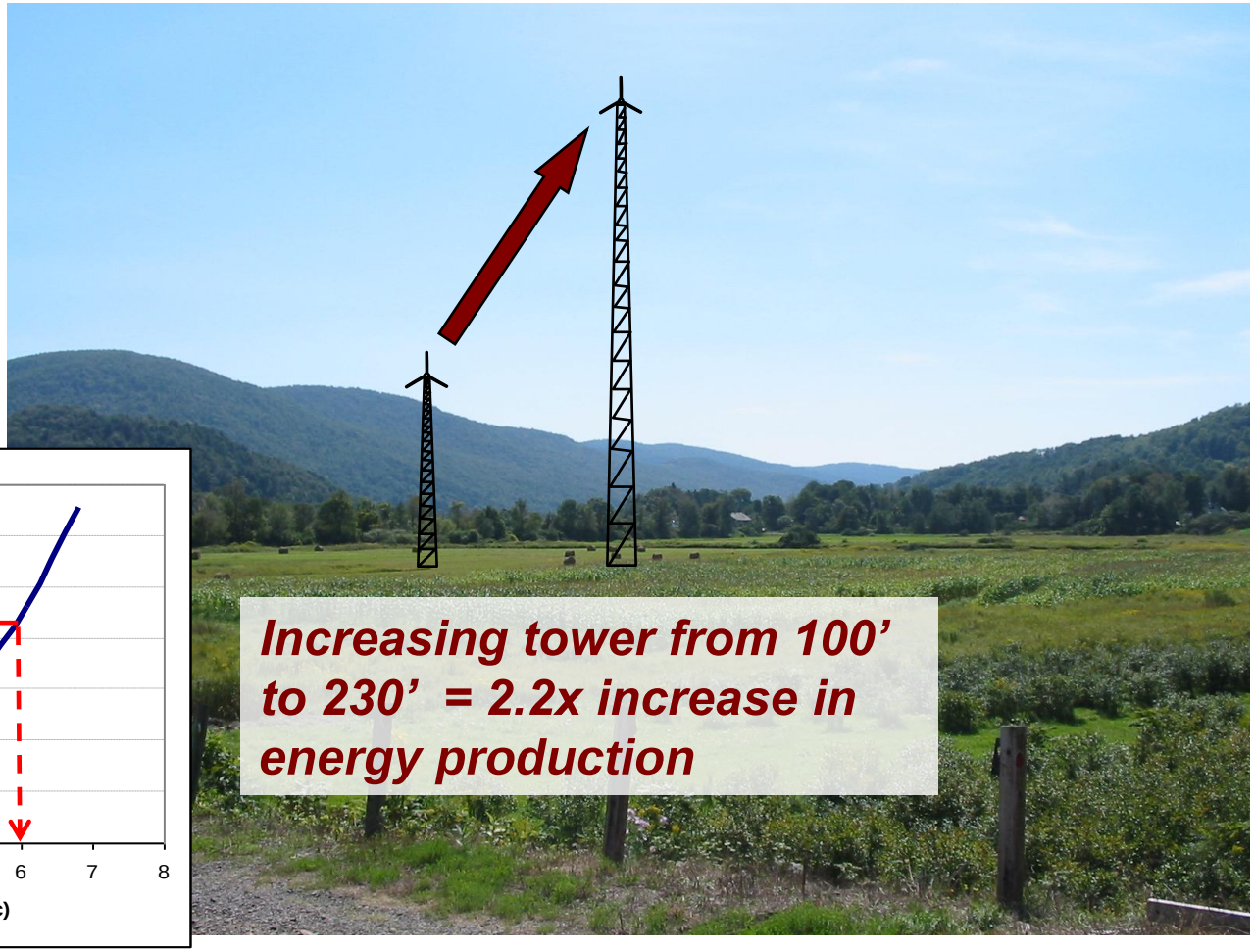
Tower Height

Wind speed increases exponentially as you increase the height of the tower.





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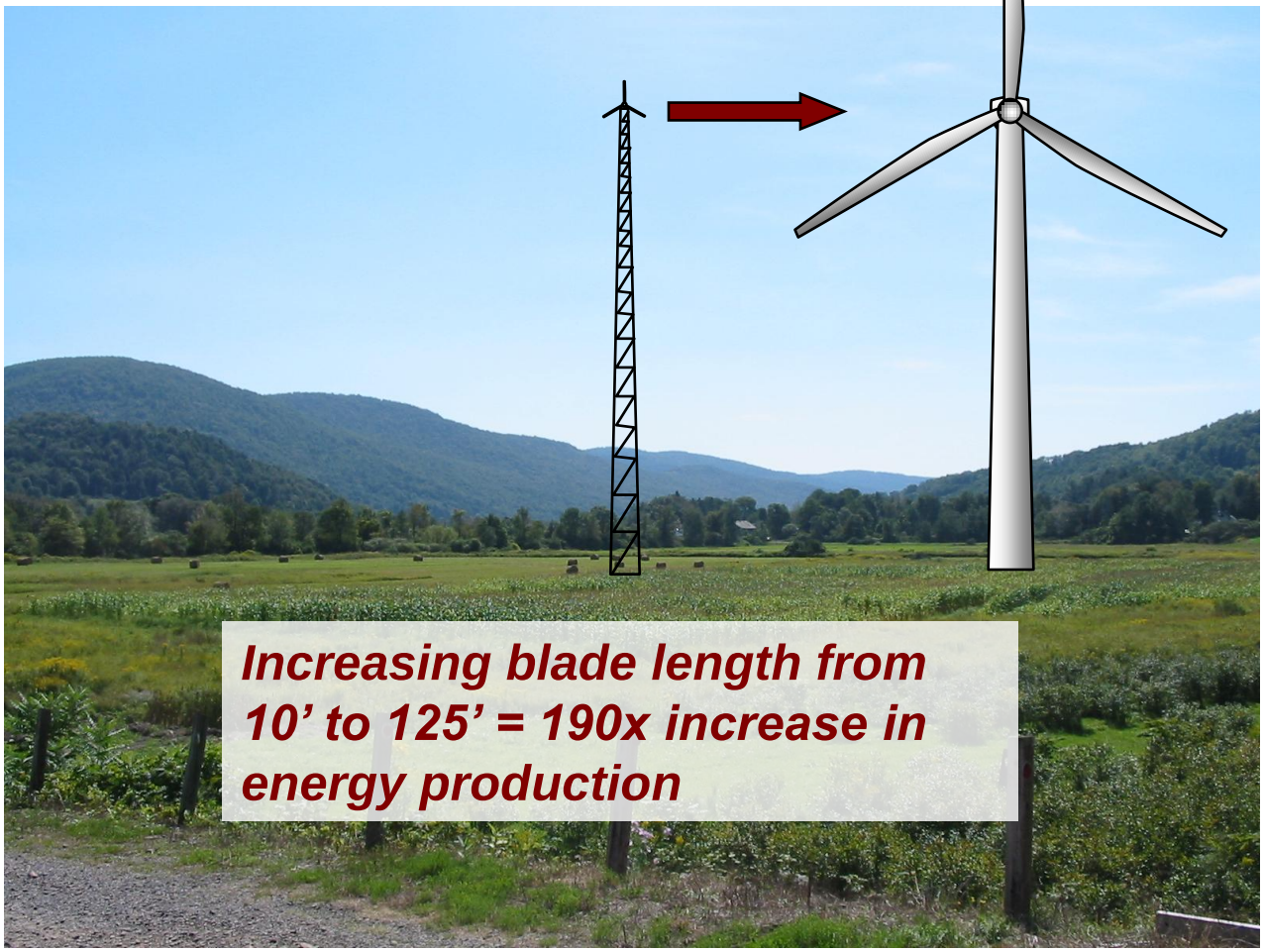
Blade Length

Power output is proportional to the square of the blade length.

Doubling blade length would result in 4x energy production

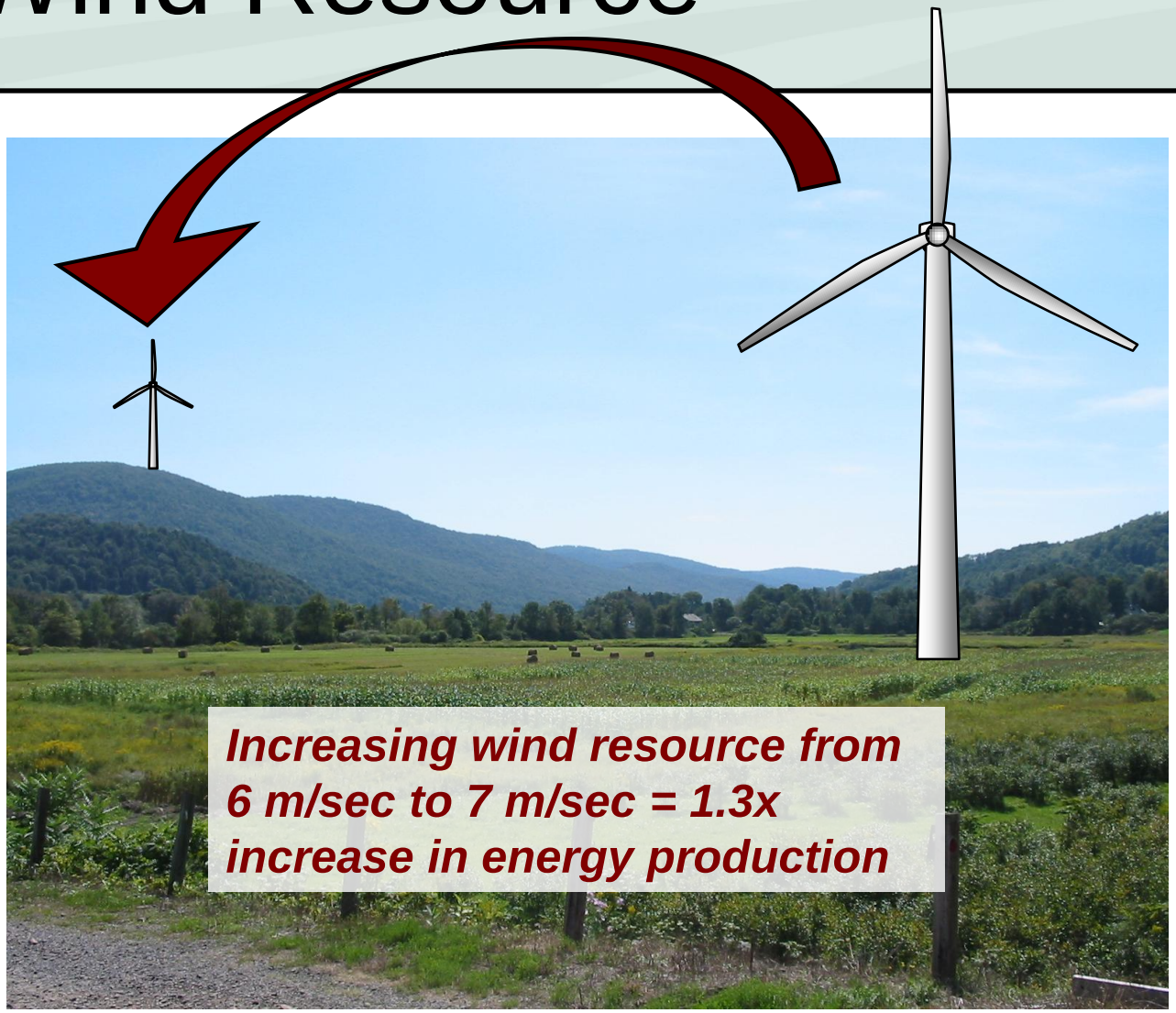


Wind Resource

Power output is proportional to the cube of the wind speed.

Hills and mountain ridgelines experience better wind resource than in the valleys.

Doubling wind speed would result in 8x energy production

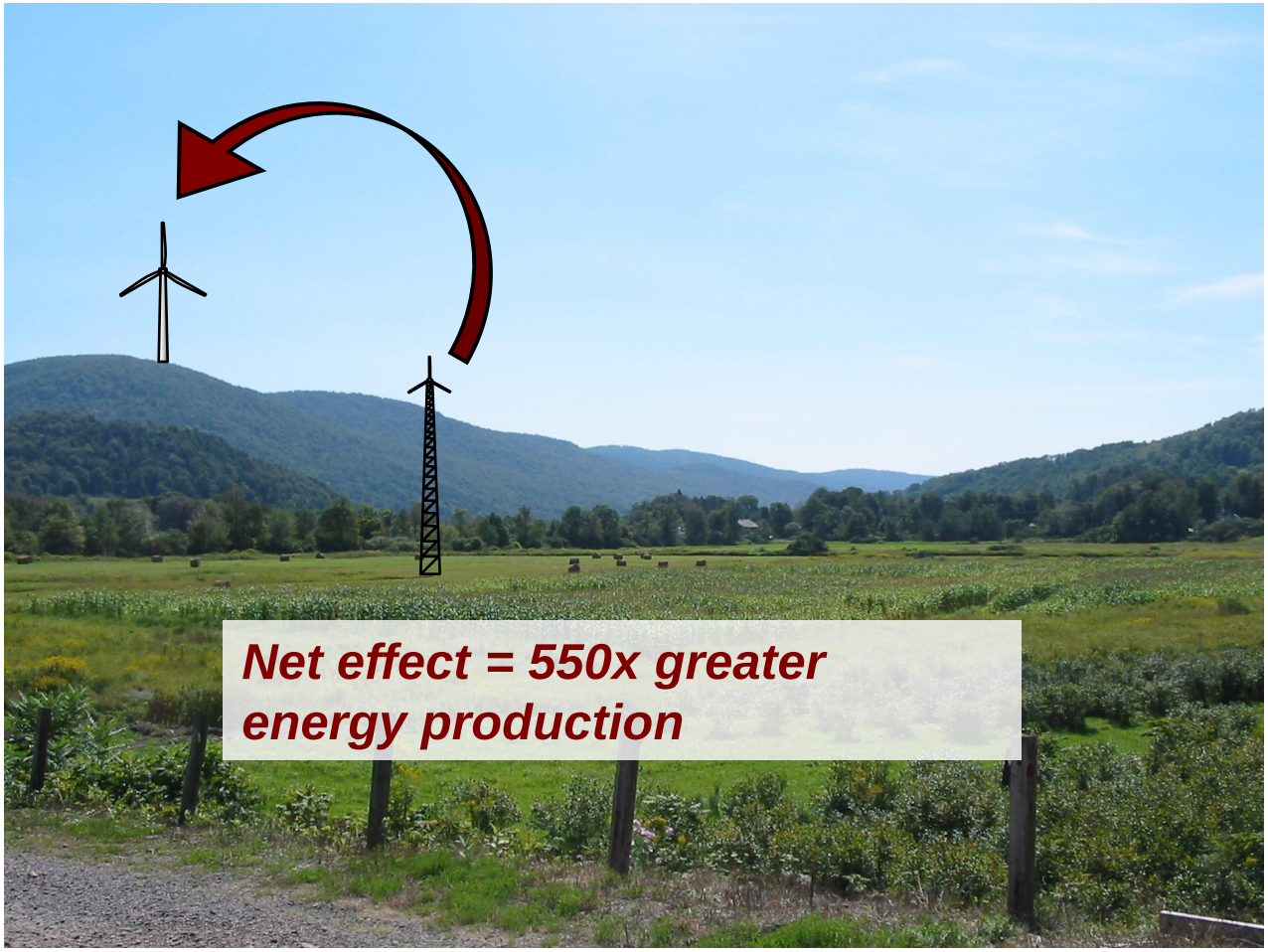


Overall impact

Small wind turbines in valley vs. large wind turbines on ridges

Capital costs (on a per kW basis) of small turbines are 2.5x more expensive than larger turbines.

Cost of electricity (on a per kWh basis) of small turbines are 3-4x more expensive than larger turbines.

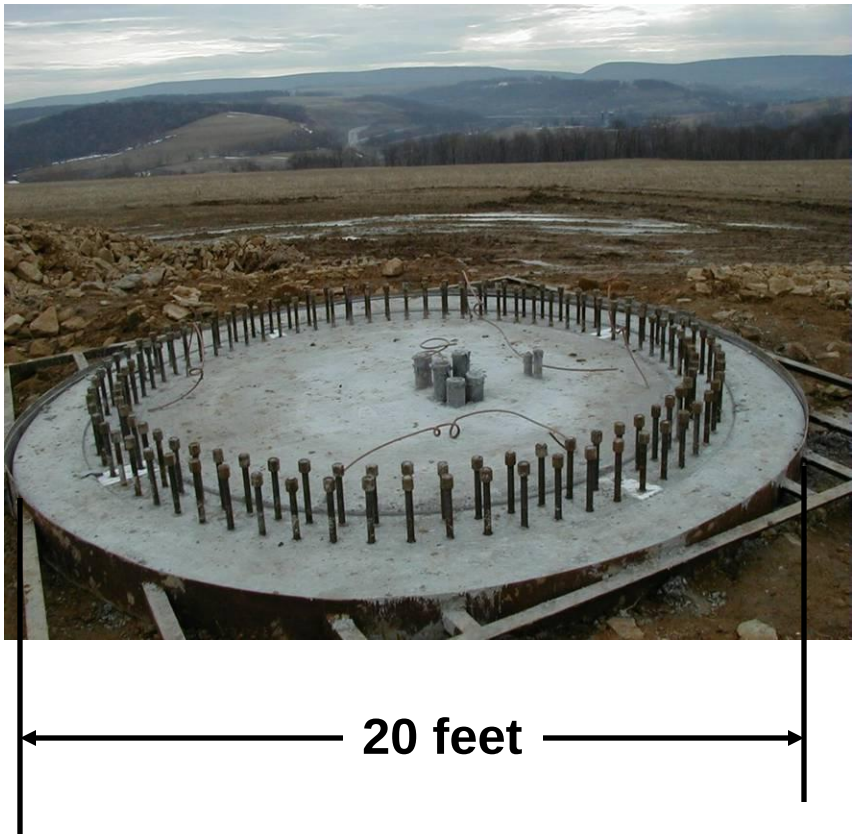


Utility Scale Wind

- The remainder of these slides address issues specific to utility-scale wind
- 1,500 kilowatts and larger
- This is the size of most interest to developers

How big are the foundations?

Turbine base above ground



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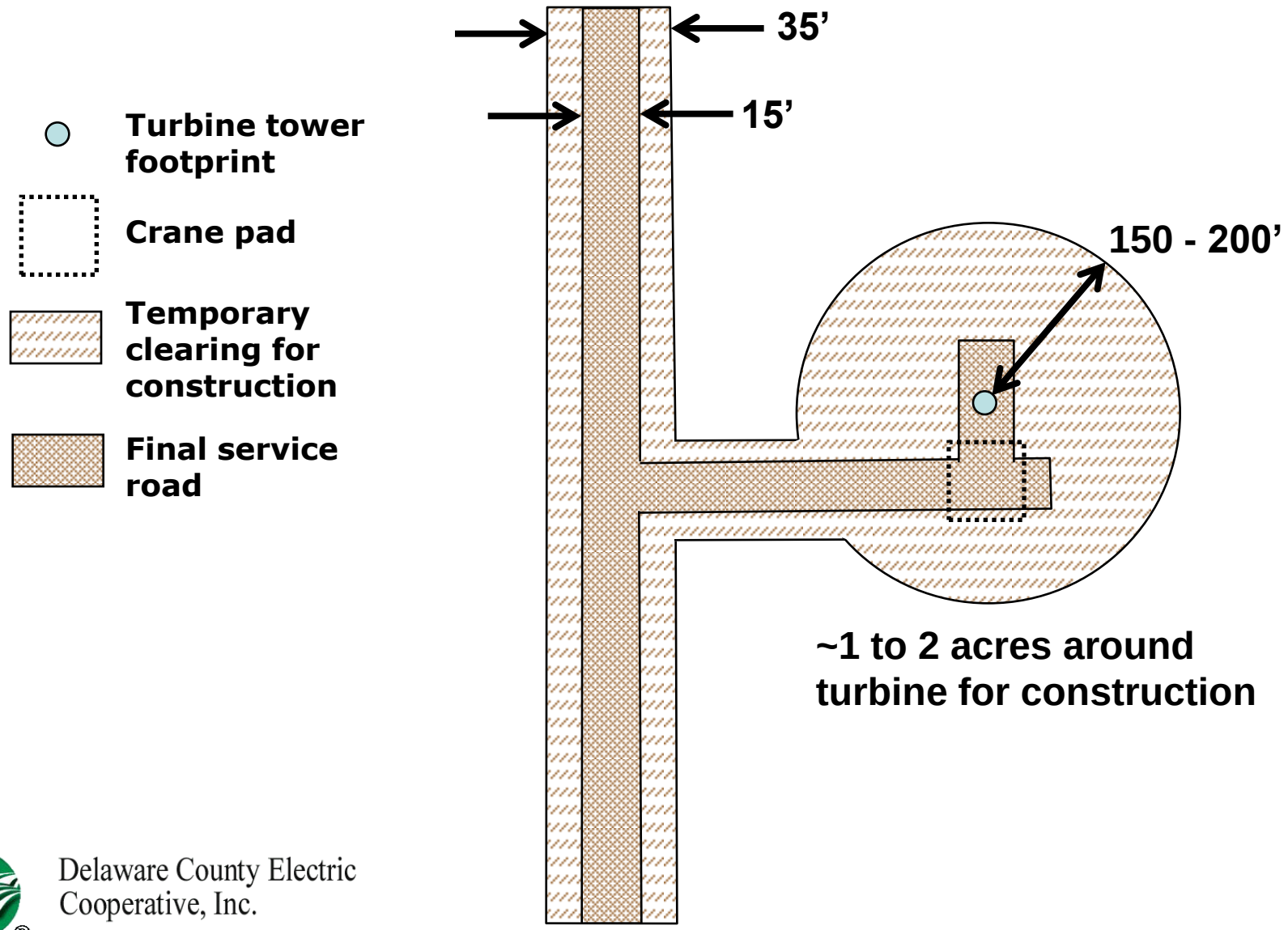
Roads and Tree Clearing (typical)



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Roads and Tree Clearing

Tower height:
80 m (260’)

Blade length:
40 m (130’)

Maple Ridge Wind

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Post Construction Clearing

Will our roads get damaged?

- Probably

Project owners need to make suitable arrangements with town to restore roads.

Test Tower Description

- 160 foot aluminum pole with guy wires, no foundation
- Spinning cup anemometers measure wind speed
- Typically measure winds for at least 1 year. *An important first step in verifying site viability.*

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Interconnection to Grid

- Power line will be underground between each turbine
- Large projects (>couple turbines) will connect to transmission lines (NYSEG)
- Substation is required (~1 acre)

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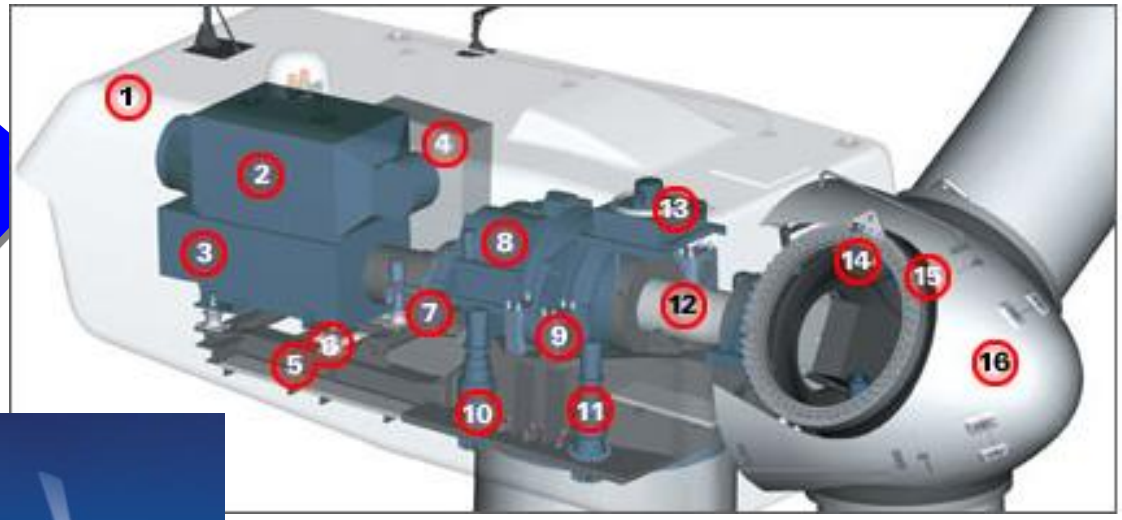
The Generator Assembly



GE Wind Energy

1. Nacelle
2. Heat Exchanger
3. Generator
4. Control Panel
5. Main Frame
6. Impact Noise Insulation
7. Hydraulic Parking Brake
8. Gearbox
9. Impact Noise Insulation
10. Yaw Drive
11. Yaw Drive
12. Rotor Shaft
13. Oil Cooler
14. Pitch Drive
15. Rotor Hub
16. Nose Cone

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Where does the power go?

Depends on who owns the project, but...typically...

- Into the NY State Independent System Operator grid
- Power can be purchased through bi-lateral contracts or sold in the spot market

Can the power stay local?

- Yes, it can
  - if the project is owned by or has a power sale agreement with a local utility (NYSEG, DCEC)
  - if a green power reseller sells directly to consumers in the local area

How do projects make money?

- Sales from electricity
- Sales of “green attributes” or renewable energy credits
- Subsidies help to mature a technology that provides a societal benefit *and* encourage efforts that are consistent with desired energy policy:
  - Federal production tax credit (PTC) applied to corporate income tax liability
  - Accelerated depreciation on the wind farm asset

Who owns these projects?

- Typically a large, for-profit corporation would hold a large portion of a project
  - allows project to take advantage of PTCs and accelerated depreciation
- Developers may choose to hold on to an equity position or play a role in the operating company
- Community-owned projects have had some success in Midwest U.S.
  - local equity holders may receive portions of profits
  - local non-profits may have relationships with the operating company

Who benefits locally?

Typical direct local beneficiaries:

- Land owners hosting turbines receive a payment
- Taxing entities (town, county, school) usually negotiate a PILOT program
- Members of the local rural electric cooperative could possibly benefit from power supply contracts from some projects
- Construction related economic benefits during the roughly 6-month construction period, and 1 to 3 long term jobs for operations and maintenance

Other Benefits: Environmental

Life cycle impacts on environment of non-renewables

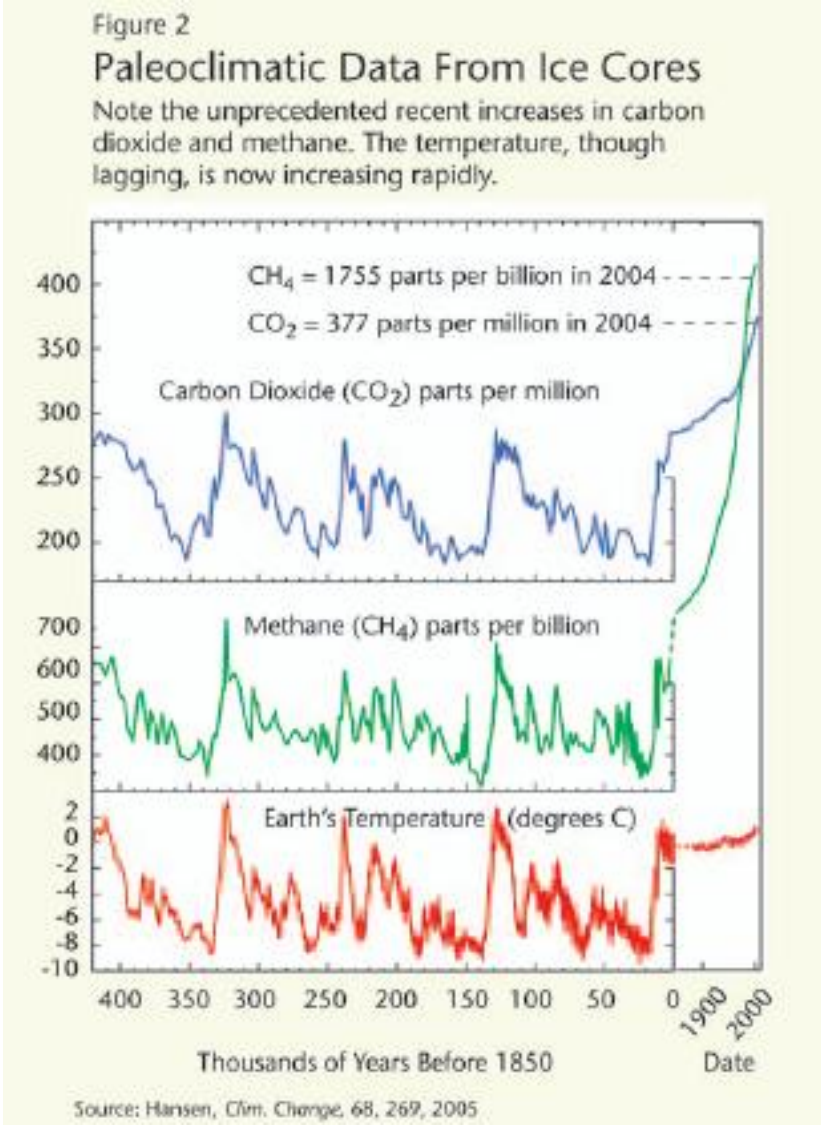
- *Mining*
- *transportation*
- *solid waste disposal*
- *airborne emissions*
- *acid rain*

Sustainability of wind energy

Environmental Benefits – CO2

Climate change from carbon dioxide (CO2) emissions is widely acknowledged as a potentially serious problem

•Wind displaces other sources of power that emit CO2. *Wind is one step among many that will reduce manmade CO2 rates.*



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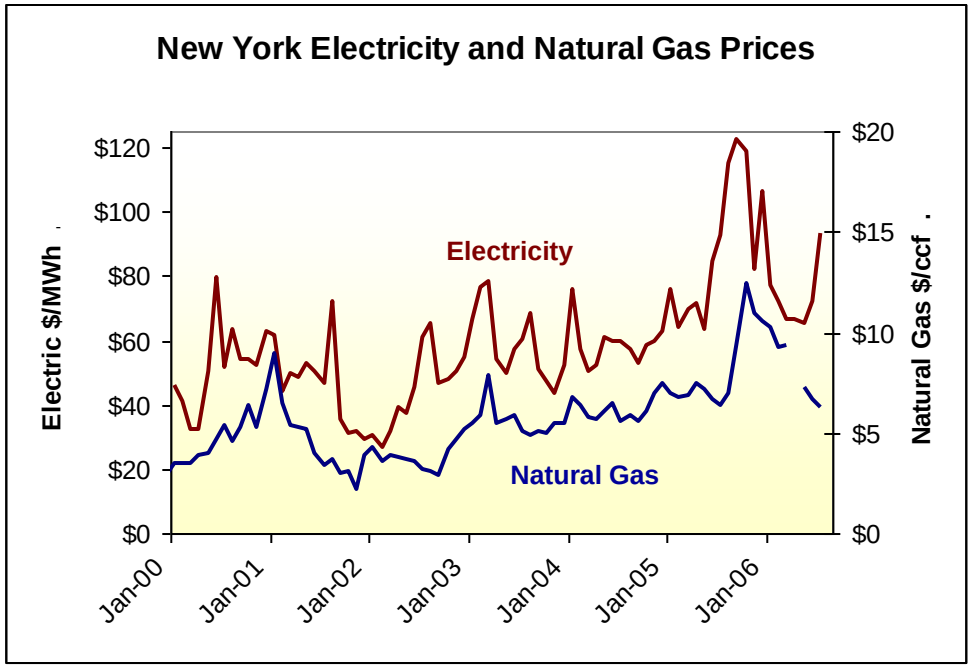
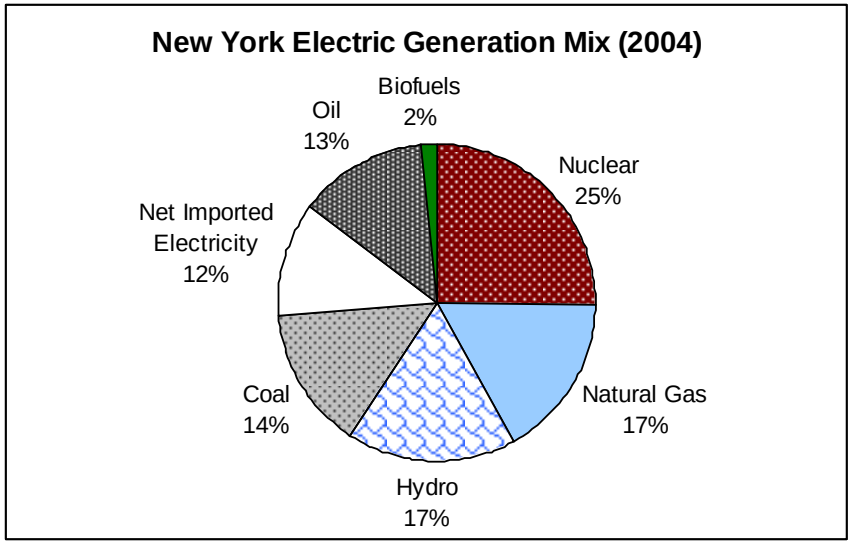
Other Benefits: Energy Prices

Wind is known to help stabilize energy prices in a region





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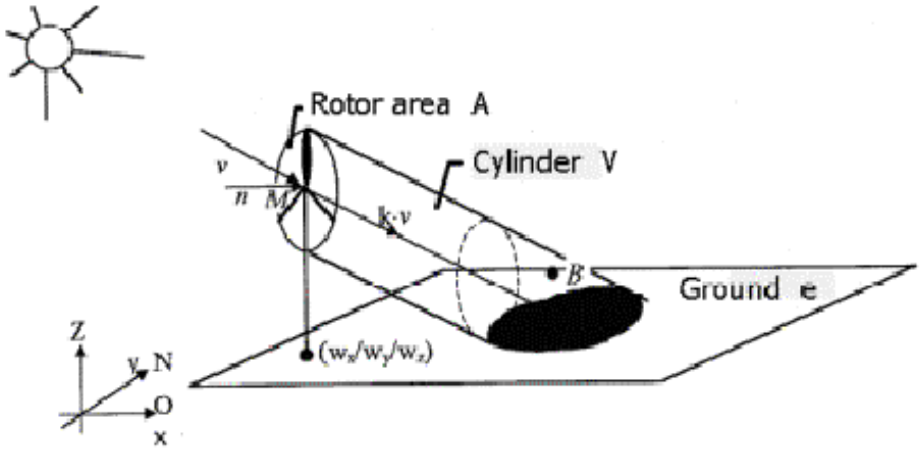
Costs and Risks - Aesthetics

- Most common concern of commercial wind development is aesthetics
  - utility scale wind turbines are big
  - people will see them, perhaps from far away
  - some people find the change to the local region's character offensive

- Animated photo montages are a standard tool for developers to portray the aesthetics of a specific proposal

Health and Safety

- Most common health and safety concerns include:
  - noise (must be modeled carefully)
  - shadow flicker (easy to predict and control)
  - ice (risks need to be understood – third party expertise would likely be helpful on this issue)



Property Values

- The exact effects on property values relating to a proposed project can not be known in advance.

- Conflicting information
  - past studies which conclude wind farms do not impact property values are old and methodologies have been questioned
  - opinions from local real estate brokers and developers are mixed
  - recent “Bard” study looks interesting but has yet to receive full scrutiny of public review

Environmental Risks

- Land disturbance from roads / foundations
- Migratory birds, migratory bats, or threatened/endangered species in a potential project area must be studied carefully.
- Any New York project is subject to State Environmental Quality Review oversight

Construction is Ugly

- Like any large construction project, wind farm construction will create:
  - dust, traffic, noise, etc.

Business Risks

- If a town allows a commercial wind project within its boundaries, that town and its residents takes on certain financial risks that can be mitigated through:
  - Escrow Funds
  - Bonds
  - Insurance
  - Host Agreements

- Examples
  - road repair funds
  - decommissioning funds

Resources for Towns

- Coalition of Regional Planning Commissions
  - funds and certain technical expertise are available
- NYSERDA
  - resource kit (www.nyserda.org)
- The rest of Delaware County
  - addressing the same issues in several planning boards
- Delaware County Electric Cooperative
  - any information or assistance we can provide
- Developers
  - not unreasonable to charge a site plan review fee to cover the cost of third-party experts

Thank You

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