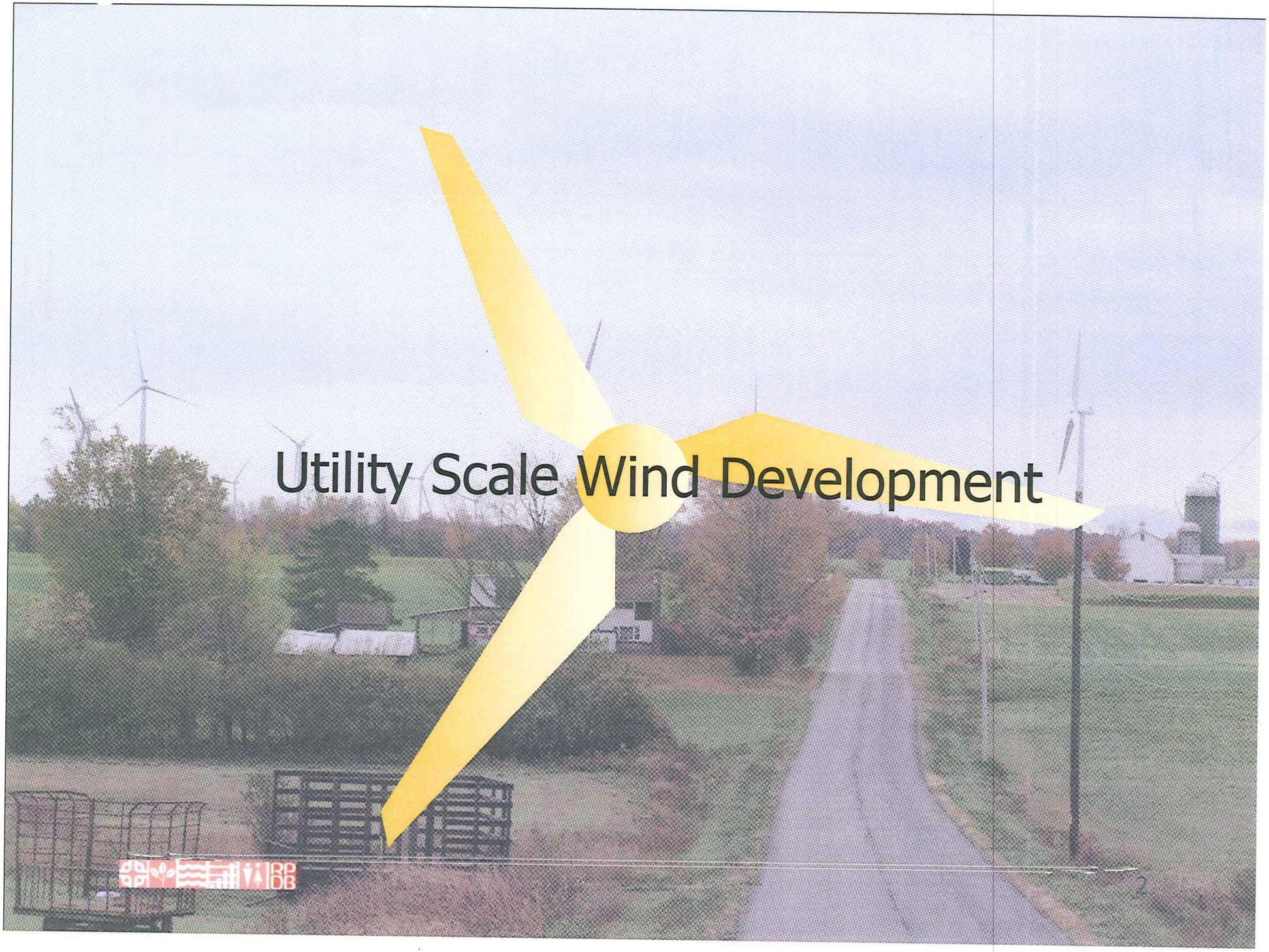
Central New York Regional Planning & Development Board

Fabius Commuinity Wind Energy Feasibility Study

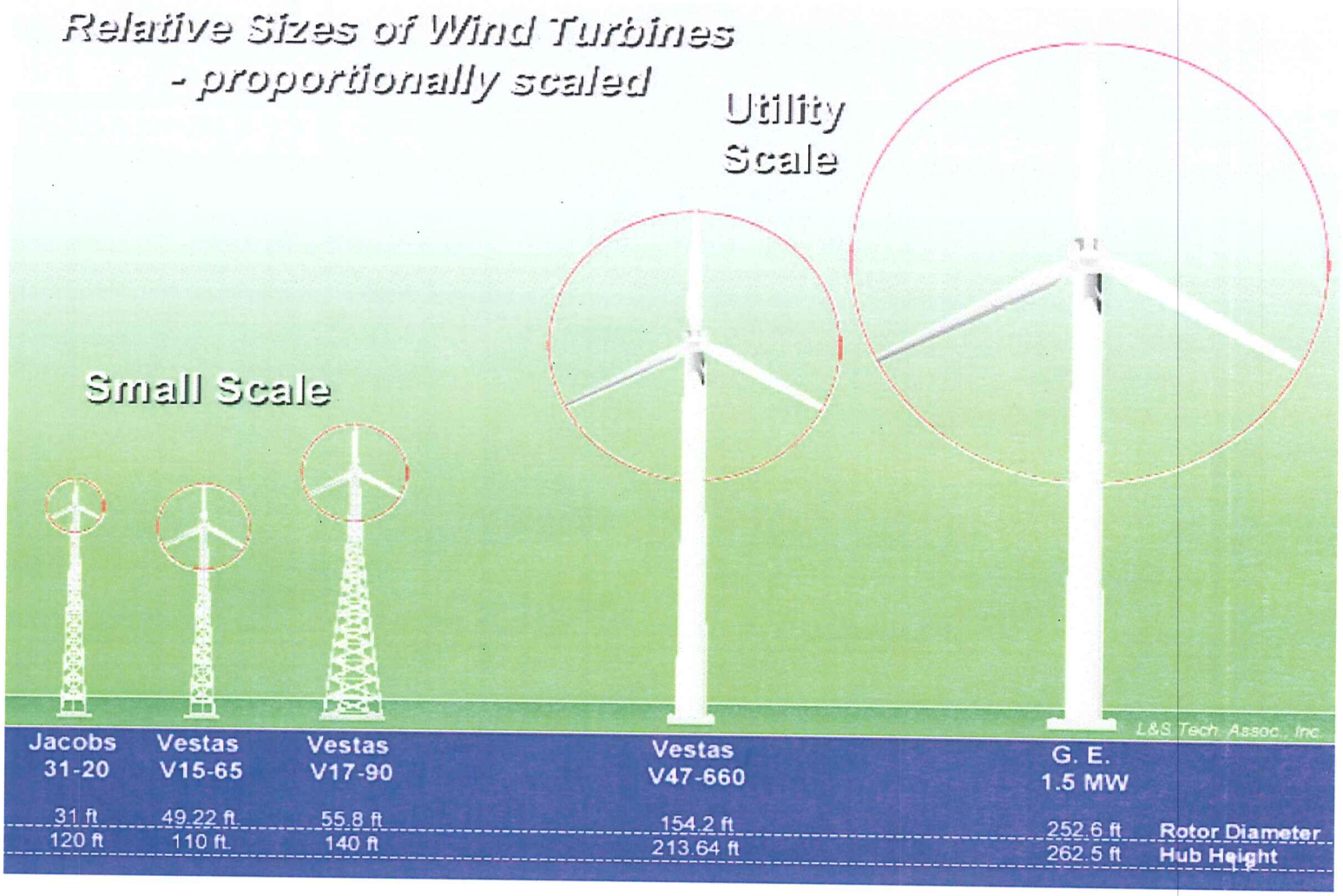
Fabius Town Board
December 21, 2009

Chris Carrick, Senior Planner
CNY RPDB Energy Program

Utility Scale Wind Development



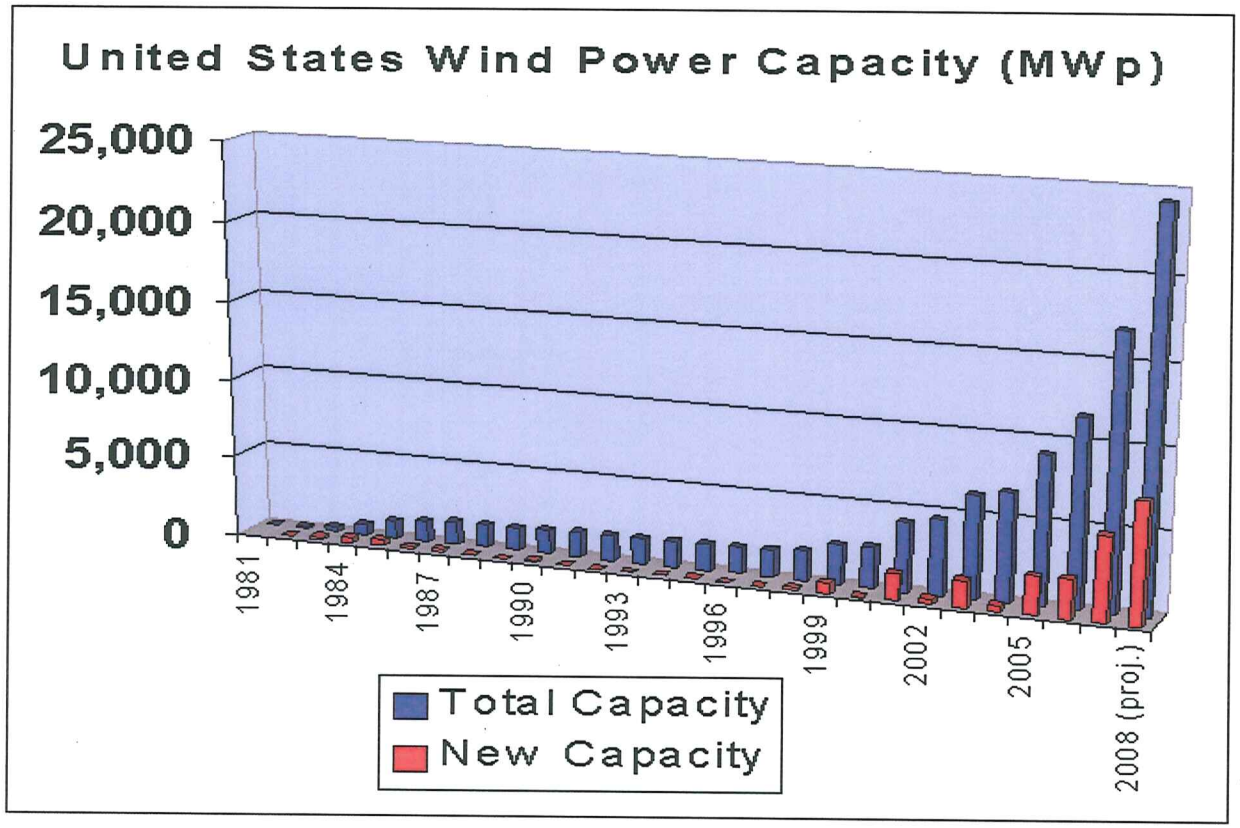
Utility-Scale vs. On-Site Wind Power

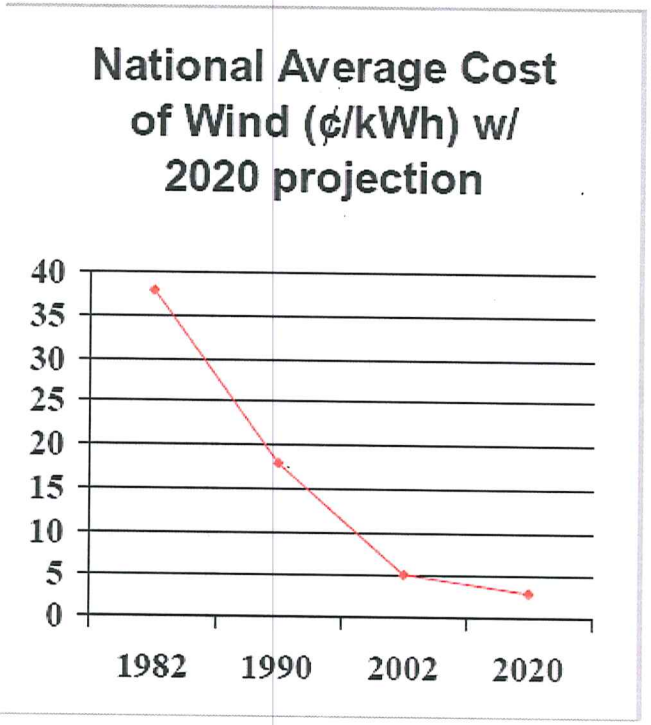


U.S. Utility-Scale Wind Energy Development

Drivers in U.S.

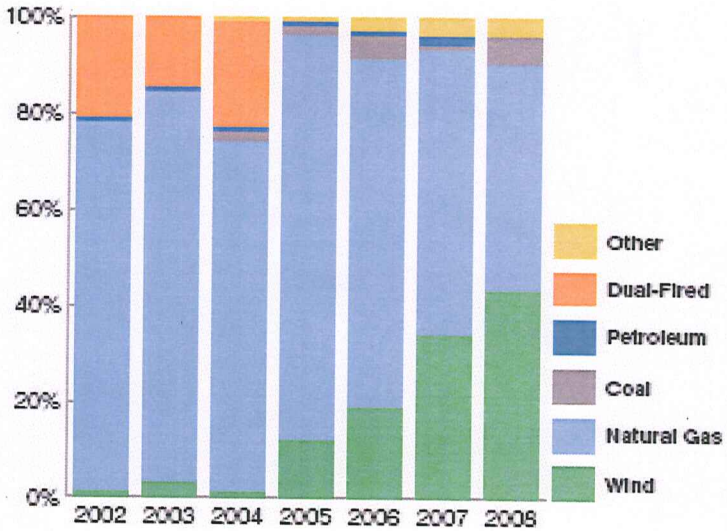
- Lower production costs ~4.5 cents/kWh (to 2.5 cents soon?)
- Renewable Portfolio Standards (RPS)
- Production Tax Credits (PTC)
- Renewable Energy Certificates (RECs)

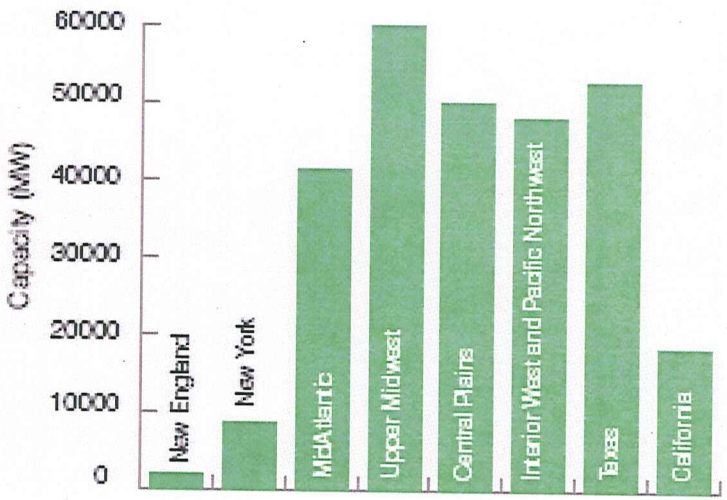




Data is from http://www.awea.org/

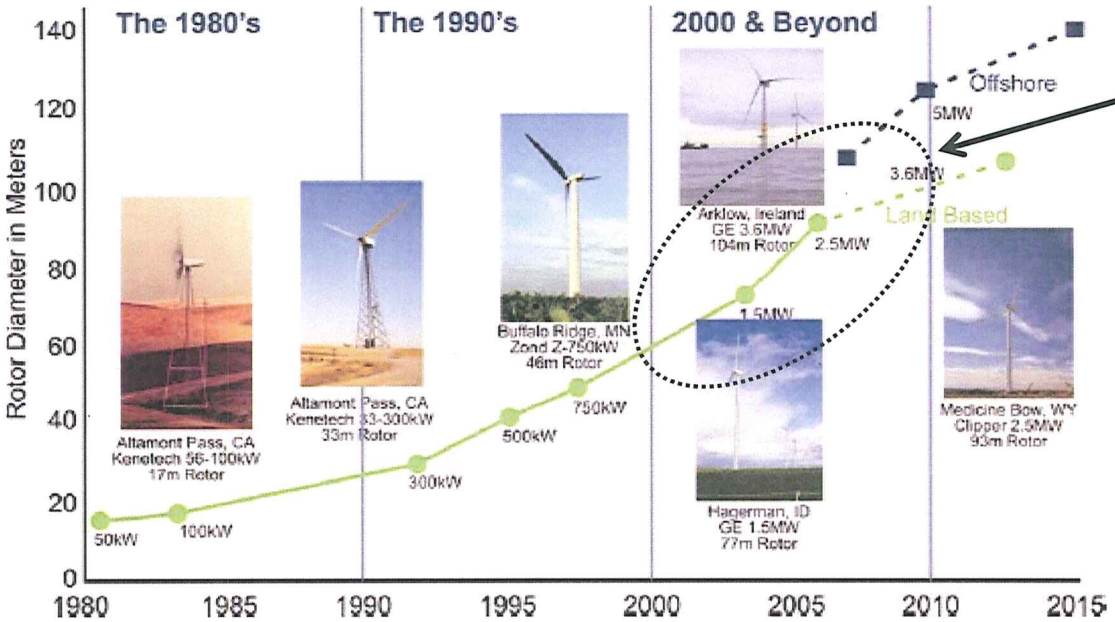
U.S. Wind Project Growth





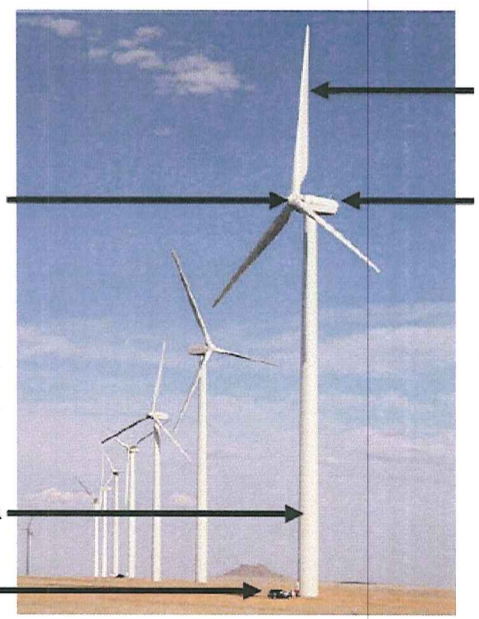
- Wind less than 2% of all the new electrical capacity added in 2004
- Increased to 35% in 2007 and 42% in 2008
- Wind and natural gas together close to 90% of all new generation capacity added since 2005
- Close to 300,000 MW of proposed wind projects are currently waiting in line to connect to the grid

U.S. Wind Project Trends

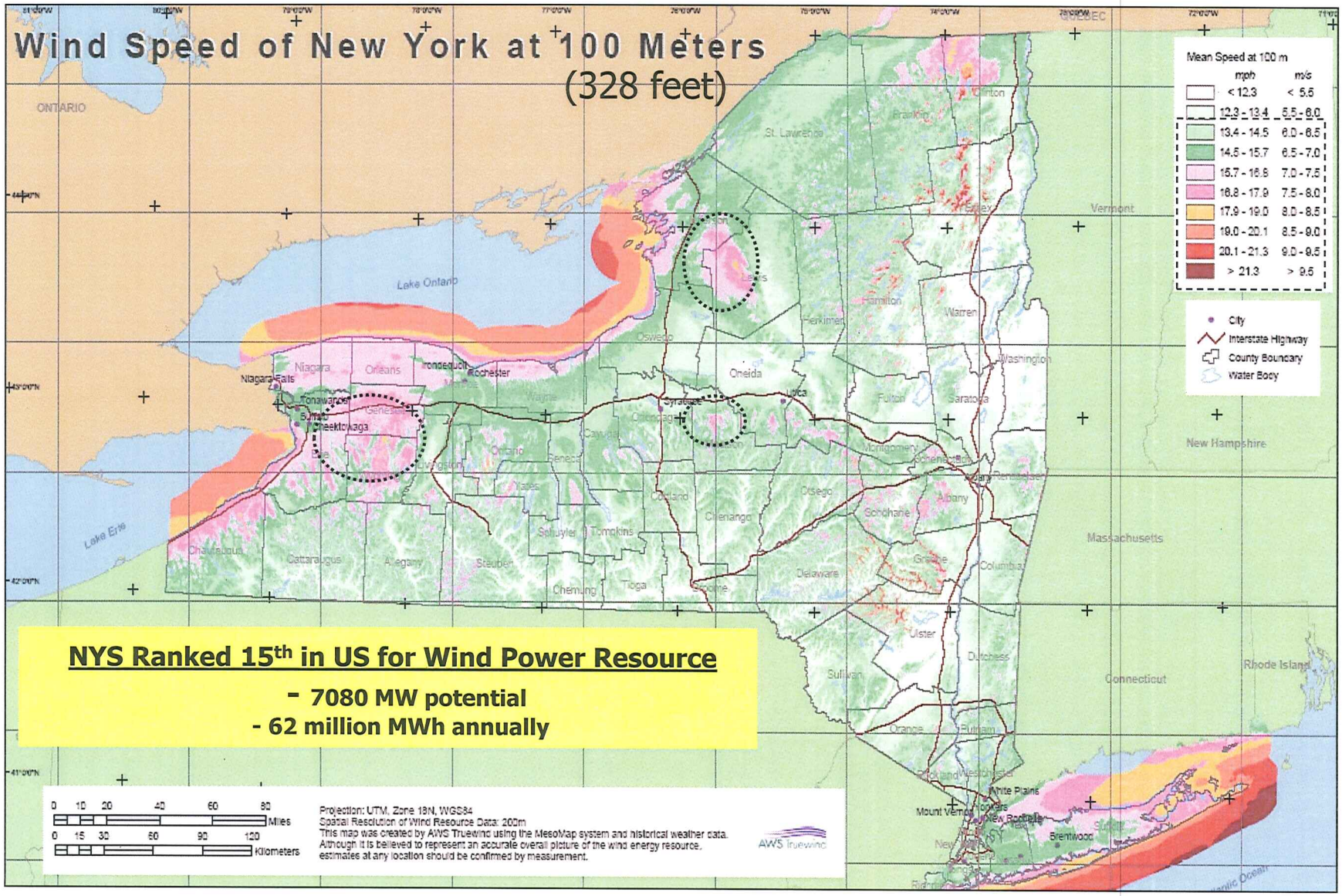


turbines getting larger, towers growing taller

1.5 MW turbines remain most popular in 2008



Wind Power Potential in NY



NYS Ranked 15th in US for Wind Power Resource

- 7080 MW potential
- 62 million MWh annually

Future Utility-Scale Wind Development in New York

What is Happening in NY?

✓NYS **ranked 7th** nationwide in installled capacity

✓**~1,275 MW** installed capacity in NYS

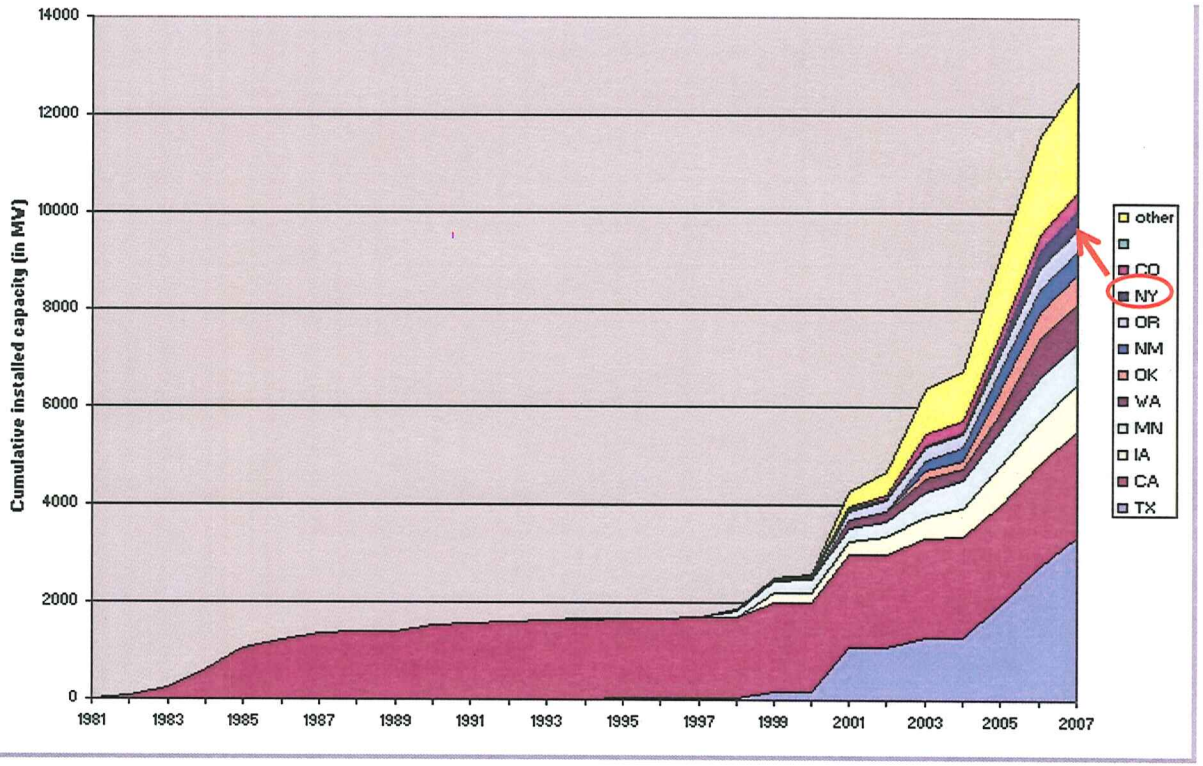
✓**7,000+ MW** in NYISO queue

NYISO Queue as of 9/5/09 (partial listing)

Queue Pos.	Owner/Developer	Project Name	Date of IR	SP (MW)	Type/ Fuel	Location County/State	Interconnection Point	Utility
113	Windfarm Prattsburgh, LLC	Prattsburgh Wind Park	4/22/02	55.5	W	Yates, NY	Eelpot Rd-Flat St. 115kV	NYSEG
119	ECOGEN, LLC	Prattsburgh Wind Farm	5/20/02	79.5	W	Yates, NY	Eelpot Rd-Flat St. 115kV	NYSEG
127A	Airtricity Munnsville Wind Farm, LLC	Munnsville	10/9/02	40	W	Madison, NY	46kV line	NYSEG
135	UPC Wind Management, LLC	Canandaigua Wind Farm	5/30/03	82.5	W	Ontario, NY	Avoca 230kV line	NYSEG
141	Flat Rock Wind Power, LLC	Flat Rock Wind Power	8/27/03	321	W	Lewis, NY	Adirondack-Porter 230kV	NM-NG
142	Airtricity Developments, LLC	Hartsville Wind Farm	10/30/03	50	W	Steuben, NY	Bennett-Palmiter 115kV line	NYSEG
144	Sheldon Energy, LLC	High Sheldon Windfarm	2/18/04	112.5	W	Wyoming, NY	Stolle Rd-Meyer 230kV	NYSEG
147	NY Windpower, LLC	West Hill Windfarm	4/16/04	37.5	W	Madison, NY	Oneida-Fenner 115kV	NM-NG
150	Reunion Power, LLC	Cherry Valley Wind Power	6/17/04	70	W	Otsego, NY	Marshville - Sharon 69kV	NM-NG
152	Moresville Energy LLC	Moresville Energy Center	7/23/04	99	W	Delaware, NY	Axtell Road-Grand Gorge 115kV	NYSEG
155	Invenergy NY, LLC	Canisteo Hills Windfarm	9/17/04	148.5	W	Steuben, NY	Bennett-Bath 115kV	NYSEG
156	PPM Energy/Atlantic Renewable	Fairfield Wind Project	9/28/04	120	W	Herkimer, NY	Valley-Inghams 115kV	NM-NG
157	BP Alternative Energy NA, Inc.	Orion Energy NY I	10/12/04	100	W	Herkimer, NY	Watkins Rd.-Inghams 115kV	NM-NG
160	Jericho Rise Wind Farm, LLC	Jericho Rise Wind Farm	10/12/04	79.2	W	Franklin, NY	Willis 115 kV	NYPA
161	Marble River, LLC	Marble River Wind Farm	12/7/04	84	W	Clinton, NY	Willis-Plattsburgh WP-1 230kV	NYPA
166	AES-Acciona Energy NY, LLC	St. Lawrence Wind Farm	2/8/05	130	W	Jefferson, NY	Lyme Substation 115kV	NM-NG
168	Dairy Hills Wind Farm, LLC	Dairy Hills Wind Farm	2/8/05	120	W	Wyoming, NY	Stolle Rd.-Meyer 230kV	NYSEG
169	Alabama Ledge Wind Farm, LLC	Alabama Ledge Wind Farm	2/8/05	79.2	W	Genesee, NY	Oakfield-Lockport 115kV	NM-NG
171	Marble River, LLC	Marble River II Wind Farm	2/8/05	132.3	W	Clinton, NY	Willis-Plattsburgh WP-2 230kV	NYPA
172	Noble Environmental Power, LLC	Clinton Windfield	2/14/05	79.5	W	Clinton, NY	Willis-Plattsburgh WP-2 230kV	NYPA
173	Noble Environmental Power, LLC	Bliss Windfield	2/14/05	72	W	Wyoming, NY	Arcade Substation 115kV	Village of Arcade
174	Noble Environmental Power, LLC	Altona Windfield	2/14/05	99	W	Clinton, NY	Willis-Plattsburgh WP-1 230kV	NYPA
175	Noble Environmental Power, LLC	Ellenburg Windfield	2/14/05	79.5	W	Clinton, NY	Willis-Plattsburgh WP-2 230kV	NYPA

New York Installed Wind Capacity as Share of National Total

U.S. Installed Wind Power Capacity 1981-2007
(Megawatts)



Top Ten States Wind Power Capacity
(as of 3/31/09)

State	Existing	Under Construction	Rank (Existing)
Texas	7,907	1,102	1
Iowa	2,883	210	2
California	2,653	125	3
Minnesota	1,803	0	4
Washington	1,479	0	5
Oregon	1,363	126	6
New York	1,261	21	7
Colorado	1,068	0	8
Kansas	1,014	0	9
Illinois	915	312	10

NY joins "gigawatt club"

Sources: U.S. Department of Energy Wind Energy Program & AWEA

Utility-Scale Wind Power Projects in Central New York

	Madison Windpower, LLC	Fenner Windpower, LLC	Maple Ridge Wind Farm
County	Madison	Madison	Lewis
Town(s)	Madison	Fenner	Martinsburg Harrisburg Lowville
Developer(s), Owners & Operators	PG&E	Canastota Wind Power, LLC	Horizon Wind / PPM
Number of Turbines	7	**20**	**195**
Project Area (Acres)	**120**	**1,536**	**21,000/23sq. mi.**
Hub Height	67 m (220')	65 m (213')	79 m (260')
Rotor Diameter	66 m (217')	70.5 m (232')	82 m (270')
Total Height	100 m (330')	100 m (330')	120m **(395')**
Turbine Size / Manufacturer	1650 kW Vestas V66	1500 kW GE Wind	1650 kW Vestas V82
Max. Capacity (MW)	**11.55**	**30**	**321**
Est. Annual Energy (MWh) / Approx. Capacity Factor	24,000 / **24%**	89,000 / **34%**	876,000 / **31%**
Equivalent Est. Homes served @ 6000 kWh/yr.	**4,000**	**14,830**	**144,500**

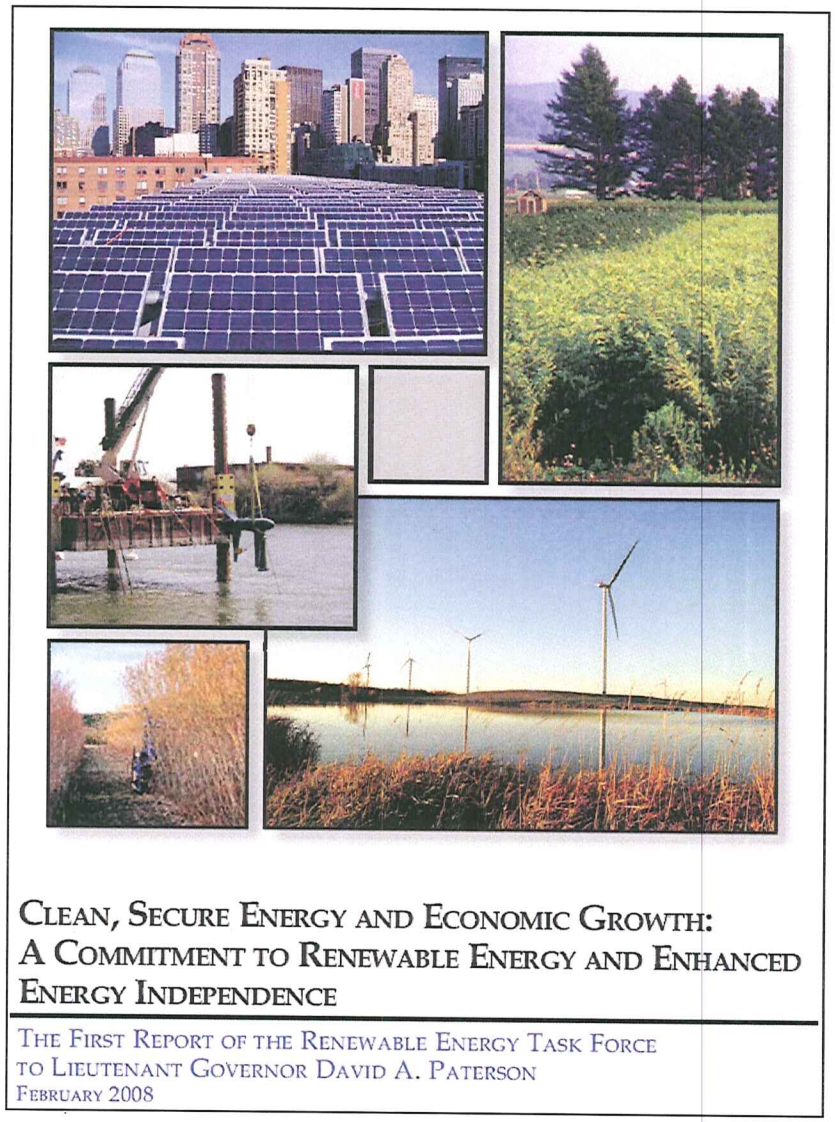
2008 Completed Utility-Scale Wind Power Projects in New York

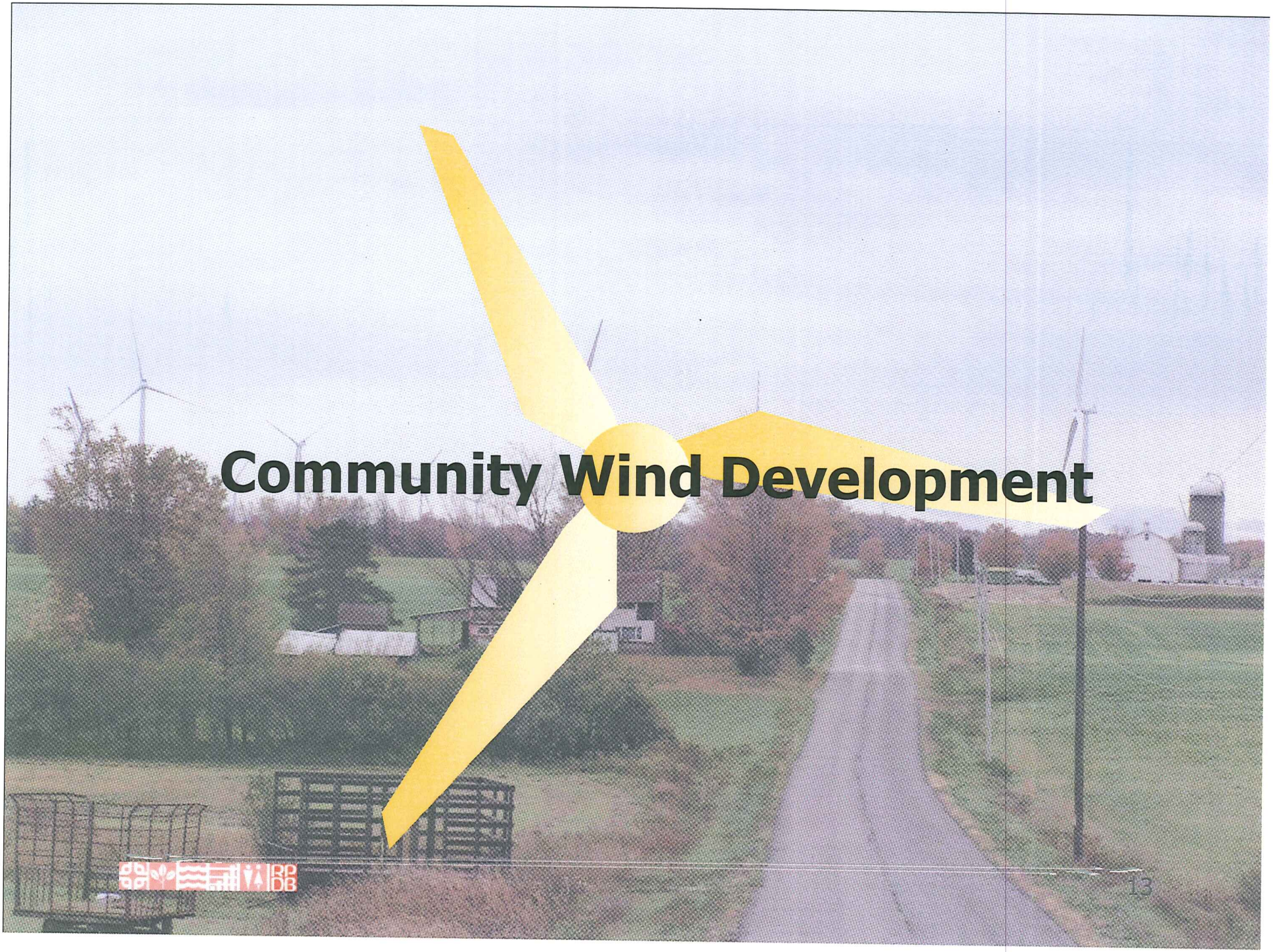
Project Name	Capacity (in MW)	Turbine Type	Owner/Equity Partner
Noble Bliss	100.5	G.E. Energy 1.5 MW	Noble Environmental
Noble Clinton	100.5	G.E. Energy 1.5 MW	Noble Environmental
Noble Ellenburg	81	G.E. Energy 1.5 MW	Noble Environmental
Dutch Hill/ Cohocton	125	Clipper 2.5 MW	First Wind

Utility-Scale Wind Power Projects in New York State

Drivers in NYS

- Decreasing cost of wind energy
- Escalating cost of conventional energy
- Government mandates (i.e. RPS)
- RECs
- Learning / career opportunities – "Green Jobs"
- Environmental stewardship





Community Wind Development

Community Wind Development Defined

What it **is not:**

– A large wind farm with dozens or hundreds of wind turbines
– Connected to the high voltage grid

What it typically **is:**

– A single turbine or a small cluster providing power to nearby facilities
– A small cluster of turbines (up to a dozen or so) that provides power under contract to a local electric utility
– Connected to the electric distribution system or lower voltage transmission lines (24kV, 34.5 kV, 69kV systems)
– **Wholly or largely owned by the local community**

Community Wind Development in Europe

	Farmer	Co-op	Corporate
The Netherlands	60%	5%	35%
Germany	10%	40%	50%
Denmark*	64%	24%	12%
Spain	0%	0%	100%
Great Britain	1%	1%	98%

Source: Dave Toke, University of Birmingham, 2005, updated to Toke 2008.

*Onshore.

Representative Community Wind Projects

	Region	Country	MW	million kWh/yr	Investors	Equity million	Total Investment million
WindShare	Ontario	Canada	0.75	1.2	425	$ 0.8	$ 0.8
Regiowind Freiamt	Baden-Whrttemberg	Germany	3.6	5.7	142	$ 2.1	$ 6.5
Minwind I & II	Minnesota	USA	3.8	11.1	66	$ 1.1	$ 3.5
Regiowind Freiburg	Baden-Whrttemberg	Germany	10.8	16.8	521	$ 6.7	$ 20.6
Paderborn	North-Rhein-Westfalia	Germany	18.2	31.4	91	$ 6.0	$ 28.5
Middelgrunden*	Zealand	Denmark	20	44	8,500	$ 38.2	$ 38.2

*20 MW of 40 MW project developed by the cooperative, ~$1,000/share.

Community Wind Development

Figure 7-2. Modern Danish Wind Cooperative. Four of the eight turbines in this project "offshore" in Denmark's Limfjord are owned by the Thyborøn-Harboøre Vindmøllelaug, or wind turbine cooperative. The Vestas V80s were installed in 2003. For an aerial view of the site and a gallery of installation photos, visit www.roenland.dk.

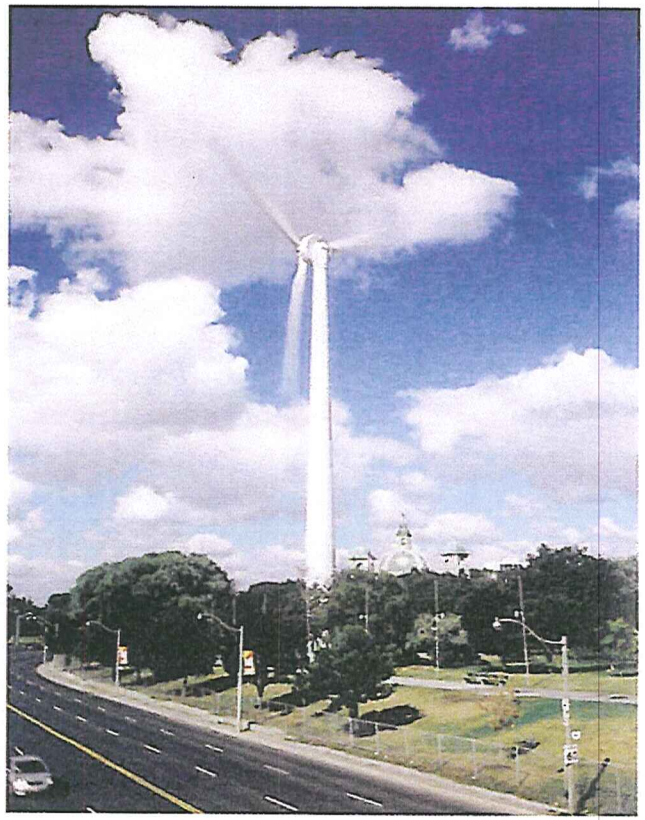


Figure 7-3. Toronto's WindShare. The Toronto Renewable Energy Cooperative developed WindShare, the first wind turbine cooperative in Canada. WindShare's turbine in downtown Toronto has become a landmark. Like similar projects in Germany and Denmark, the turbine is co-owned by the cooperative and the local municipal utility, Toronto Hydro. There are more than 400 members, including the lead singer for the popular Canadian rock band Barenaked Ladies, Steven Page. For more information, visit www.windshare.ca.

Community Wind Development

Figure 7-4. Velling Mærsk-Tændpibe. When installed in the mid-1980s, Velling Mærsk-Tændpibe was the largest wind plant in Europe. It consisted of 100 turbines of various sizes co-located on a polder south of Ringkøbing on the west coast of Denmark's Jutland Peninsula. One-third of the turbines are cooperatively owned.

Community Wind Development

Figure 7-6. Fesa *Bürgerbeteiligung.* Two Enercon E-70s on the flanks of Schauinsland in southern Germany's Black Forest. The 98-meter (320 ft) concrete towers used here raise the 1.8 MW turbines well above the treetops. Developed by Josef Pesch's Fesa, these turbines are part of a group of six in Regiowind Freiburg. Investors live in the "solar city" of Freiburg on the valley floor in the background. Regiowind Freiburg produces 2 percent of the city's electricity.

Community Wind – Electrical System Benefits

- Distributed wind generation typically lowers transmission system losses in most areas where it is installed
  - the wind generation is often closer to local loads
  - savings might be in the range of 2% to 5%

- Utilizing the lower voltage transmission grid often allows more wind generation to be connected in an area since higher voltage lines may already be fully utilized by large wind farms

- Spreading out wind generation tends to smooth out changes in power output due to spatial diversity

Community Wind – Economic Development Benefits

- Community wind tends to be developed at a smaller scale, but MW for MW the local economic benefits can be several times as great

- NREL study for the U.S. Government Accountability Office compared economic impacts of one 40 MW plant owned by outside investors to twenty 2 MW plants owned locally:

	Large Wind/ Outside Owners	Small Wind/ Local Owners
Stay in Community	$12,220	$65,900
Stay in State	$5,100	$100,300
Leave the State	$148,000	$21,300

- Tom Wind, an Iowa-based community wind expert, made a similar comparison and found annual benefits on a per MW basis:
  - impact of power sales under the community model was 16% percent higher than under corporate ownership
  - wage impacts were 42% higher
  - business income impacts were 53% higher
  - state and local tax revenue impacts were 8% higher

Community Wind Economic Impact

University of Minnesota study of 10.5 MW Big Stone County project:

Annual Direct, Indirect, and Induced Effect on Value Added			
	Community Wind	Community Wind	Corporate Wind
	5%	8%	
Value Added	$ 1,300,000	$ 640,000	$ 250,000
Jobs	14.5	8.2	4.3
Source: Arne Kildegaard, University of Minnesota, Morris			

Community Wind Development Barriers

1. Pre-development funding and support is key
   - 2 MW project with eventual costs of $4 million might require expenditures in the area of $200,000 even before it is certain the resource can be developed and marketed, and then that much again to complete agreements
   - no NYSERDA pre-development funding currently (Massachusetts Technology Collaborative offers $85,000 to public entities for feasibility studies with met tower)
   - no met tower loan program in New York (25 states have them)
2. High transaction costs and related diseconomies of scale
   - LBNL 2004 analysis of 28 wind projects indicates levelized costs per MW for a 9 MW project will be 6% higher than for comparable 50 MW project and 36% above a 200 MW project
3. Lack of capacity
   - According to a 2006 Farmers Legal Action Group (FLAG) report, "most community wind projects are, almost by definition, first-time projects for which significant capacity building is necessary."

Community Wind – Community Investment and Control

Due to their lower total cost, distributed wind generation projects can offer local residents an opportunity to invest money in renewable energy

Figure 7-5. Local Democracy in Action. Basia Pioro collects votes from WindShare members at the 2006 annual general membership meeting in Toronto. Each member has one vote regardless of the number of shares he or she owns. WindShare also sponsors an annual summer picnic beneath the wind turbine. Dairy coops have been a successful business and community development model in both Denmark and North America. Wind coops could be equally successful.

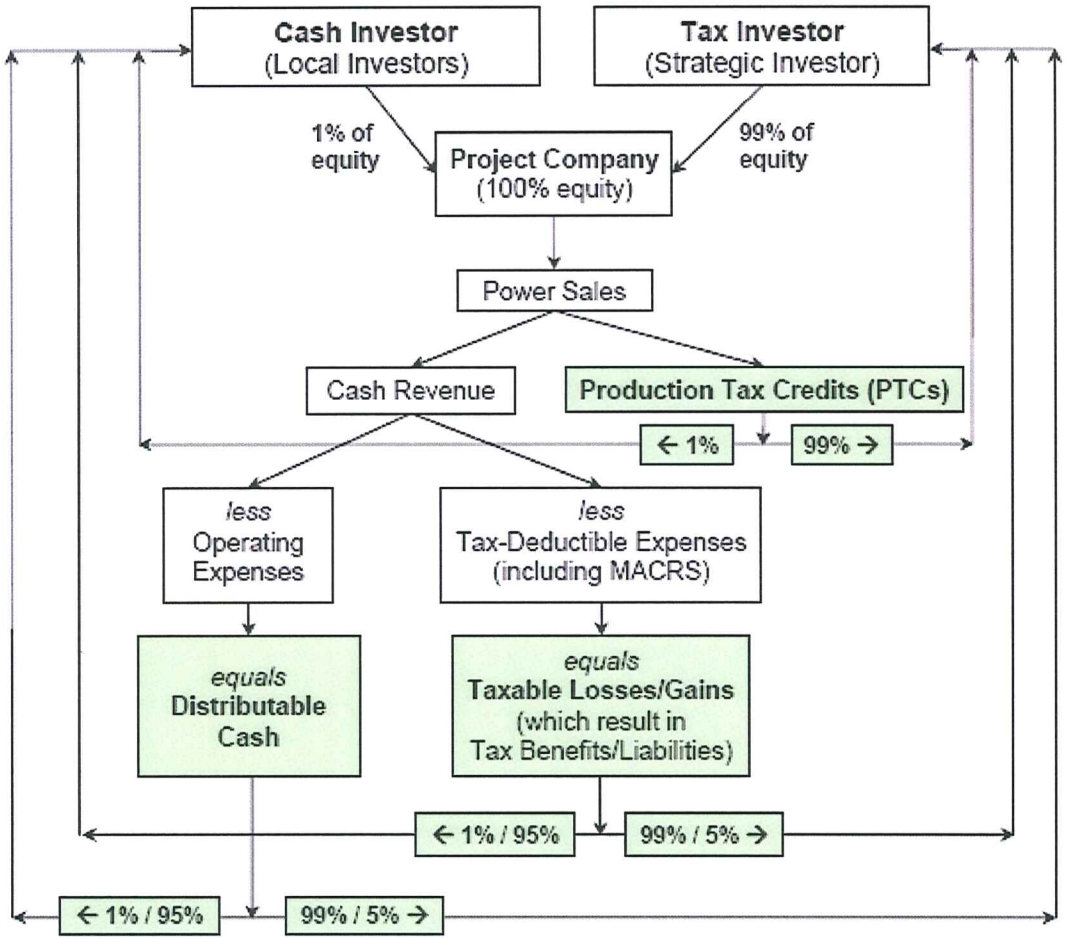
Community Wind Development Policy: Minnesota Model

- ~1,800 MW total installed capacity and ~350 MW are community-owned
- 2005 Community-Based Energy Development (C-BED) tariffs
  - requires utilities to offer 2.7 cents/kWh over 20 years (NPV) with higher rates during first 10 years
- Community wind set-aside in state RPS
  - Leading utility Xcel Energy is required to develop 1,125 MW of wind by 2010, with 160 MW to come from projects of two MW and under
- Expedited permitting
  - zoning permits issued on state basis for projects > 20 MW

MinWind 1&2 Developments

- Flagship success story of community wind development in the U.S.
- Two farmer-owned cooperatives, each owns two 950 kW wind turbines
- Developed at a cost of $3.6 million – 70% raised from a local bank and 30% from sales of shares (66 local residents)
- Most difficult part was securing PPA from utility
  - state legislation in 2005 helped to ensure that community wind developers could get a fair price
- Connected to 24kV sub transmission system

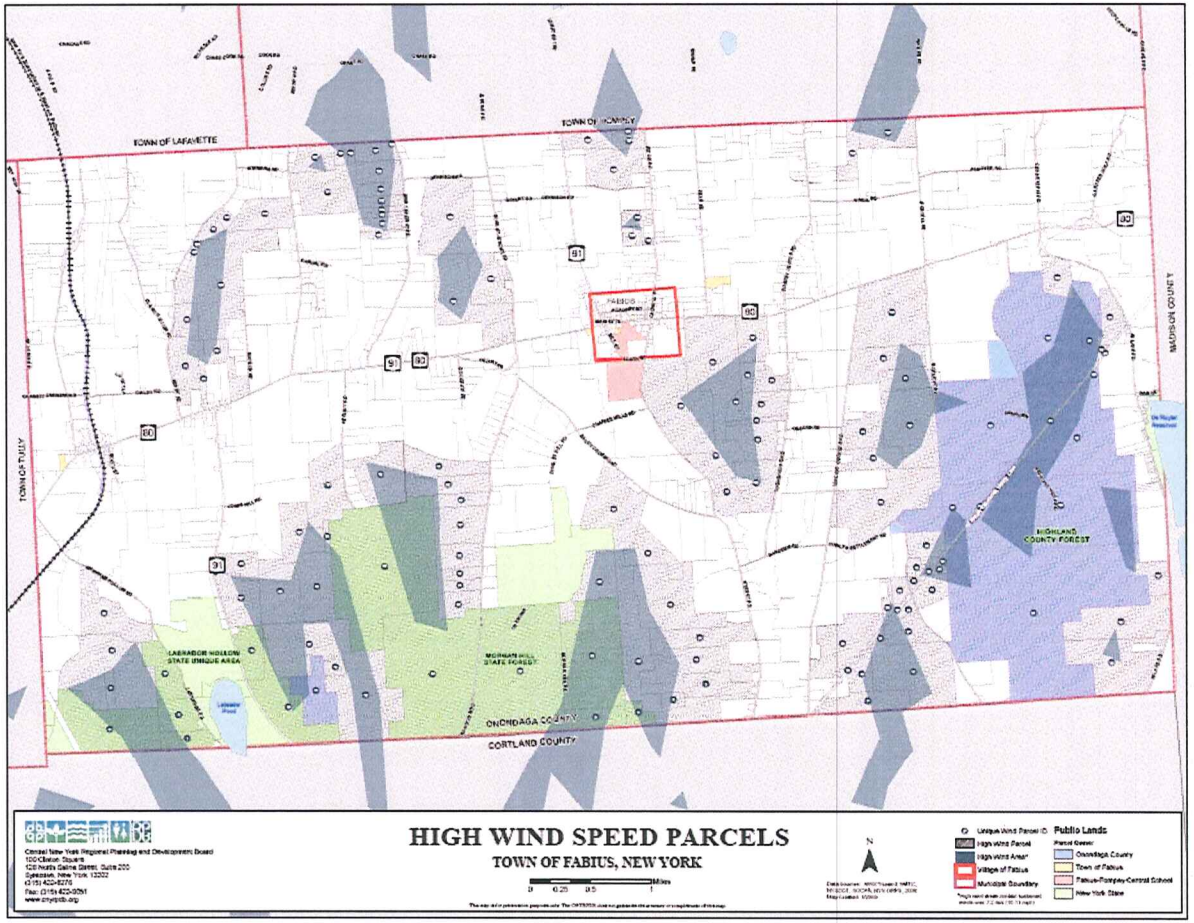
"Minnesota Flip" and Community Wind



- All-equity structure with two types of investors – Cash and Tax Investors
- Tax Investor provides almost all (99%) the equity
- Pre-flip cash and tax allocations proportional to equity investment
- **Cash allocations:** 99% to Tax Investor until Flip; then 95% to Cash Investor
- **Tax allocations:** 99% to Tax Investor until Flip; then 95% to Cash Investor
- **PTCs** must follow allocation of taxable income
- Most common flip structure used for community wind

Fabius Community Wind Project

- 4-5 parcels with Class 4+ winds (5.6-6.0 m/s)
- Each parcel may support as many as 4-6 1.5 MW turbines
- Compared to corporate-owned development, community-based wind projects may yield up to 5x the economic impact on local value added and 3-4x the impact on local job creation
- 2009 USDA Rural Business Enterprise Grant proposals to establish local for-profit wind energy development company and regional met tower loan program



Fabius Community Wind Project – Feasibility Study

- Funded through USDA Rural Business Enterprise Grant Program:
  - provides grants for rural projects that finance and facilitate development of small and emerging rural businesses in rural areas (population < 50,000)

- $98,000 award to complete feasibilty study:
  - Site Prospecting
  - Wind Resource Assessment/Energy Yield Analysis
  - Development Team Formation (for-profit entity)
  - Pro Forma Analysis
  - Land Lease Structure Evaluation
  - Public Education

Fabius Community Wind Project – Feasibility Study

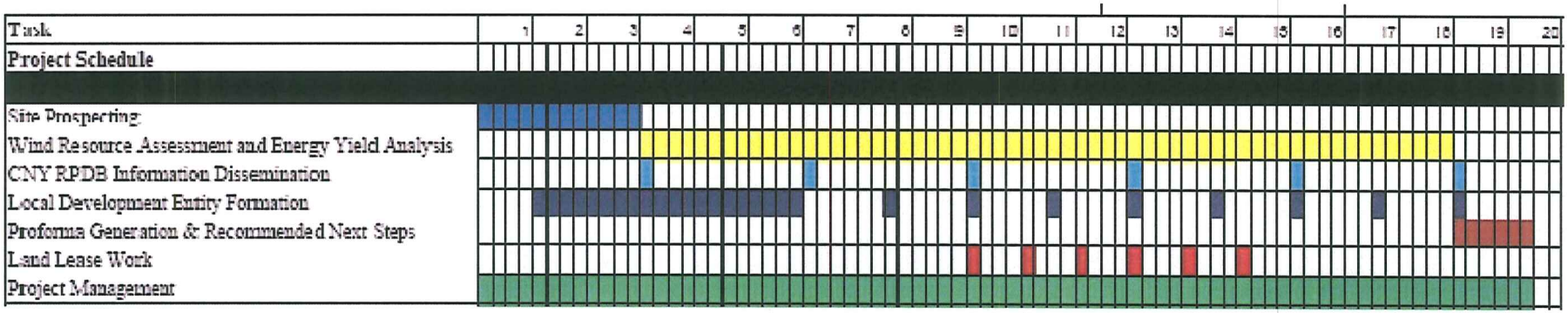
1. Site Prospecting
   - Identify all eligible sites (estimated wind resource, proximity to transmission capacity, land use, and ease of construction)
2. Wind Resource Assessment/Energy Yield Analysis
   - Siting, permitting, and installation of a 60m wind measurement tower for one year of wind data collection
   - Energy Yield Analysis using up to three different wind turbine models
3. Development Team Formation
   - Create and educate local development team (legal for profit entity) that will use the USDA-funded feasibility study to evaluate various project ownership options and move forward with future development efforts

Fabius Community Wind Project – Feasibility Study

4. Pro Forma Analysis
   - Produce pro forma statements associated with possible financing and ownership structures that Development Team may utilize in order to gain ownership in a wind power project.
   - Project pro forma statements will be developed for each ownership scenario using the results of the Energy Yield Analysis, forecasted energy values, and estimated construction costs.
   - Recommended steps to reach successful project completion will be included.
5. Land Lease Structure Evaluation
   - meet with potential turbine hosts, along with other project stakeholders, to agree upon desired lease terms
   - offer recommendations on how to structure a lease agreement to meet those terms.
6. Public Education
   - Organize community forums/workshops
   - Produce "lessons learned" report

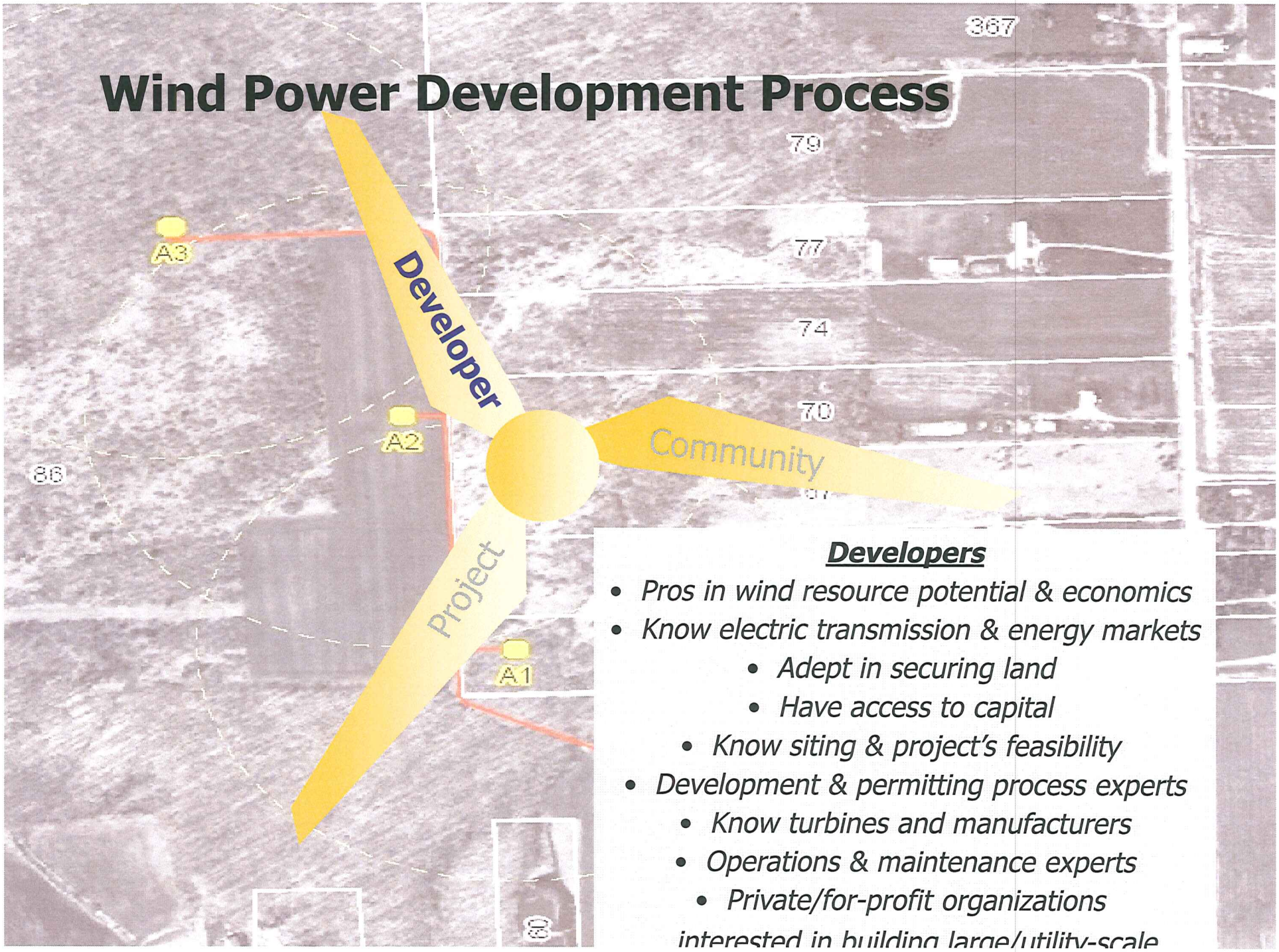
Fabius Community Wind Project – Feasibility Study

- Project period is approximately 18-20 months:



- In-kind contribution from community and CNY RPDB:
  - Development Team formed within approx. 3 months of project start date
  - Over next 15 months, DT of about 10 individuals meets for approx. 2 hours monthly and contributes about 20 additional hours per month as a group
  - CNY RPDB contributes MET Tower and about 100 hours

Wind Power Development Process



Developers

- *Pros in wind resource potential & economics*
- *Know electric transmission & energy markets*
  - *Adept in securing land*
  - *Have access to capital*
- *Know siting & project's feasibility*
- *Development & permitting process experts*
  - *Know turbines and manufacturers*
  - *Operations & maintenance experts*
  - *Private/for-profit organizations*

interested in building large/utility-scale

Wind Power Development – Two Main Options

1) Private Company Developers

- Majority of current wind systems
- Own, operate & maintain wind farms - no community ownership option
- Finances cost of development/equipment
- Assume majority of the risk
- Profits from energy sales to grid
- Interested in 30+ MW development

2) Community Wind Developers

- Non-traditional, gaining attention
- Community has option to own part or all of wind system
- O&M options
- Shares in energy sales profits
- Assume part of the cost and risk
- Flexible to development size

Some of the Players…

Private Developers

PPM (Scottish Power)
Horizon Wind (Goldman Sachs)
Invenergy LLC
Global Winds Harvest
UPC Wind Partners
Enel North America
PG&E

Equipment Suppliers

GE Wind (U.S.)
Vestas (Denmark)
Siemens (Germany)
Gamesa (Spain)
Mitsubishi (Japan)
Suzlon (India)

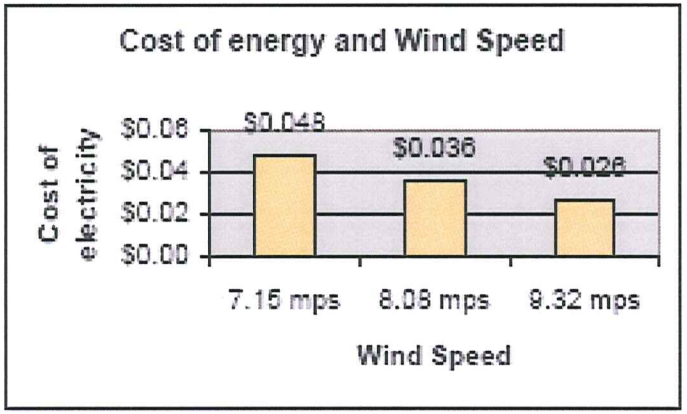
Community Wind Options

Sustainable Energy Developments, Inc.
John Deere
Empire State Wind Energy
Community Cooperatives
Private Companies

Wind Power Developer – Economics of Wind

From the Eyes of the Developer

- Not all wind is equal

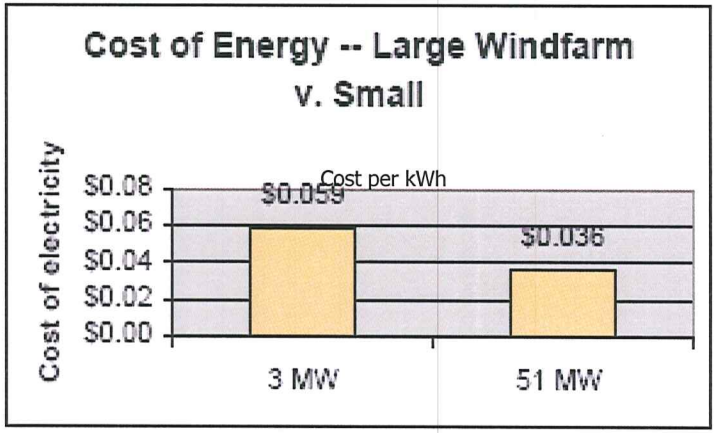


Higher wind speeds – lower unit cost/kWh

- Capital intensive venture – cost of financing a major factor

New Facility Energy Costs:
Wind - 4.9¢/kWh
Coal - 3.7¢/kWh
Natural Gas - 7.0¢/kWh
@$12/MMBtu

- Economies of scale



The more turbines the better

- Low hanging fruit projects 1st

Wind Generator Costs:
Capital Costs - 3.3¢/kWh (67%)
Operating Costs - 1.6¢/kWh (33%)
Total - 4.9¢/kWh

Source: Economics of Wind Energy (AWEA)

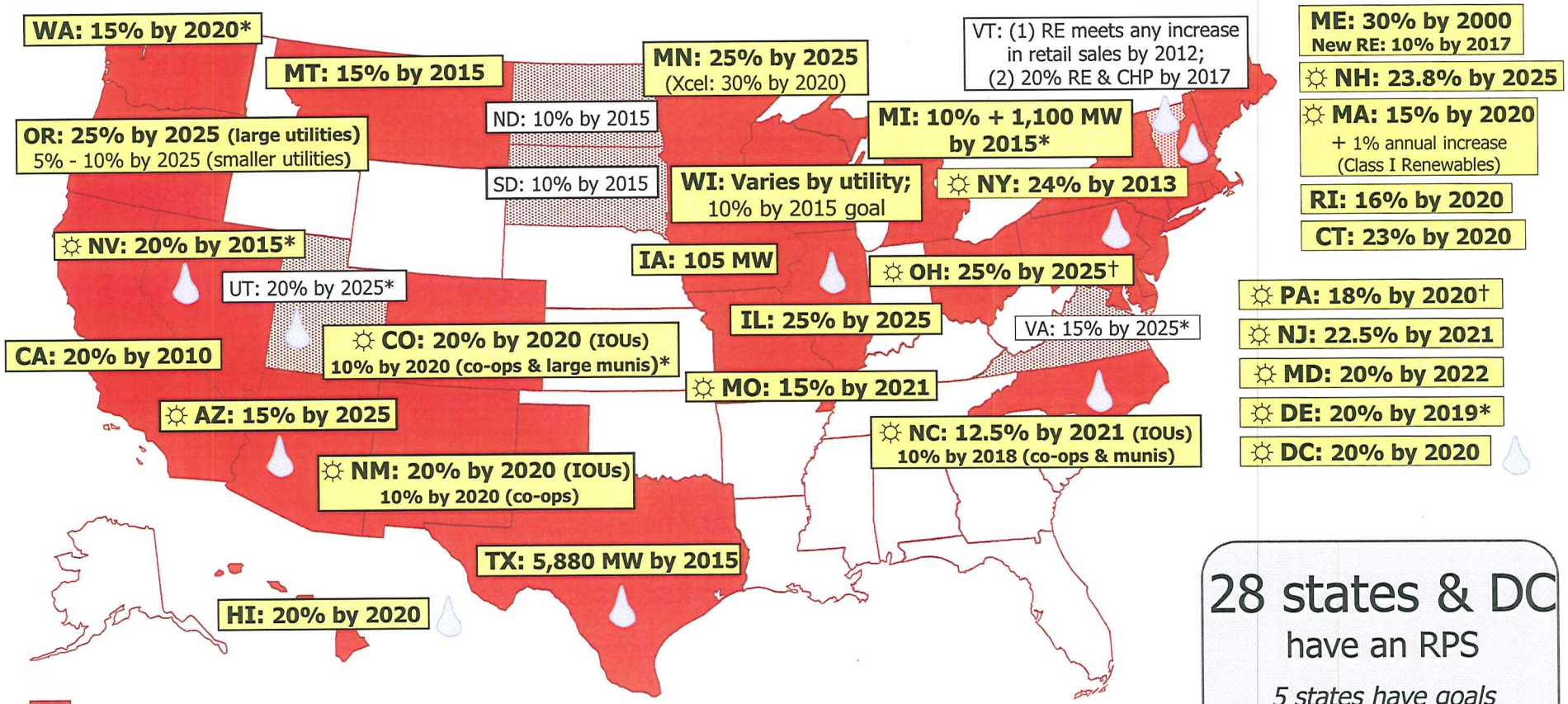
Developer – Incentives Make a Difference

Utility-Scale Wind Development Incentives

- ✓ Federal Production Tax Credit (PTC) $0.021 / kWh tax credit for first 10 yrs
  - Worth between $47,500-55,000 (after tax) per installed MW (35% of installed project cost)
- ✓ Accelerated Depreciation (MACRS) – 5 years rather than 20 (30% subsidy)
- ✓ PTC and MACRS together represent over 60% of total financial return
- ✓ RECs/Carbon credits - $'s/ton of emissions (cap & trade system proposed)
- ✓ New York State renewable energy property tax exemption
  - PILOT agreements
- ✓ New York State Renewable Portfolio Standard (RPS) - 'Main-Tier'

Renewable Portfolio Standards

www.dsireusa.org / April 2009



28 states & DC
have an RPS
5 states have goals

State renewable portfolio standard

State renewable portfolio goal

Solar water heating eligible

Minimum solar or customer-sited requirement

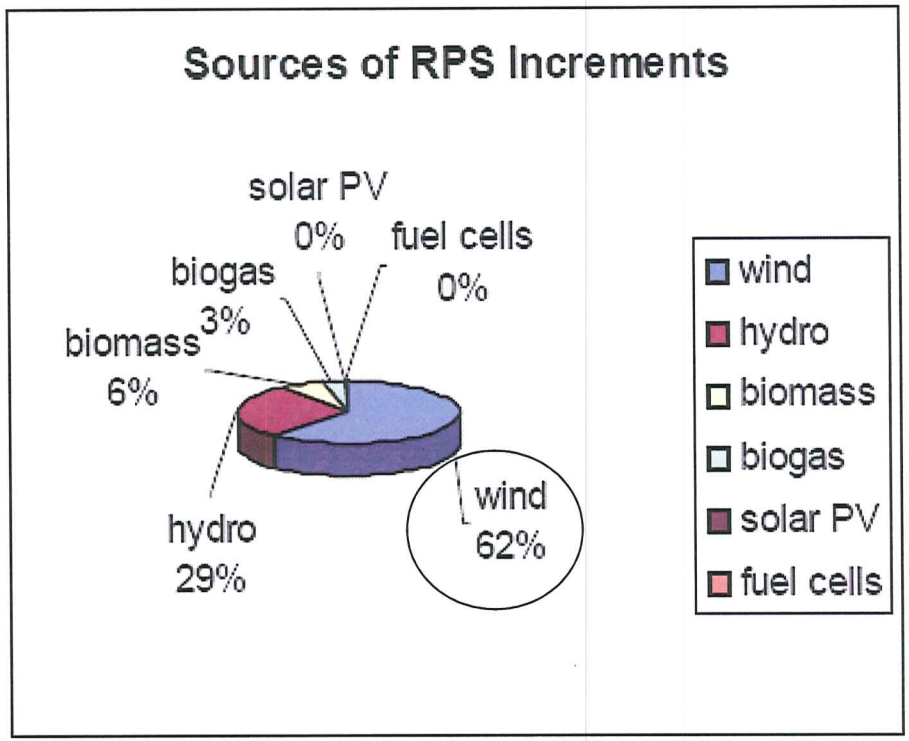
* Extra credit for solar or customer-sited renewables

† Includes separate tier of non-renewable alternative resources

New York State RPS

- Goal – "25% renewable energy by 2013" – which really means 6% increment in renewable energy use
- Achieved via centralized procurement by NYSERDA competitive sealed bids, pay as bid, for 10 year contracts for RECs, energy sold on NYISO-administered wholesale energy market
- Bids evaluated on price and economic benefits to NY
- Estimated that the majority of new green power would come from wind or hydro

Where will the Energy Come From?



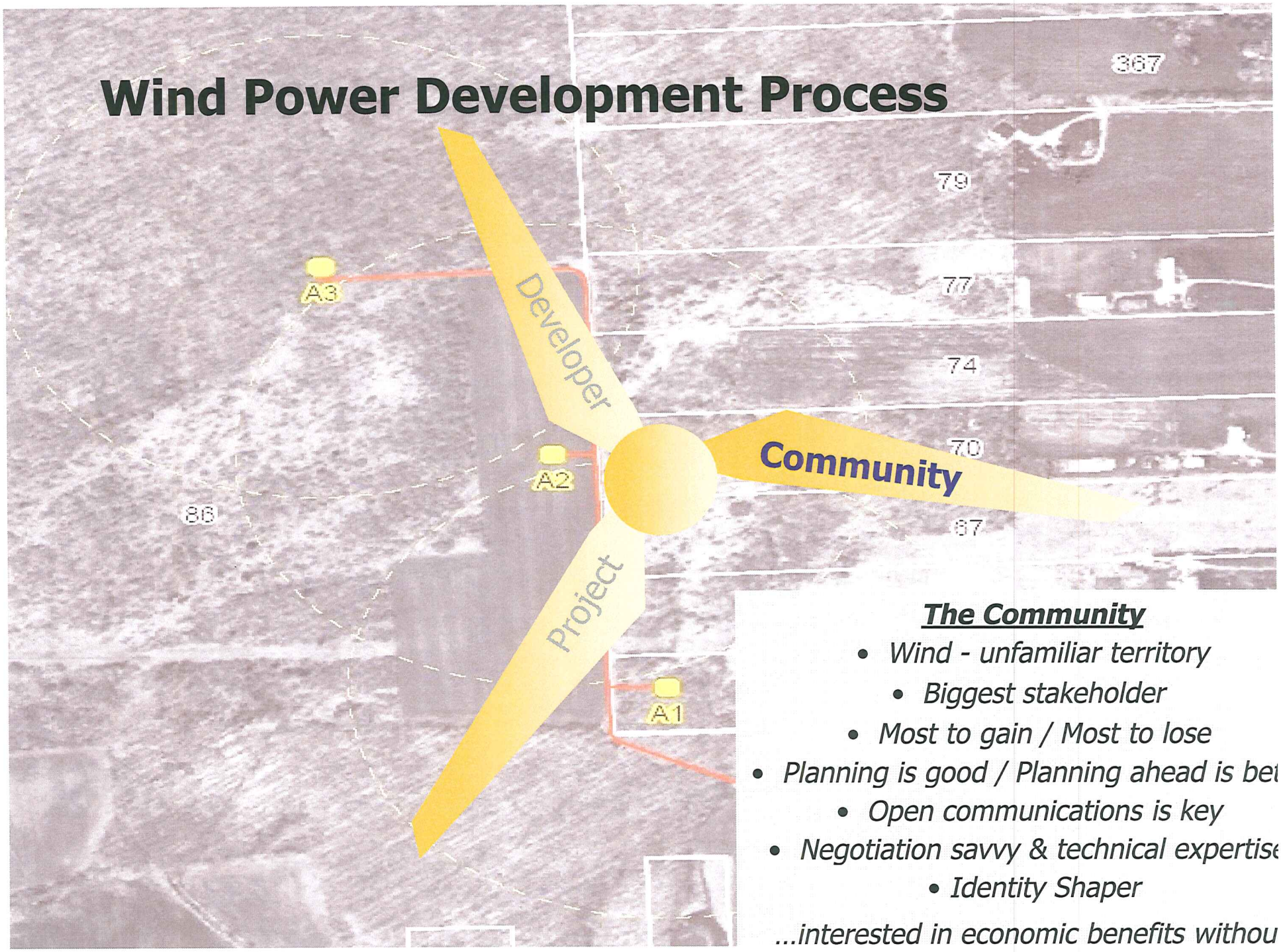
Economies of Scale

Size	Relative Installed Cost*	
	Low $/m²	High $/m²
Micro	1,500	2,500
Mini	1,250	2,500
Household	1,250	2,250
Small Commercial	800	1,250
Large**	700	1,000

*Gross approximation only.

**Several turbines in small clusters.

Wind Power Development Process

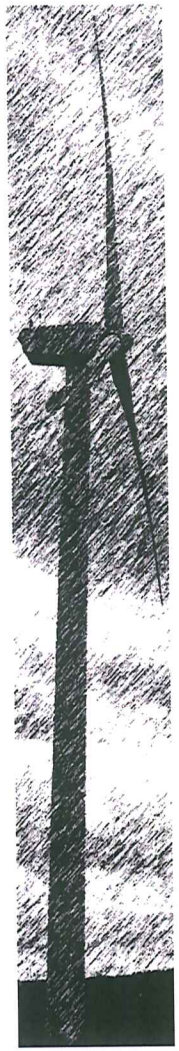


The Community

- *Wind - unfamiliar territory*
- *Biggest stakeholder*
- *Most to gain / Most to lose*
- *Planning is good / Planning ahead is bet*
- *Open communications is key*
- *Negotiation savvy & technical expertise*
- *Identity Shaper*

...interested in economic benefits withou

The Community – Planning for Wind

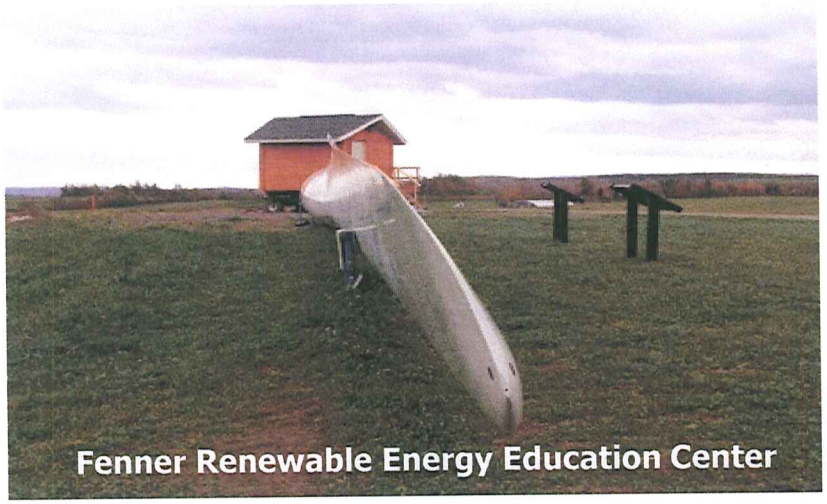


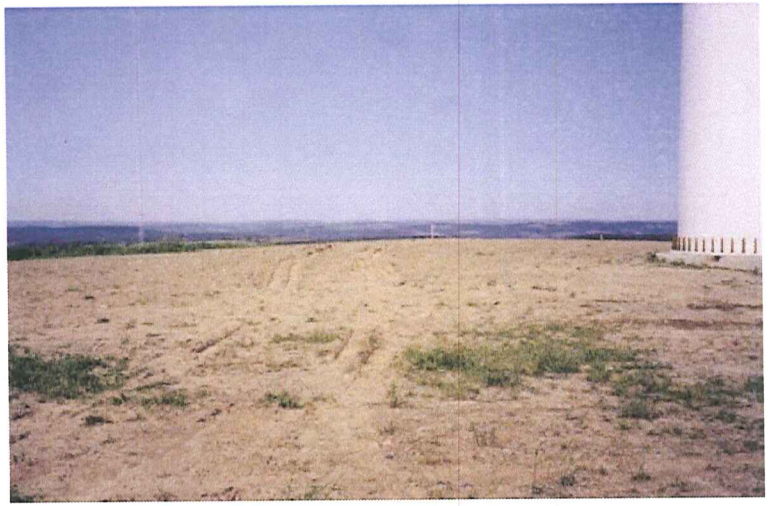
Pros

- ✓ New industry to community – short & long term jobs
- ✓ Increase of municipal tax base or PILOT payments
- ✓ No emissions or hazardous waste
- ✓ Renewable energy source
- ✓ Landowner income
- ✓ Co-exists with current land-use

Cons

- ✓ Aesthetics
- ✓ Noise
- ✓ Disturb natural environment
  - land, birds, habitat
- ✓ Shadows and/or flicker effects
- ✓ Ice shedding
- ✓ Long term (20+ years)





The Community – Planning for Wind

The Comprehensive Plan

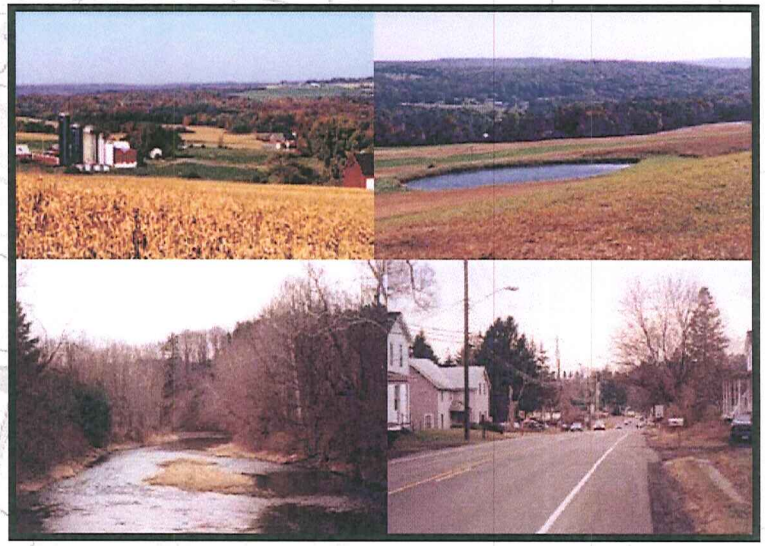
- Goals & Objectives
  - Proactive approach to land use regulation
  - Minimize later environmental review
- Action Strategy
  - Inventory: identify high wind potential areas
- Analysis
  - Consider other natural & cultural resources, residential areas
  - Identify locations with fewest conflicts for future wind development

Zoning Review

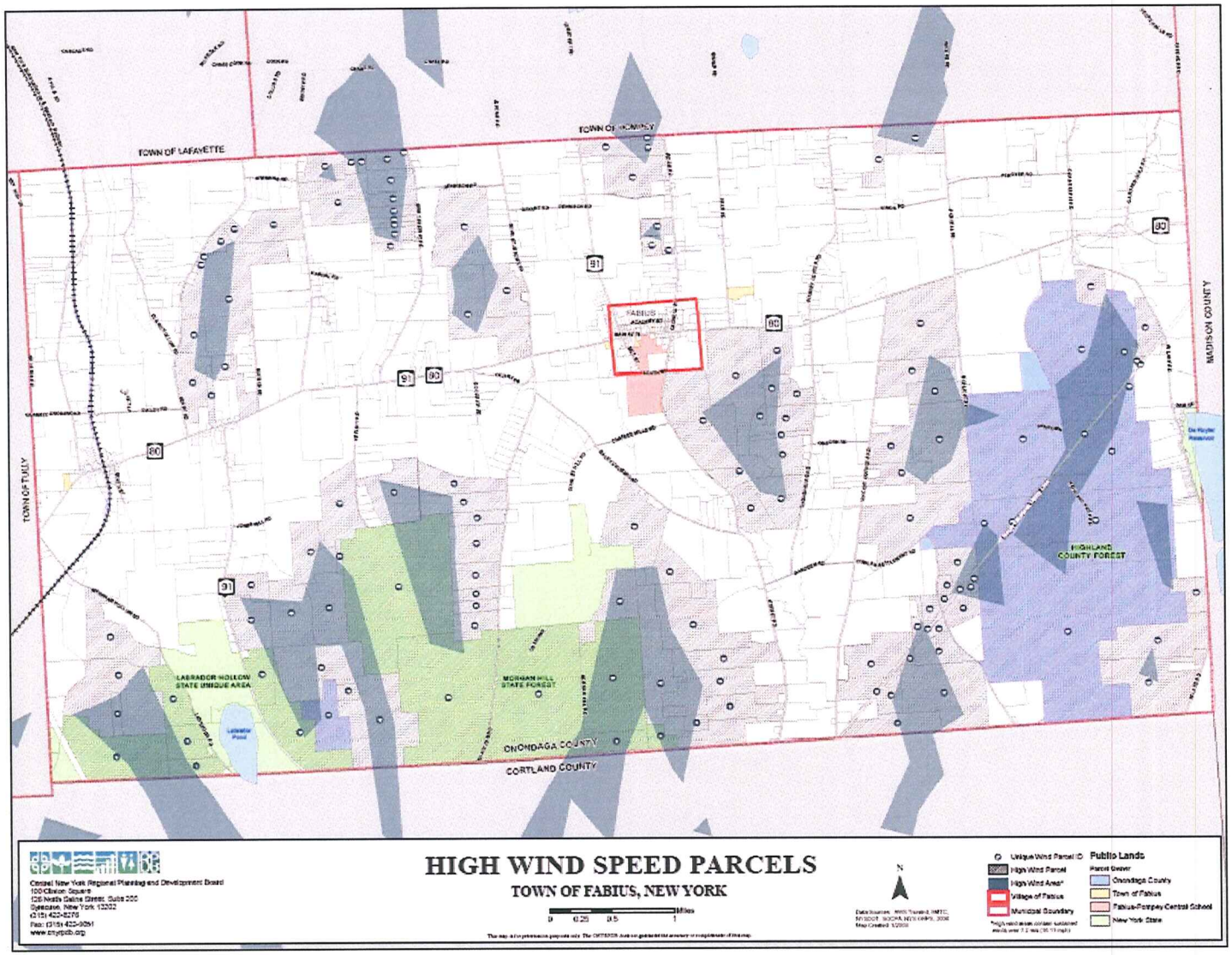
- Siting & installation standards
- Setbacks from residences, roads and property lines
- Height limits
- Nuisance impacts: sound, electromagnetic interference
- Visual impacts
- Environmental impacts

Identify Resources to be Protected

- Infrastructure
  - Habitable vs. non-inhabited structures
  - Residential neighborhoods
  - Roads
  - Water/sewer access
  - Other WECS
- Natural
  - Wildlife habitats
  - Wetlands
  - Migration paths
- Visual Resources
  - Scenic vistas
  - Cultural or Historic attractions
  - See DEC *Assessing and Mitigating Visual Impacts*: http://www.dec.ny.gov/docs/permits_ej_operations_pdf/visual2000.pdf

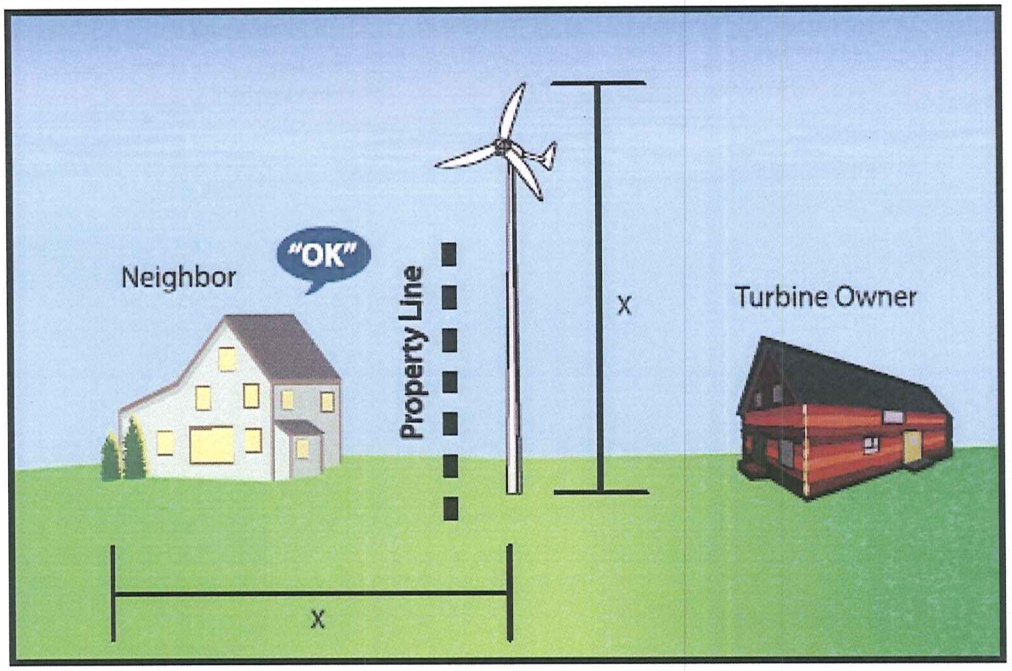


Identify Areas for Development



Types of Setbacks

- Distance to structures
  - Habitable vs. non-inhabited
  - Can vary for participating land owners
- Distance to property lines and roads
  - Potential for waivers if adjacent property owners are participating in WECS application
- Separation from other turbines
  - Usually dictated by wind resource and concerns about turbulence, interference



Allowing abutting property owners to submit signed easements may be an alternative form of compliance should roads and utility lines be absent in the immediate vicinity.

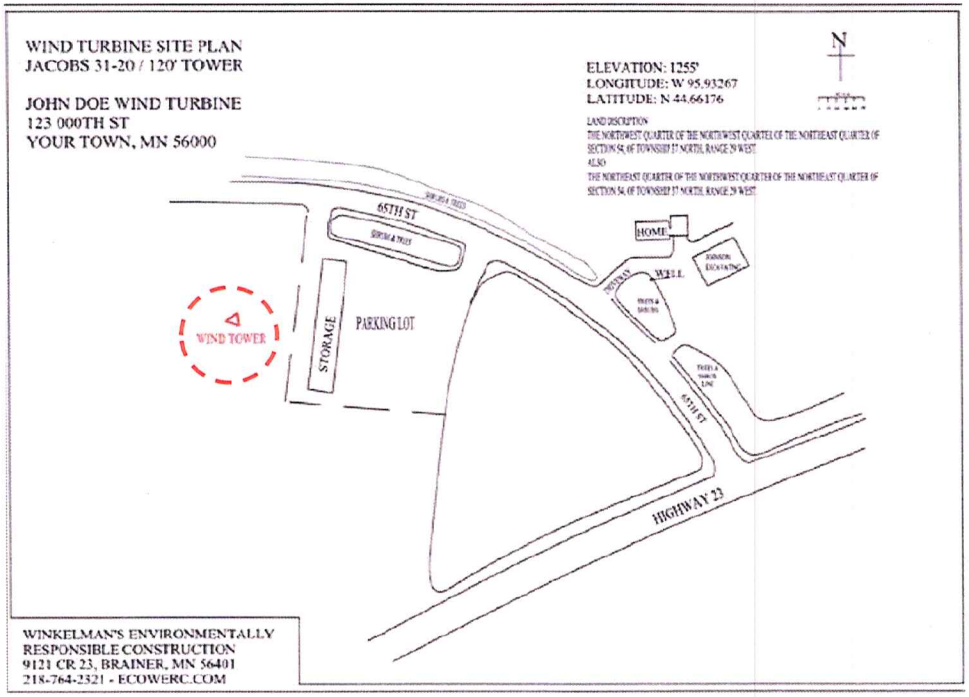
Consider:

- **Height of windmill**
- **Sound**

Site Plan Review Criteria

- Allows installation after physical inspection of site and surroundings
- Usually accompanied by a special use permit
- Example of items for review:
  - Tower location
  - Tower design
  - Utility lines
  - SEQRA forms
  - Safety and access (fencing)

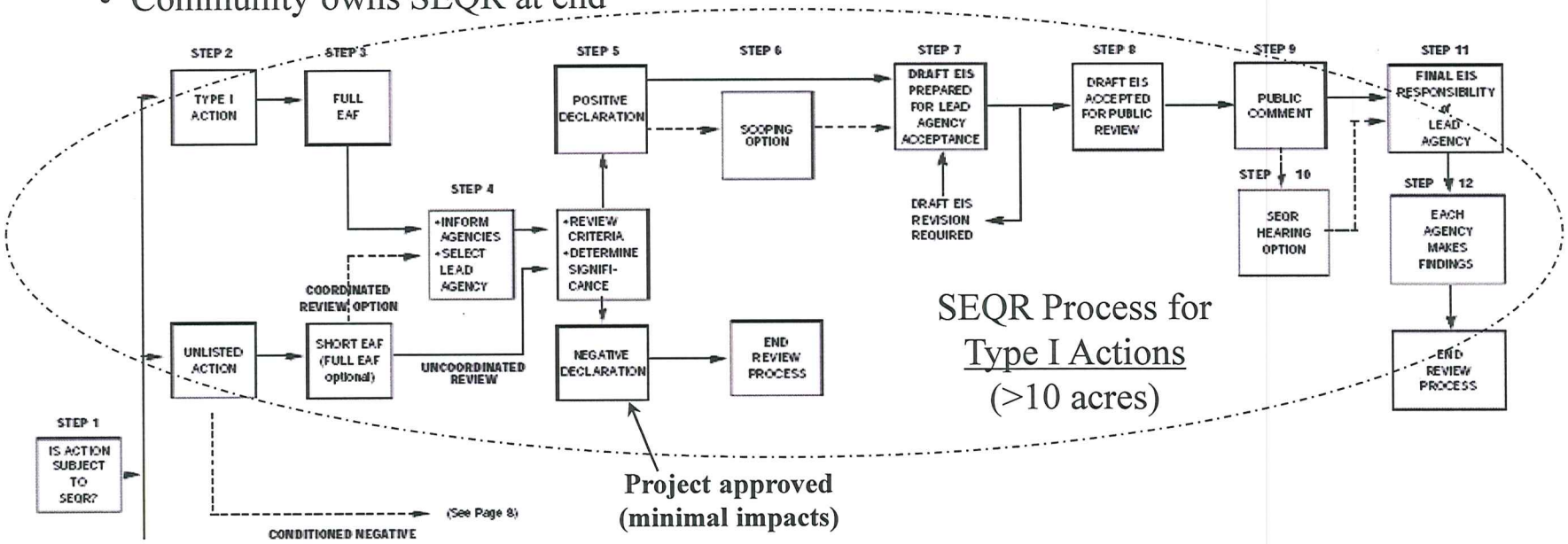
- **Can be used with or without zoning**
- **Develop submission requirements**
- **Develop clear decision criteria**
- **Do not require expensive third-party review**



The Community – Environmental Impacts

SEQR – Environmental Impact Assessment

- Local Government – 'Lead Agency' for SEQR
- Full Environmental Assessment Form (EAF) required
- SEQR Process assesses (9 –12 mos.)
  - Avian, Noise, Land use, Agricultural
  - Cultural & archeological,
  - Site conditions & construction impacts
  - Aesthetics & viewshed
- 'Pos Dec' leads to EIS – more thorough
- Community owns SEQR at end



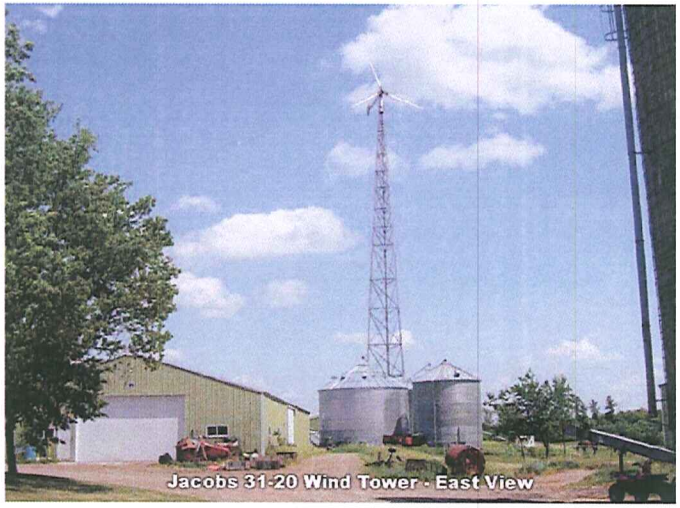
Visual Impacts

- Visual resources identified in Visual EAF:
  - Does the project violate a clear written community standard intended to preserve the aesthetic or scenic natural beauty of an area?
  - Stronger review for historic or natural preservation areas
- How visible will the turbines be?
  - Details visible up to a half-mile away (foreground)

See DEC *Assessing and Mitigating Visual Impacts*:
http://www.dec.ny.gov/docs/permits_ej_operations_pdf/visual2000.pdf

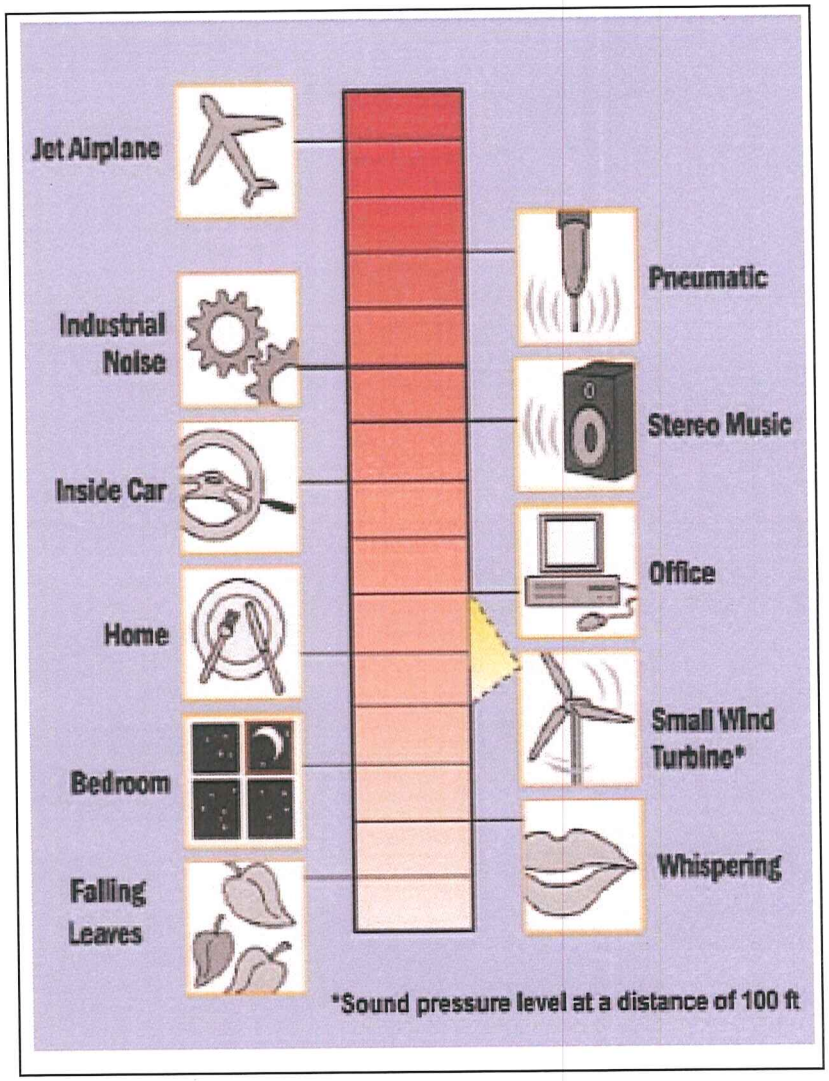
Photo of the Tower Site

Photo Mock-Up of Turbine in Place



Wind Turbines and Sound

- Myth: Noise created by wind turbines is excessive and can be heard at great distances
- Fact: At 750-1,000 ft wind turbines are no noisier than a new refrigerator or air conditioner would be from an adjacent room:
  - Innovation with blade design and insulation makes today's turbines much quieter
  - Ambient noise level of most modern residential wind turbines is around 52 to 55 decibels



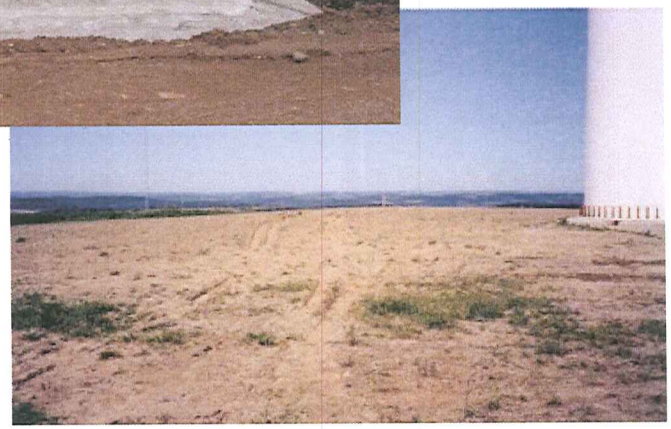
The Community –Impacts to Farmland

Positive Impacts

- Additional Income
- Improved Access

Negative Impacts

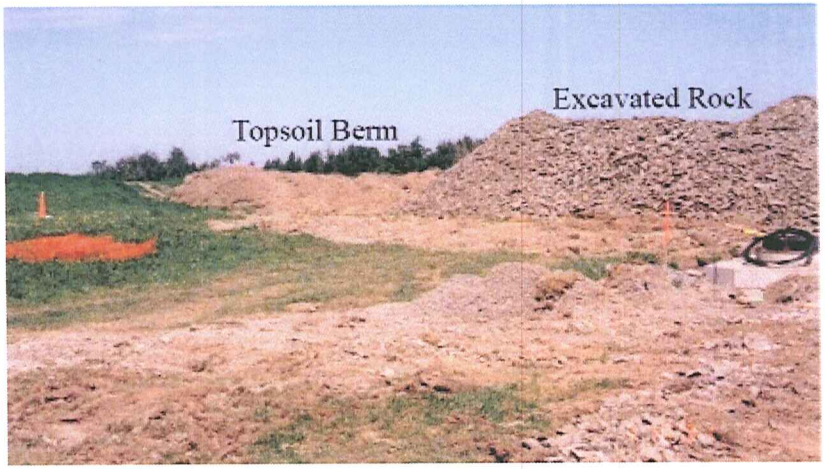
- Lost Acreage (2-acre footprint)
- Soil Resource Damage
- Drainage/Runoff
- Crop Loss/Damage



The Community –Impacts to Farmland

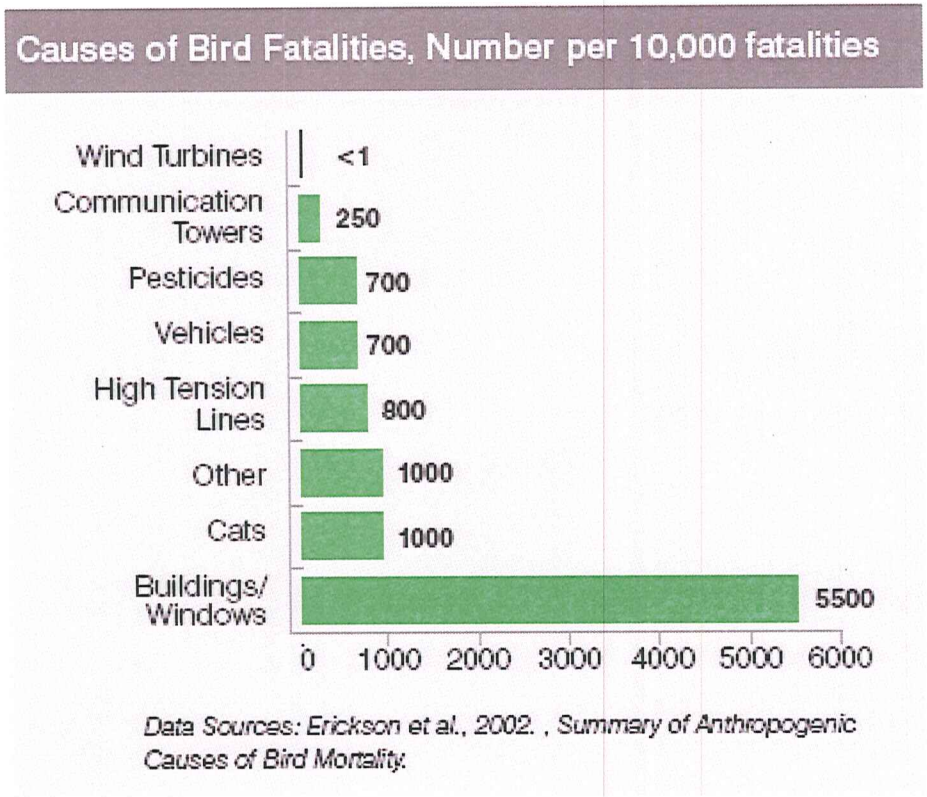
Areas of Impact

- Tower Sites
- Access Roads
- Collector System



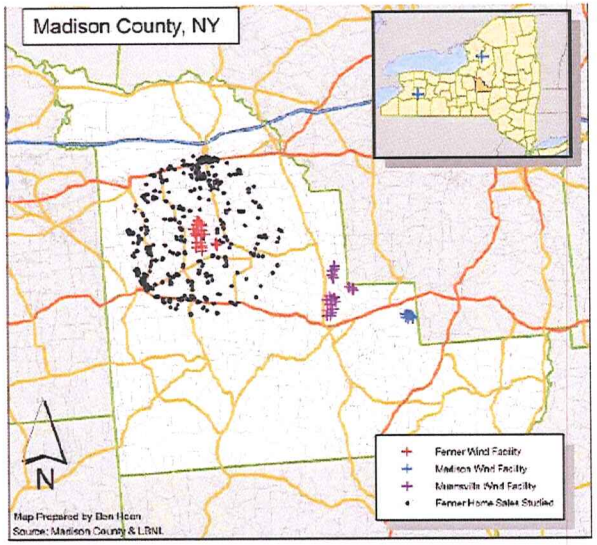
The Community – Wildlife Impacts

- Causes of bird mortality
  - collisions, pollution & toxics, global warming, habitat fragmentation
- Modern turbine designs prohibit birds from perching and generate energy with larger, slower moving blades, which can help birds avoid the structure
  - but bats attracted to slow moving turbines
- Bird and bat impacts vary depending on location
  - proximity to wetlands is more important than forested
- Bird deaths from collusions can range from <1 to 9.6 birds per turbine per year
- Bat fatalities estimated to range from <2 to 50 bats per turbine per year



The Community – Property Values

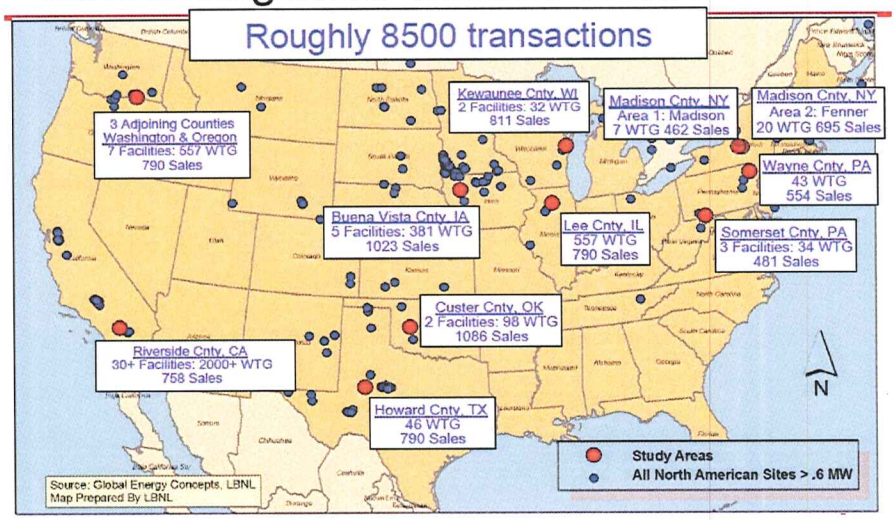
- Hoen & Sethi, Madison County Study
  "Effects Of Windmill Proximity & Visibility On Property Values Surrounding the Fenner Wind Facility In Madison County, NY." (working title), Bard Center for Environmental Policy, Bard College – Ongoing Research
- Hoen, Wiser et. al, National Study
  "Do Wind Farms Affect Surrounding Residential Property Values? Final Results From A Nationwide, Multi-Site Analysis." (working title), Lawrence Berkeley National Laboratory, USDOE Funded – Ongoing Research



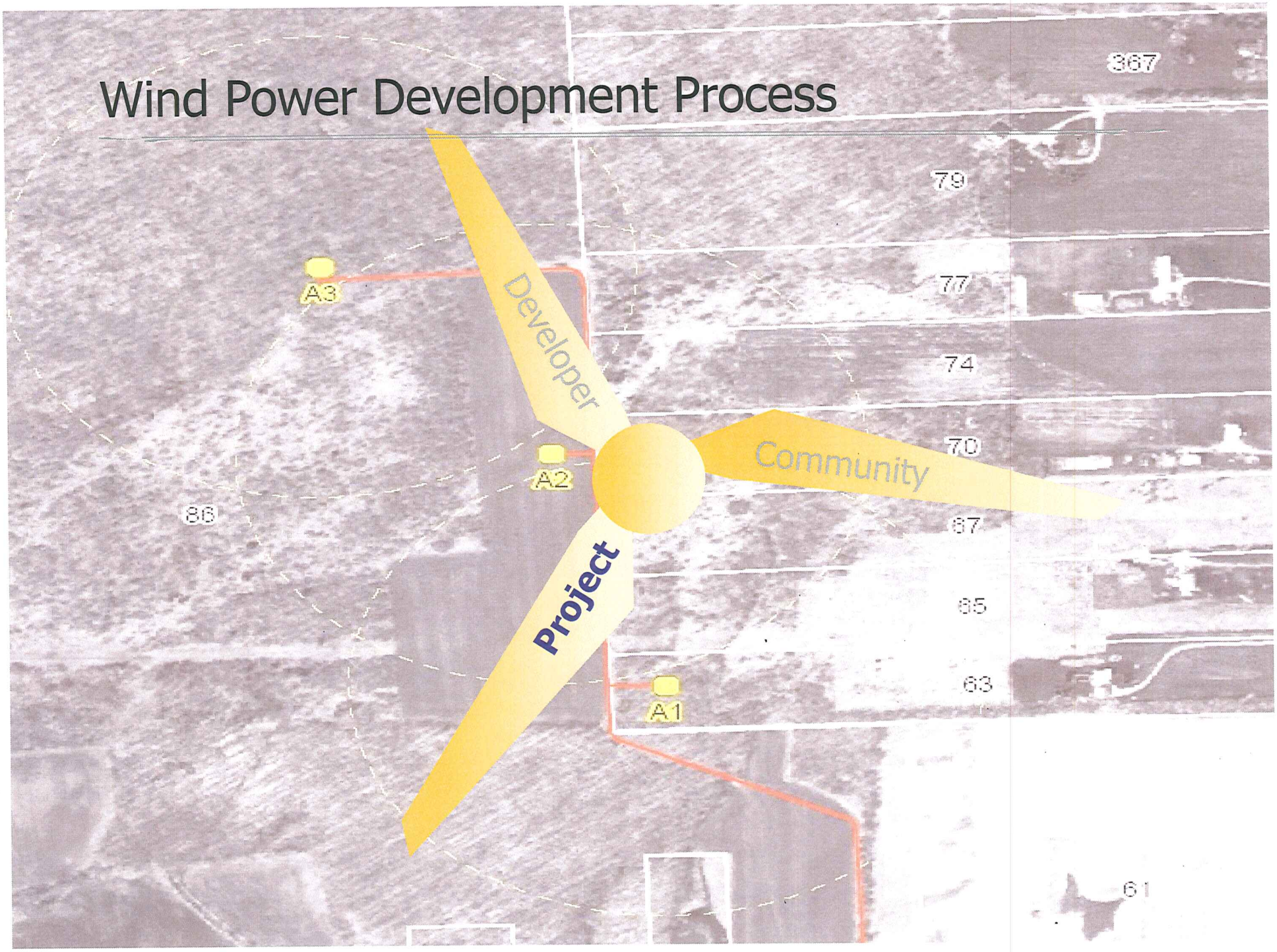
Preliminary Results

- Scenic Vista Effects: There is no statistical evidence to support the claim that homes with a view of wind turbines have different values than homes without such views
- Proximity Effects: There is no statistical evidence to support the claim that homes within ½ - 1 mile of turbines, with or without a view of them, sell for different values than those further away

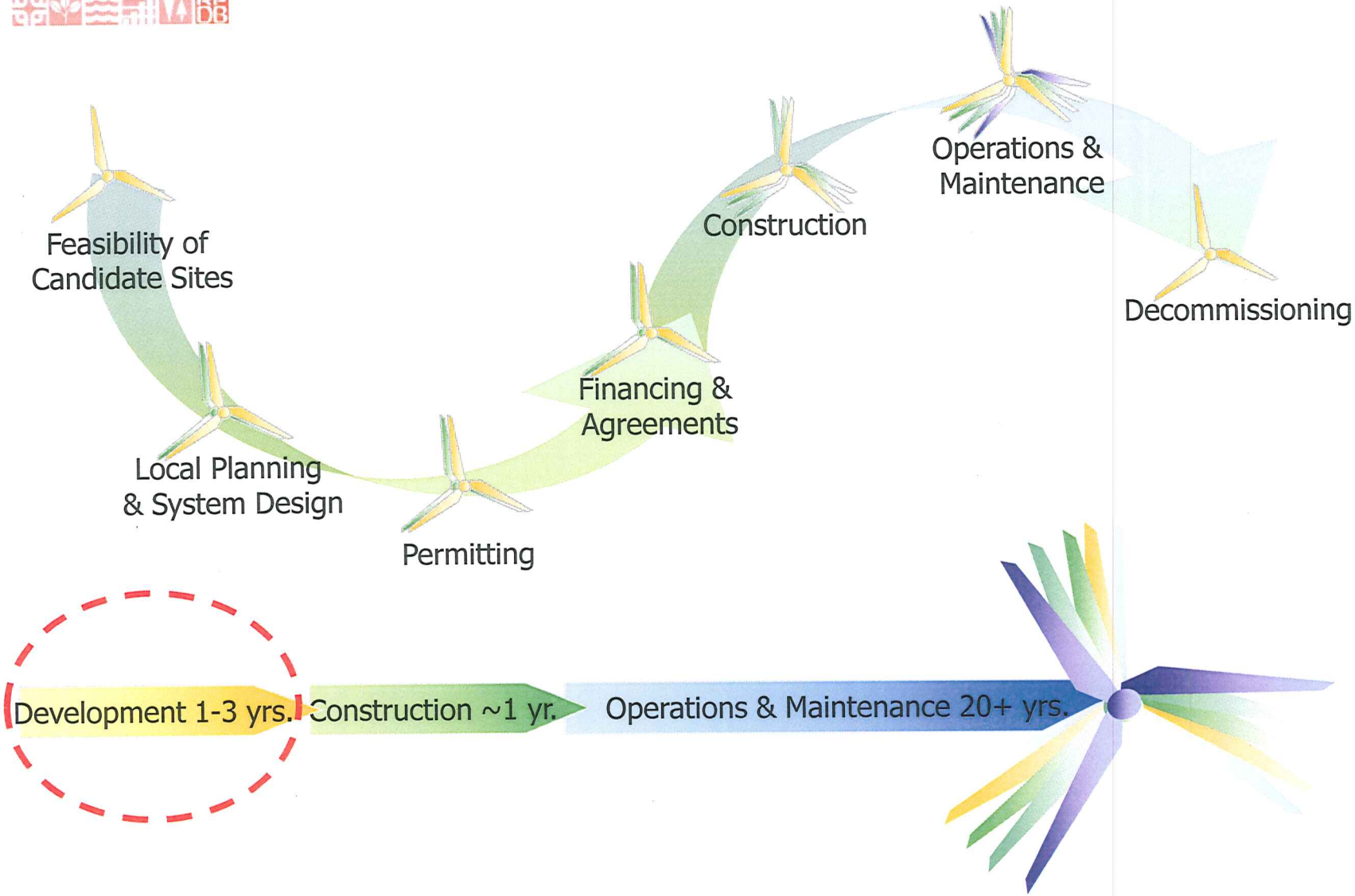
Data Collected From 11 Study Areas Surrounding More Than 25 Wind Facilities



Wind Power Development Process



Wind Power Project – Lifecycle



Wind Power Project – Lifecycle

Feasibility of Candidate Areas

Prospecting:

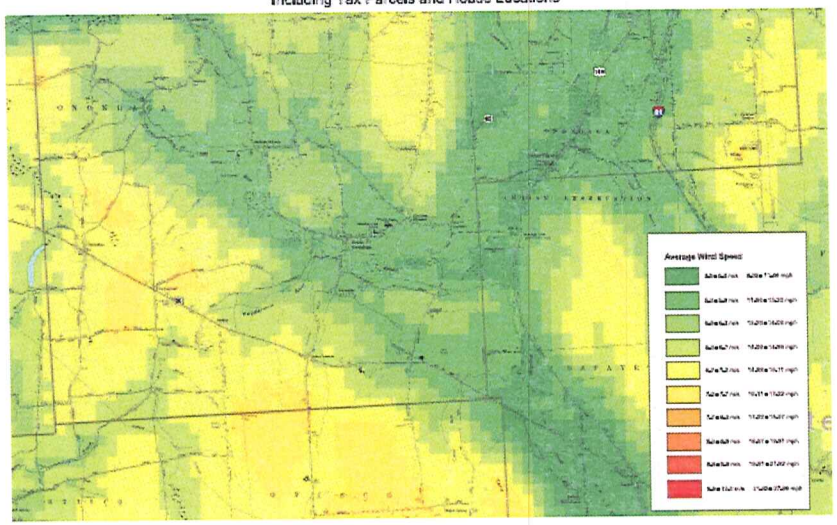
- Wind Resource Potential:
  - AWS Truewind base maps (desktop analysis)
- Minimum average annual wind speed: 6.0 m/s (about 13.4 mph)
  - Meteorological study
- Possible to rent a met tower for a year for ~$8,000
  - installed cost is $18,000 for 50M and $24,000 for 60M
- Land: availability, quantity, access, terrain, slope, elevation
- Access to Transmission: line voltage, distance, trunk line, available capacity

Community Litmus:

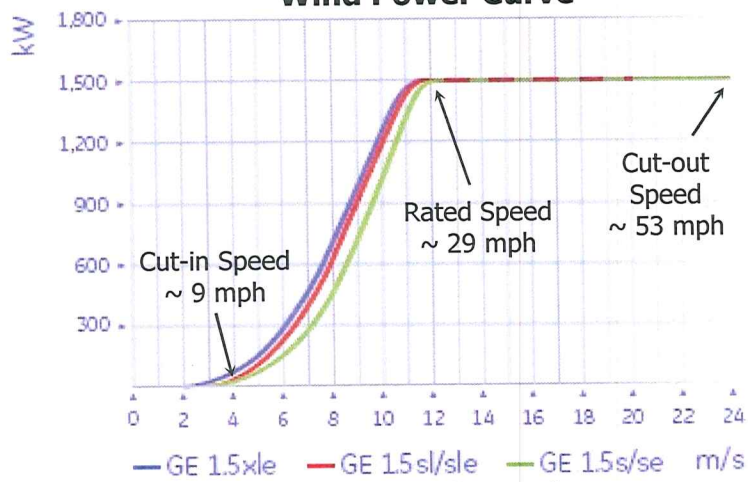
✓ Local government interest

✓ Community acceptance

Average Annual Wind Speed - Hub Height 100 Meters
Including Tax Parcels and House Locations



Wind Power Curve

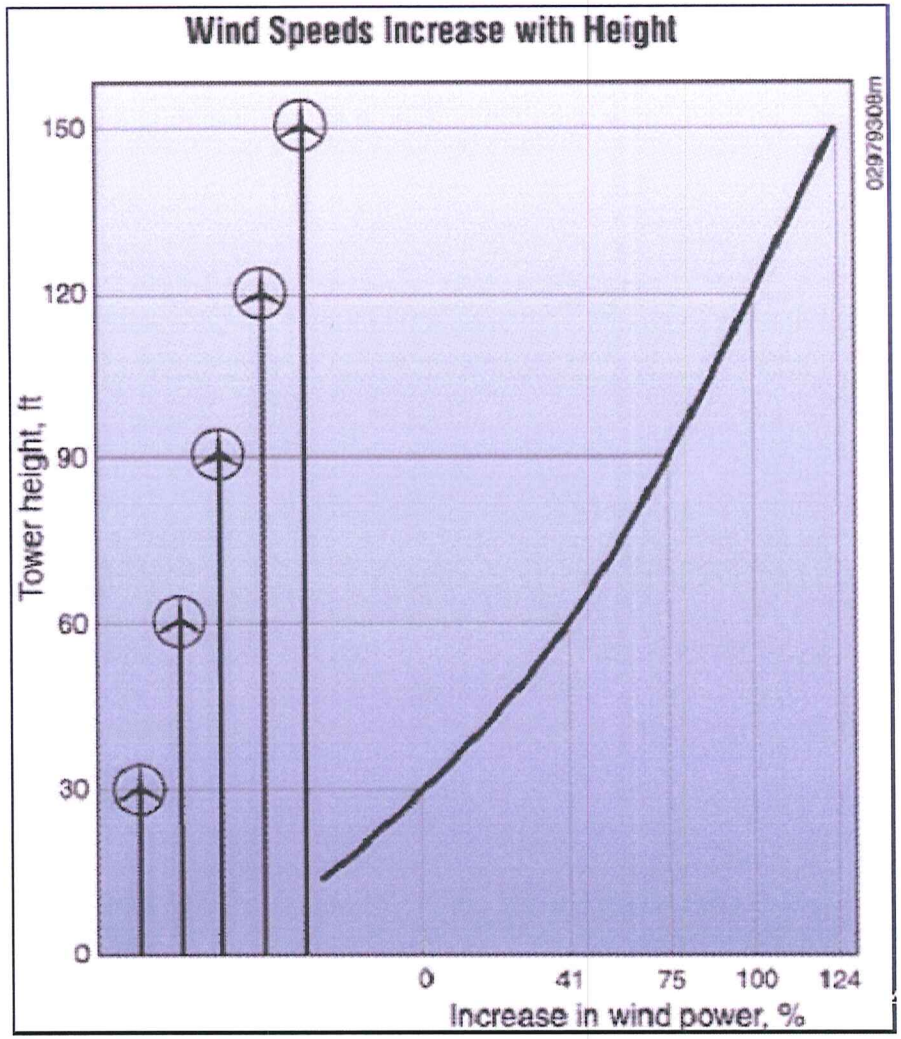


(GE 1.5 MW Turbine brochure)

Wind Power Project – Lifecycle

Turbine Tower Height Matters

- Wind speed increases with hub height
- Small increases in wind speed result in large increases in power
  - 10% more velocity = 33% more power
- Tall towers often needed for clearance above obstacles (turbulence)
- May require a variance or special permit depending on your municipality
  - time-consuming
  - costly (10% of total project budget)



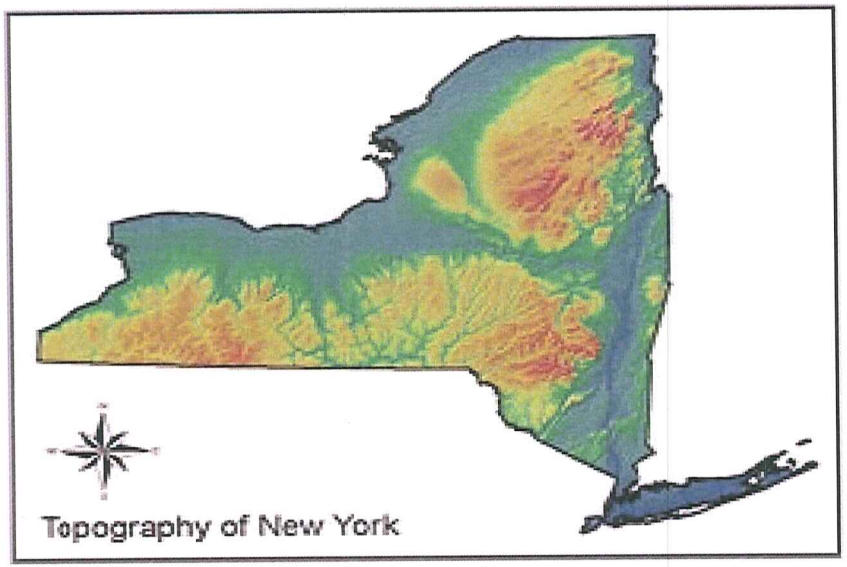
Wind Power Project – Lifecycle

Topography matters

- Wind energy potential relates to changes in elevation which means that topography is often a factor in identifying sites for further exploration

- With prevailing westerly winds, preferred locations tend to be at the east end of large lakes or the western edge of mountain ranges

Buffalo Ridge Minnesota



Wind Power Project – Lifecycle

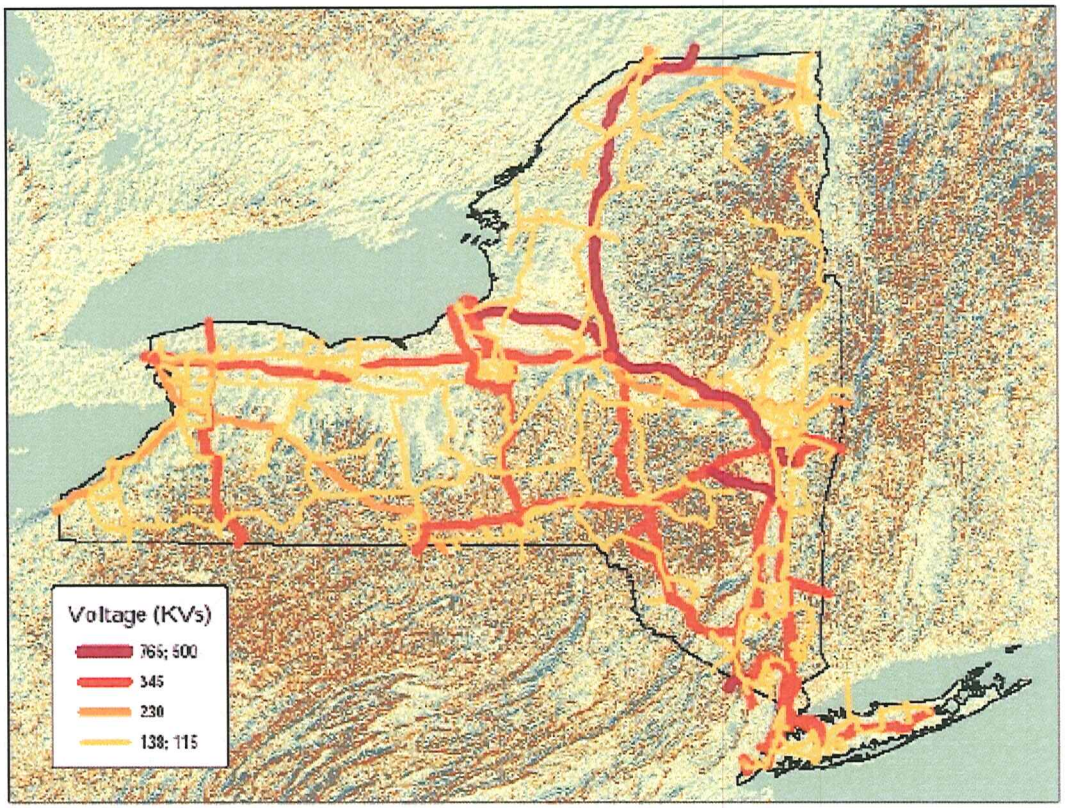
Access to Transmission Lines

- ✓ Voltage and Distance
- ✓ Available capacity – Oct. 2008 NYISO White Paper "Integration of Wind into System Dispatch"
- ✓ NYISO studies expensive (>$70k) and lengthy (15-30 months)
  - Once study starts, maintains schedule with required payments
  - Study helps "legitimize" project
- ✓ Distribution system interconnect could avoid cost and wait

Extending Transmission Lines

- ✓ Cost $100K to $1M per mile
- ✓ Higher end of range in NYS:
  - Securing rights-of-way
  - Irregular topography at ridgeline locations

New York State Electric Transmission Lines (higher than 115 kV)

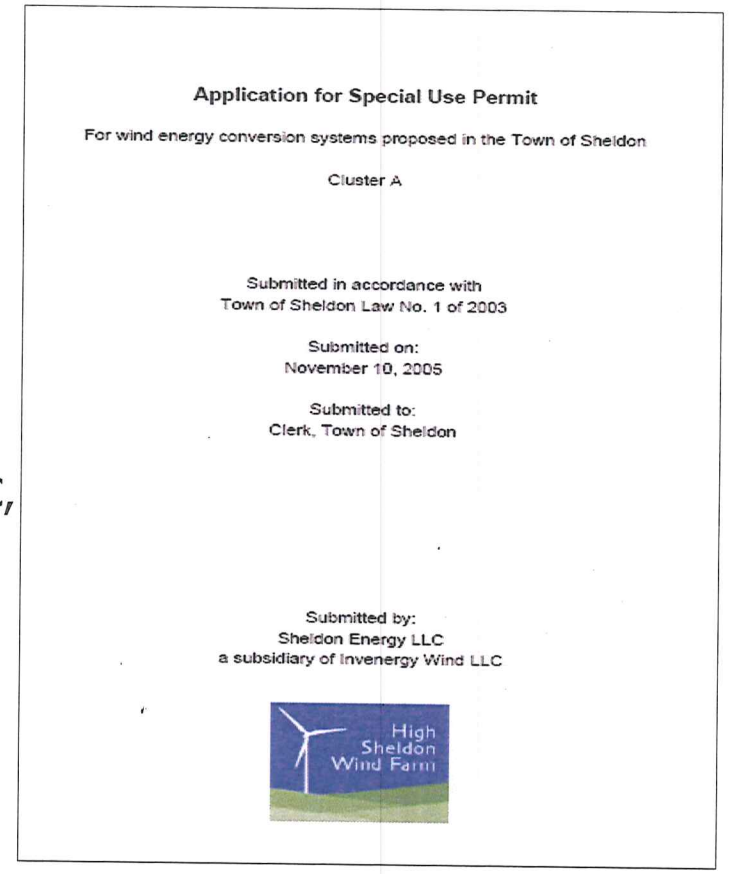


Wind Power Project – Lifecycle

Permitting

Permitting – several steps to address

1. Local land use regulations – municipal/county permits
   - need site plan, setback distances, noise limits
2. New York State
   - State Environmental Quality Review Act (SEQR)
   - DEC, NYS Ag & Mkts., NYS Parks & HPO, PSC, DOT
2. Federal
   - FAA, US Fish & Wildlife, USACE
3. Other
   - IRS (Production Tax Credit)
   - NYSERDA (funding/RPS)
   - NYISO
   - Electric utility/code compliance



Application for Special Use Permit

For wind energy conversion systems proposed in the Town of Sheldon

Cluster A

Submitted in accordance with
Town of Sheldon Law No. 1 of 2003

Submitted on:
November 10, 2005

Submitted to:
Clerk, Town of Sheldon

Submitted by:
Sheldon Energy LLC
a subsidiary of Invenergy Wind LLC

High Sheldon Wind Farm

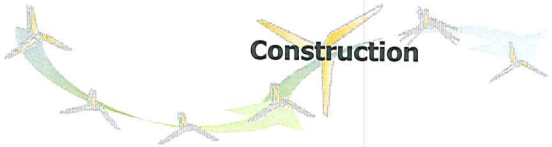
Wind Power Project – Lifecycle

Contract Negotiations

- Banks will not finance a wind project without a 10-year or longer PPA
- Need price per kWh, amount of energy delivered, and term of agreement
- Hire experienced lawyer to negotiate/review PPA
  - Take or Pay contracts offers best financial security
  - Energy only or energy and capacity payments?
  - Who gets the Renewable Energy Certificates?

Interconnection

- For projects <10MW, need 12-41kV interconnect, for 10-50MW need 69kV
- Interconnect at substation serving nearby town with extra capacity on transformer, OR
- Interconnect on a 3-phase high voltage line along farm property, eliminates expensive feeder line (~$80,000/mile)
- Budget $200,000 or more for interconnect, even for small projects



Turbine Procurement

- Many turbines unavailable until 2011
  - Recent slowdown has improved situation somewhat
- Start with turbine type used on other projects in the area
  - GE 1.5 MW most common in Upstate NY
- Consider partnering early with equity investor project that has turbines pre-ordered
- Turbine order now requires 20% down and Letter of Credit for full amount

Wind Power Project – Lifecycle

Pre-Construction Engineering

- Site plan with road length and map, underground wire length
- Soil borings to determine foundation design
- Electrical firm engages utility on interconnect study
- Turbine manufacturer requires wind data (shear, turbulence) to qualify turbine at site

Construction Bidding

- Strongly consider hiring experienced consultant to oversee construction
- Use experienced lawyer to review all construction and turbine supply agreements to protect against delays/damages
- Be aware of insurance and equipment ownership during construction phase
- Contractual obligations to perform within time period and under certain total project costs

Wind Power Project – Lifecycle

Construction

- Construction period 6 - 12 months
  - Factors: project size, terrain, weather conditions, etc.
- Construction contingency of $50,000-$100,000 needed
- Road improvements, access roads, crane pads, foundations, trenching, power cabling, trunk line
- Local labor
  - i.e. 200 of 300 from Lewis County for Maple Ridge
- Open communications between developer & community
- Large capacity crane:
  - 350' boom height, ~$30 K breakdown, 16' or 32' road
- Traffic increase

Wind Power Project – Lifecycle

Operations & Maintenance – 20 to 30 years

- Ongoing monitoring of actual system performance against pre-construction projections
  - Perform adjustments as needed to fine tune productivity
- Contingency set aside for repairs of 35-45% of turbine price over 20 years
- Insurance costs increase rapidly, currently $17,000 or more per year per turbine
  - Many lenders require $1 million minimum property/casualty liability coverage plus business interruption insurance

Decomissioning and Removal

- Project agreement should include fund for each turbine to be controlled by some entity (may be local municipality)
- Within 18 months of turbine operating termination, turbine must be removed and restored down to a depth of 48 inches

Thank You for Your Attention

Questions?

For Further Information Contact:
Chris Carrick
Senior Energy Planner, CNY RPDB
CNY Energy $mart Communities Coordinator for NYSERDA
(315) 422-8276 ext. 213
ccarrick@cnyrpdb.org

Central New York Regional Planning & Development Board

U.S. Dept. of Energy

Central NY Energy $mart Communities

New York Energy $mart

Public Service Commission — NYSERDA