GovEnergy Webinar Series: Wind Technologies in the Federal Sector

Roman Piaskoski

Kevin Shulte

Robi Robichaud

GSA Wind Project at Jackman, ME LPOE

Roman Piaskoski

GSA New England has 765 kW of Distributed Generation

• Williams crystalline solar,	30 kW	1999
• Williams co-gen 75 kW,	75 kW	2001
• Waltham thin film solar,	325 kW	2007
• Cotter Bldg. thin film solar	50 kW	2010
• O'Neill Bldg. hybrid solar	95 kW	2010
• Jackman wind turbines	200 kW	2011
• Cleveland crystalline solar	69 kW	2011

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This Project First Conceived in 2001

- LPOE existed as an 1,800 sq ft facility
- Initial feasibility conducted with assistance from Department of Energy
- Turbine visualized was 10 kW

In 2004 Congress funded a New Facility

- Busy 24 / 7 hrs. commercial port
- New structure is 75,000 sq ft
- Completed in 2007
- New wind feasibility study conducted in 2005

Larger Facility Created Greater Opportunity

- Boston FMSP team conducted market research
- Secured funding from Energy Center of Expertise
- New LPOE electrical usage estimated at 450,000 kWh
- Recruited as ARRA project in 2009

RFP Issued September 2010

- Award made in December 2010 to *ALTERIS RENEWABLES*
- Two 100 kW direct drive turbines ... manufactured in Barre, VT by *Northern Power Systems*
- Estimated to provide 50% of facility's electric power

2011GovEnergy_Jackman RP - Microsoft PowerPoint

100331 NW100B Power Curve.pdf - Adobe Reader

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Annual Energy Calculation

User input in RED

alteris RENEWABLES

Turbine Model:	NW100	
Diameter:	21 Meters	
Site:	Jackman, ME	
Number of Turbines:	1	
Density:	1.225	kg/m^3
MET Tower Data:	6.13	mps
MET Tower Height:	37	m
Wind Shear (Roughness):	0.25	---
Wind Tower Hub Height:	37	m
Wind Speed at Hub Height:	6.1	mps
Form Factor, k	2.00	---
Scale Factor, A	6.92	---
Availability:	94%	
Net Losses:	6%	
Time-on-Line	8197	Hours/Yr
Energy	**204,590**	kWHrs/Yr/Turbine

Environmental Attributes

*1 MWH equals 909 lbs (Northern NE)

**Ave household consumption in New England equals 7142kWh / year

*Lbs. of CO2	REC Value / mWh	REC Value / mWh, 5 year contract
185,973	$ 40.00	$ 30.00

Total REC Value	$ 8,184
5 year contract	$ 30,689
**# of households	29
Capacity Factor	23%
Energy	204,590 kWh Total

Wind Speed Distribution

Vhub mps	Hours/Yr
1	357.0
2	670.8
3	906.7
4	1044.9
5	1082.8

Power Curve

Vhub mps	Power kWe
1	-0.5
2	-0.6
3	-0.7
4	3.7
5	10.5

Energy Production

Vhub mps	Run Time Hours/Yr	Energy kWhrs/Yr
1	335.6	-158
2	630.5	-356
3	852.3	-561
4	982.2	3396
5	1017.9	9999

Click to add notes

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Start 2:54 PM Friday

2011GovEnergy_Jackman RP - Microsoft PowerPoint

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Wind Shear (Roughness):	0.25	---			
Wind Tower Hub Height:	37	m	Total REC Value	$	8,184
Wind Speed at Hub Height:	6.1	mps			
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Wind Speed Distribution

Vhub mps	Hours/Yr
1	357.0
2	670.8
3	906.7
4	1044.9
5	1082.8
6	1033.3
7	919.6
8	769.0
9	607.1
10	454.1
11	322.6
12	217.9
13	140.3
14	86.1
15	50.4
16	28.2
17	15.1
18	7.7
19	3.8
20	1.8
21	0.8
22	0.3
23	0.1
24	0.1
25	0.0

Power Curve

Vhub mps	Power kWe
1	-0.5
2	-0.6
3	-0.7
4	3.7
5	10.5
6	19.0
7	29.4
8	41.0
9	54.3
10	66.8
11	77.7
12	86.4
13	92.8
14	97.3
15	100.0
16	100.8
17	100.6
18	99.8
19	99.4
20	98.6
21	97.8
22	97.3
23	97.3
24	98.0
25	99.7

Energy Production

Vhub mps	Run Time Hours/Yr	Energy kWhrs/Yr
1	335.6	-158
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3	852.3	-561
4	982.2	3396
5	1017.9	9999
6	971.3	17360
7	864.4	23888
8	722.8	27841
9	570.7	29142
10	426.9	26788
11	303.2	22145
12	204.9	16630
13	131.9	11500
14	80.9	7398
15	47.4	4452
16	26.5	2511
17	14.2	1339
18	7.2	679
19	3.5	330
20	1.7	153
21	0.7	68
22	0.3	29
23	0.1	12
24	0.1	5
25	0.0	2

NW100 Power Curve

120

1200 35,000

Click to add notes

Grid Inter-connection is Single Largest Issue

- HQ Electric Company is a French Canadian privately held company
- Language barriers
- Business perspective barriers
- Assumptions are too easily made

HQ Electric not interested in USA / GSA Goals for Renewable Power

- The “parties” have not been able to communicate well.
- HQ has “net metering” guidelines for generator’s at 60 kW and under ... and 1 Mega-Watt and over
- Not for 200 kW

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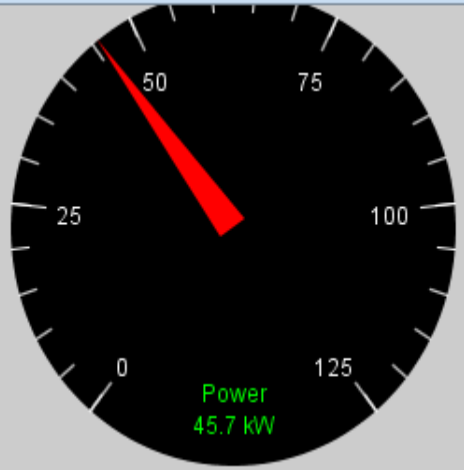
Page Safety Tools

WTG1 Overview | WTG2 Overview | Trends



Rotor Speed	58.6	RPM	1 min. Wind Speed	9.0	m/s	Total Energy Produced	33409	kWh	Yaw Position	301.9
			10 min. Wind Speed	9.0	m/s	Time Available	1700	Hr	Yaw Turns	-0.2

Wind Turbine Controls

Run | Stop | Service

Enabled

Dispatch Enabled

Base Switch Run

Nacelle Switch Run

Yaw OK

Wind Turbine Status

Turbine State	Running
Inverter State	Active
Warnings	No Warnings
Faults	No Faults

Fault Reset

Operating Conditions

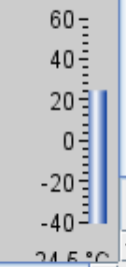
Wind Speed OK

Temperature OK

External Conditions OK

Grid OK

Ambient Ter



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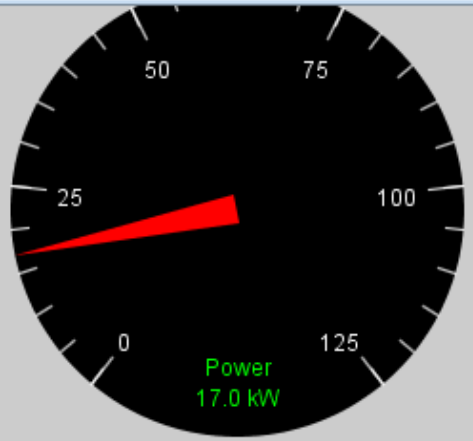

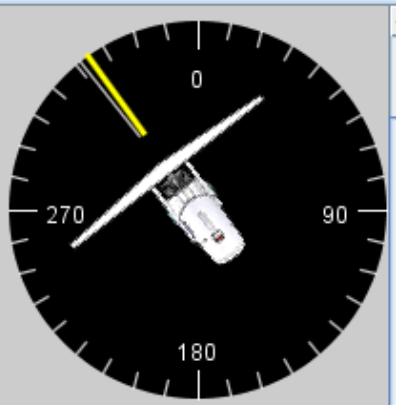

Rotor Speed	58.4	RPM	1 min. Wind Speed	8.3	m/s	Total Energy Produced	37286	kWh	Yaw Position	321.8
			10 min. Wind Speed	8.8	m/s	Time Available	1989	Hr	Yaw Turns	-0.1

Wind Turbine Controls

Run | Stop | Service

Enabled

Dispatch Enabled

Base Switch Run

Nacelle Switch Run

Yaw OK

Wind Turbine Status

Turbine State	Running
Inverter State	Active
Warnings	No Warnings
Faults	No Faults

Fault Reset

Operating Conditions

Wind Speed OK

Temperature OK

External Conditions OK

Grid OK

WTG2_R_AnyExtCond != 0: value '0', quality = good

Ambient Ter

60
40
20
0
-40
24.7 °C

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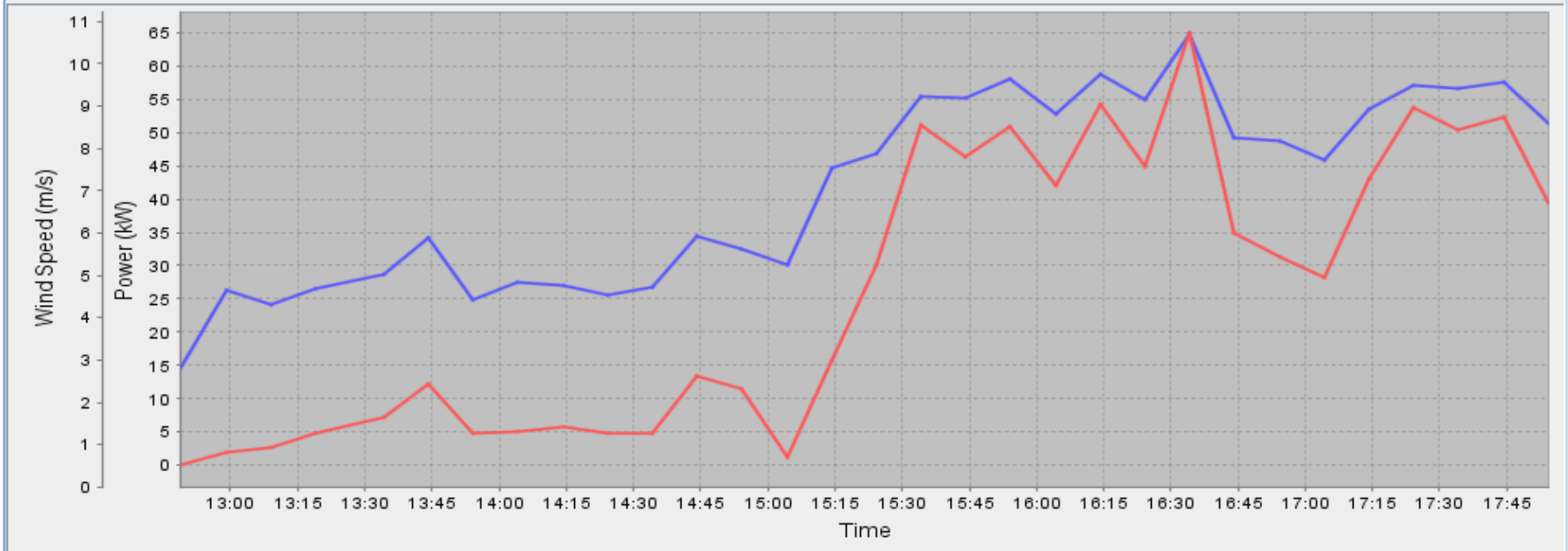

Series Name	Axis	Cursor (0)	Minimum	Maximum	Average
WTG1_R_InvPwr_kW	Power (kW)	0	-0.022	64.945	26.258
WTG1_R_WindSpeed_mps	Wind Speed (m/s)	0	2.812	10.696	7.079

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WTG1 Overview | WTG2 Overview | Trends

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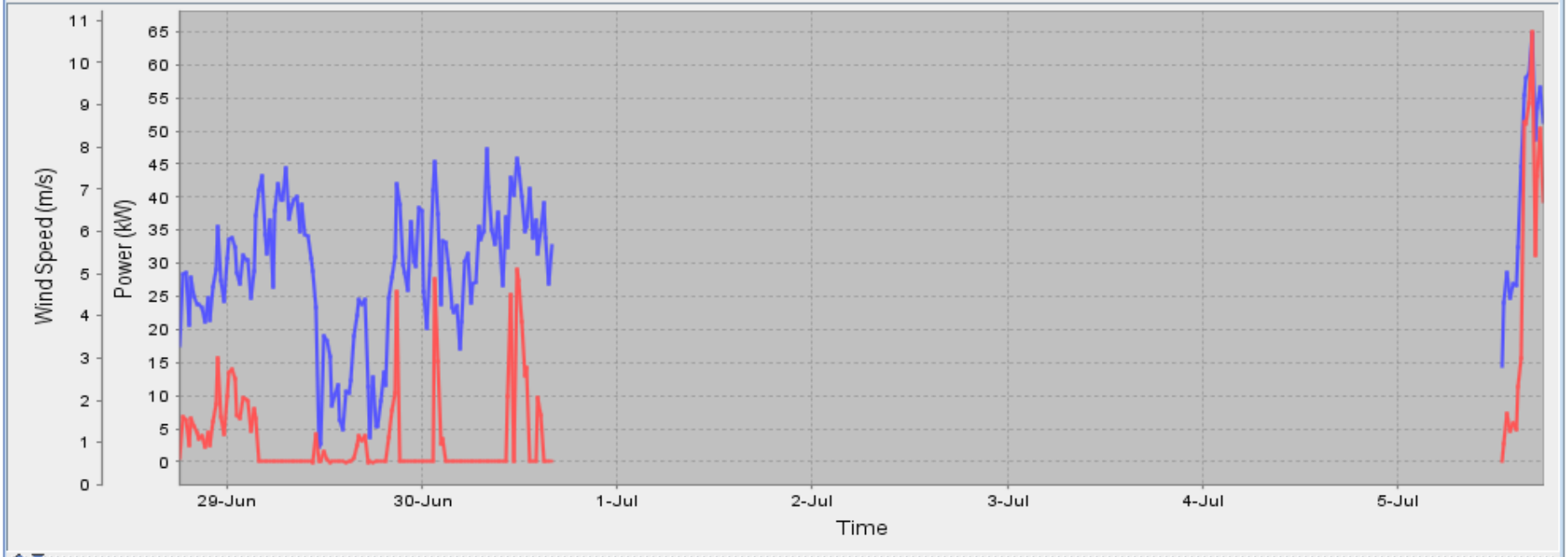

Series Name	Axis	Cursor (0)	Minimum	Maximum	Average
WTG1_R_InvPwr_kW	Power (kW)	0	-0.2	64.945	5.913
WTG1_R_WindSpeed_mps	Wind Speed (m/s)	0	0.881	10.696	5.217

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WTG1 Overview | WTG2 Overview | Trends

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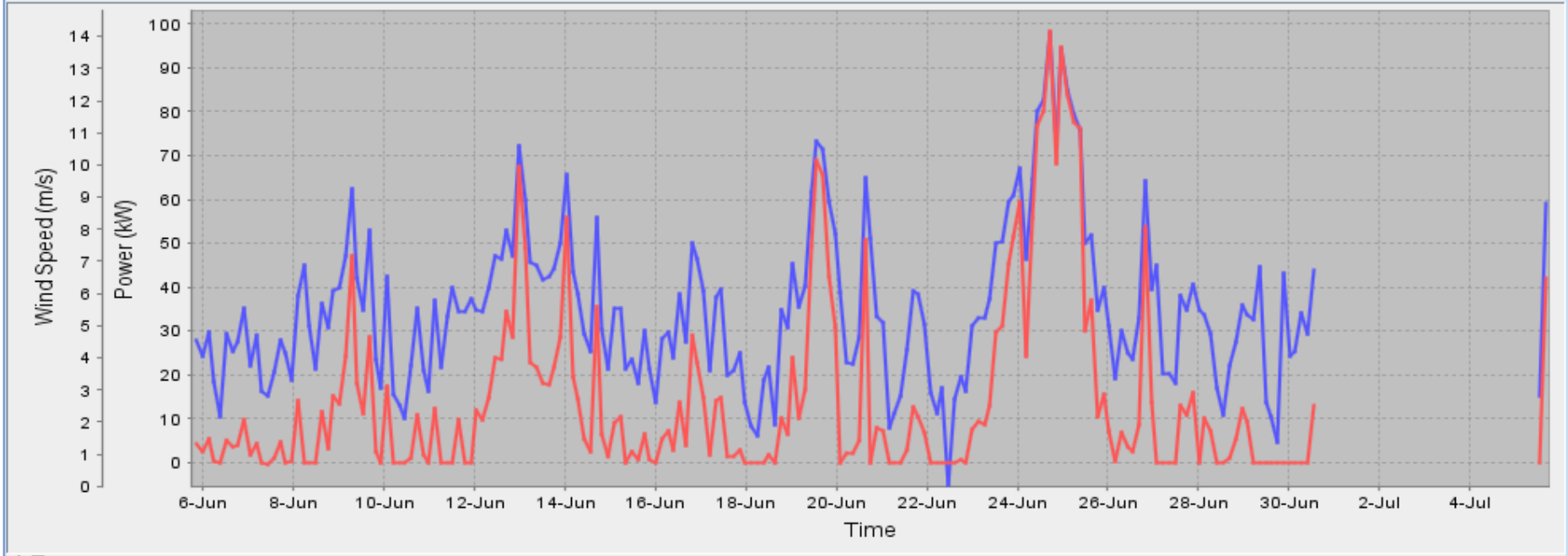

Series Name	Axis	Cursor (0)	Minimum	Maximum	Average
WTG1_R_InvPwr_kW	Power (kW)	0	-0.522	98.274	14.429
WTG1_R_WindSpeed_mps	Wind Speed (m/s)	0	0.012	14.118	5.521

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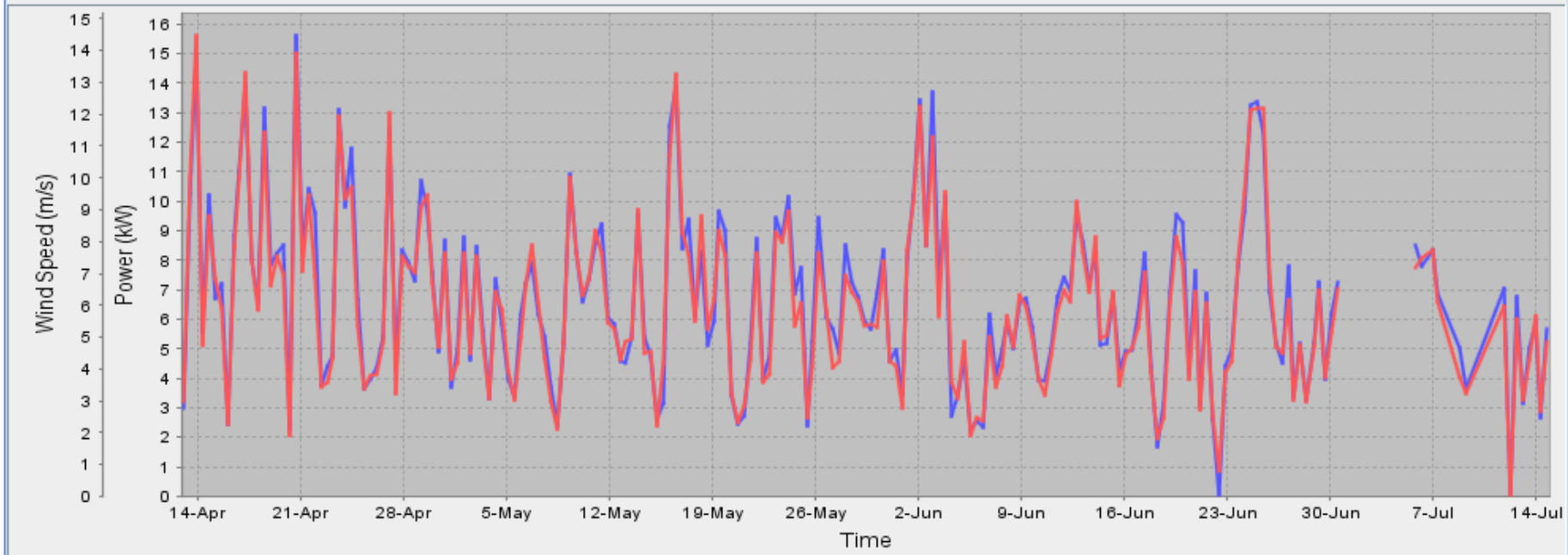

Series Name	Axis	Cursor (0)	Minimum	Maximum	Average
WTG2_R_WindSpeed_mps	Power (kW)	0	0.001	15.619	6.444
WTG1_R_WindSpeed_mps	Wind Speed (m/s)	0	0.001	14.476	6.148

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WTG1 Overview | WTG2 Overview | Trends

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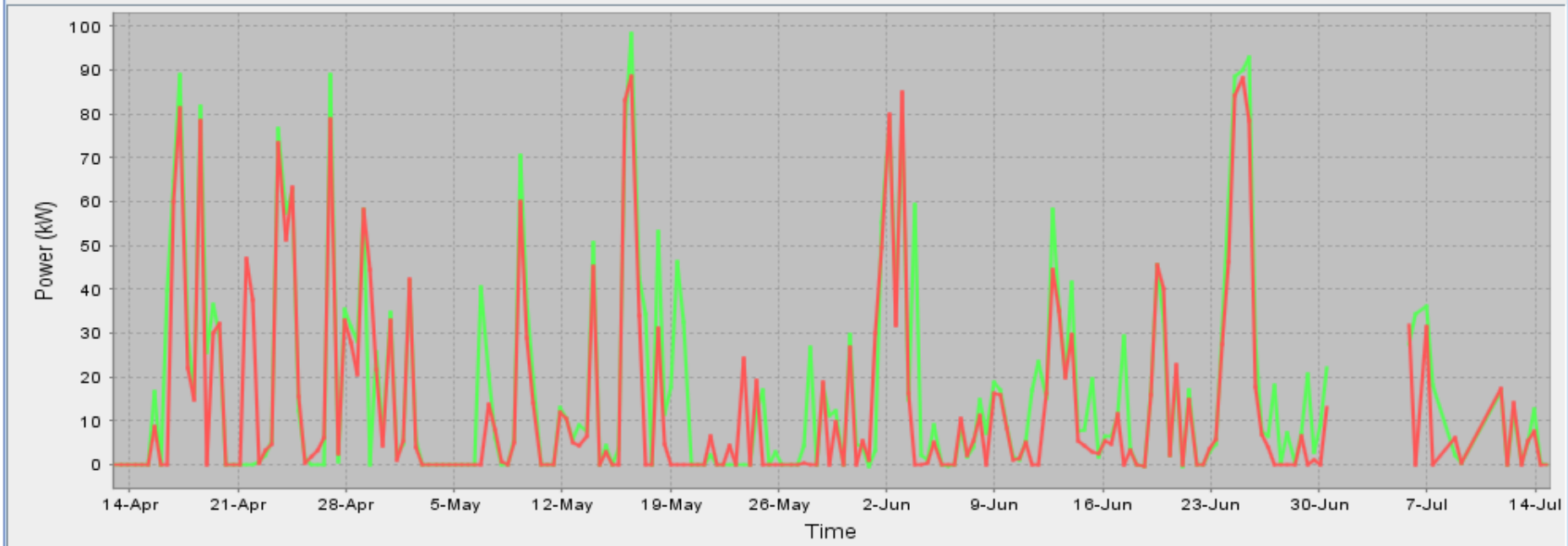

Series Name	Axis	Cursor (0)	Minimum	Maximum	Average
WTG1_R_InvPwr_kW	Power (kW)	0	-0.37	88.566	13.942
WTG2_R_InvPwr_kW	Power (kW)	0	-0.401	98.304	17.074

SmartView HMI 3.2.0 Data OK

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Success, with Lessons Learned ...

- How does the Team work with a foreign country ?
  (can a team member speak the language?)

- Technology innovation is a two edged sword.
  (*Kelly Aerospace* blade ice melt system)

- Have a plan to “live” with the project.
  (communications protocol for all parties)

THERMABLADE | Wind Turbine Ice Protection System - Windows Internet Explorer provided by General Services Administration
http://www.kellyaerospace.com/thermalsystems/wind_turbine_ice_protection.html
kelly aerospace
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THERMABLADE | Wind Turbine Ice Protection System
Page Safety Tools

THERMABLADE: WIND TURBINE ICE PROTECTION SYSTEM (WTIPS)

A practical solution to recover lost turbine□output caused by blade icing.

THERMABLADE deices the blade's leading edge through the application of electrical power to externally mounted □heater mats that safely shed small ice particles allowing for uninterrupted turbine operation during □hazardous icing conditions. **THERMABLADE** is an electro-thermal based deicing system using □technology originally developed in conjunction with NASA for Aviation and Aerospace applications.

Kelly Aerospace Thermal Systems has been manufacturing a similar deicing product, ThermaWing™, □for general aviation aircraft for over 7 years. The ThermaWing™ deicing system is a reliable advanced □design technology which is easy-to-install and maintain. Modified to fit the needs of large scale wind □turbines and rebranded as **THERMABLADE**, Kelly Aerospace Thermal Systems has successfully □applied this deicing technology to wind turbines. The result is increased renewable energy efficiency, □lower overall operating cost and a better return on investment for the farm owner.

Advantages.

- SHEDS ICE DURING OPERATION
- NO NEED TO SHUT DOWN DURING ICING CONDITIONS
- PROTECTS BLADES FROM LEADING EDGE EROSION
- SCALED TO MATCH AVAILABLE POWER
- SIMPLE EXTERNAL INSTALLATION ON BLADE
- EASY TO REPAIR/MAINTAIN
- AUTOMATIC SHEDDING CYCLES
- PLC CONTROLLED DEICING SYSTEM
- FLEXIBLE GRAPHITE FOIL
- LIMITS BLADE IMBALANCE DURING ICE ENCOUNTER
- REDUCES WIND TURBINE SYSTEM VIBRATION AND WEAR
- FACTORY OR FIELD INSTALLABLE

Operation.

Power is cycled around the wind turbine to multiple heater mat zones which maintain □symmetrical / balanced deicing characteristics. The total deicing cycle varies between one (1) □and ten (10) minutes depending on environmental conditions, the length of the wind turbine □blade and the power available to the deicing system.

The **THERMABLADE** system operates automatically based on ambient temperature. No operator □interface is required. Due to the short de-ice cycle intervals, our **THERMABLADE** system sheds □small ice particles rather than "large chunk" ice throws which can be hazardous to property and life.

If you have questions, Contact us anytime.
(440) 951-4744

Commercial wind turbines provide an increasing portion of electricity to both urban and sparsely populated remote areas, as well as regional electrical power grids.

Blades are not the only Wind Turbine component □susceptible to the effects of ice. In addition to reduced □output and reduced income, ice on the blades takes a□toll on big dollar items like the gear box, generator, □brakes, bearings, etc.

The flexible graphite system has a near ideal thermal capacitance, which means the thermal cycle from cold to hot is nearly instantaneous.

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Wind Project Feasibility and Economics

Kevin Shulte

GovEnergy
www.govenergy.gov

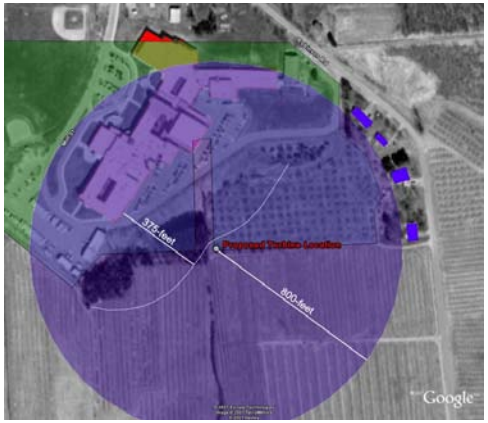
Wind Power Development Process

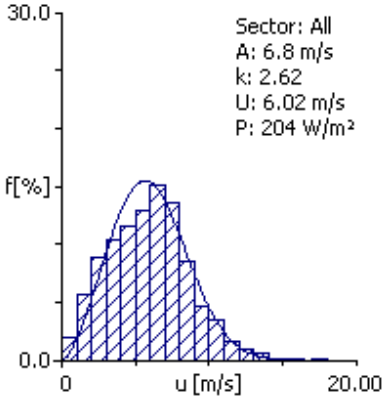
1. FUNDING AND GRANTS
2. Feasibility Study, Technical Assessment, 35% Design – NYSERDA PON 1197
   - Includes Tasks such as Wind Resource Assessment, Siting/Turbine Selection, Electricity Value, Electrical System Impact, Permitting Assessment, Permitting Toolbox, Buildability, Costs, Budgets, Schedules, Economics Analysis, Financing Options.
   - Critical to get answers – should get the where, what, when, how, how much, when does it pay for itself etc., answered.
3. Project Design
   - Tasks Include – Detailed Design, Interconnection, Procurement, Financing and Permitting
   - Project Is Ready for Construction
4. Construction
   - Build it, Interconnect it, Turn it on, Commission it, Break it in
5. Operations and Maintenance
   - Make sure it runs for 20 years.

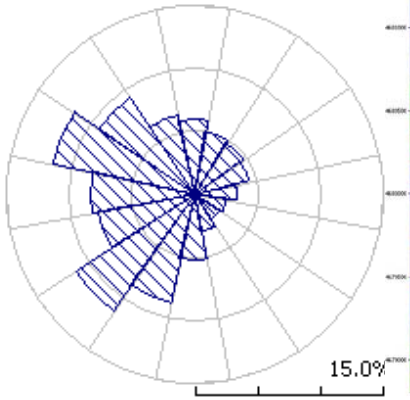
Output Modeling/Site Selection

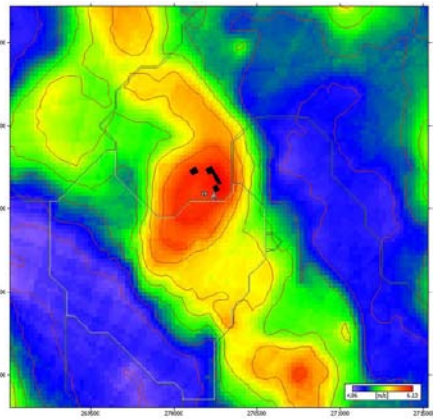
- Site Selection is underway
  - Tier 1 Sites – Appropriate Setbacks, buildable, no legal entanglements
  - Tier 2 Sites - Potential issue with distance to public ways and access points.
  - Tier 3 Sites – Desired by project officials. Development hurdles, which includes land ownership, sensitive habitat, difficulty to access and interconnect

- Modeling AEO
  - Completed wind resource assessment and commercial wind assessment software
    - WindPro, WAsP, Wind Farm, Wind Farmer



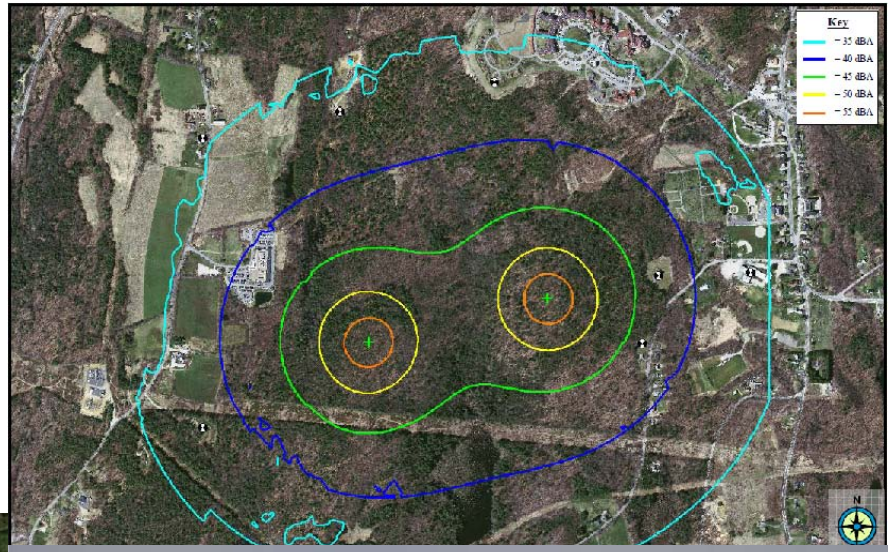


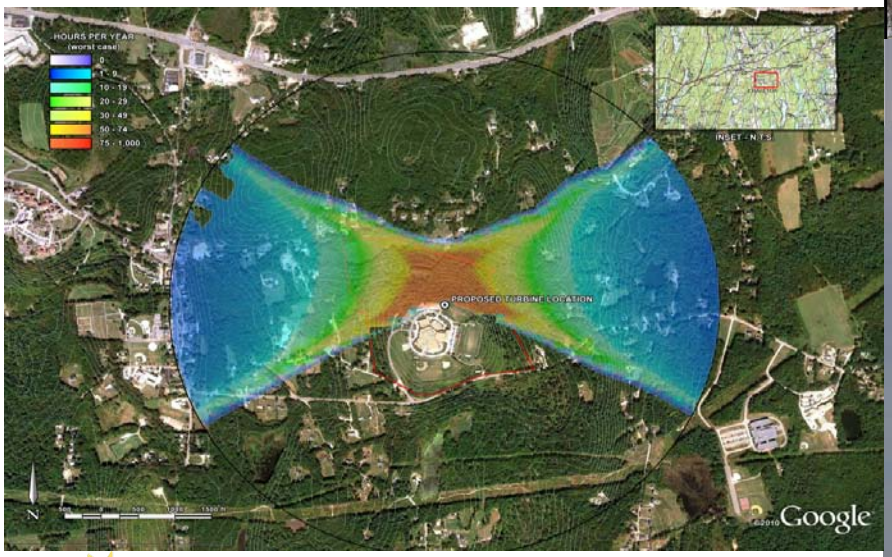




Environmental Studies

- Sound
- Shadow
- Avian and Wildlife
- Visual





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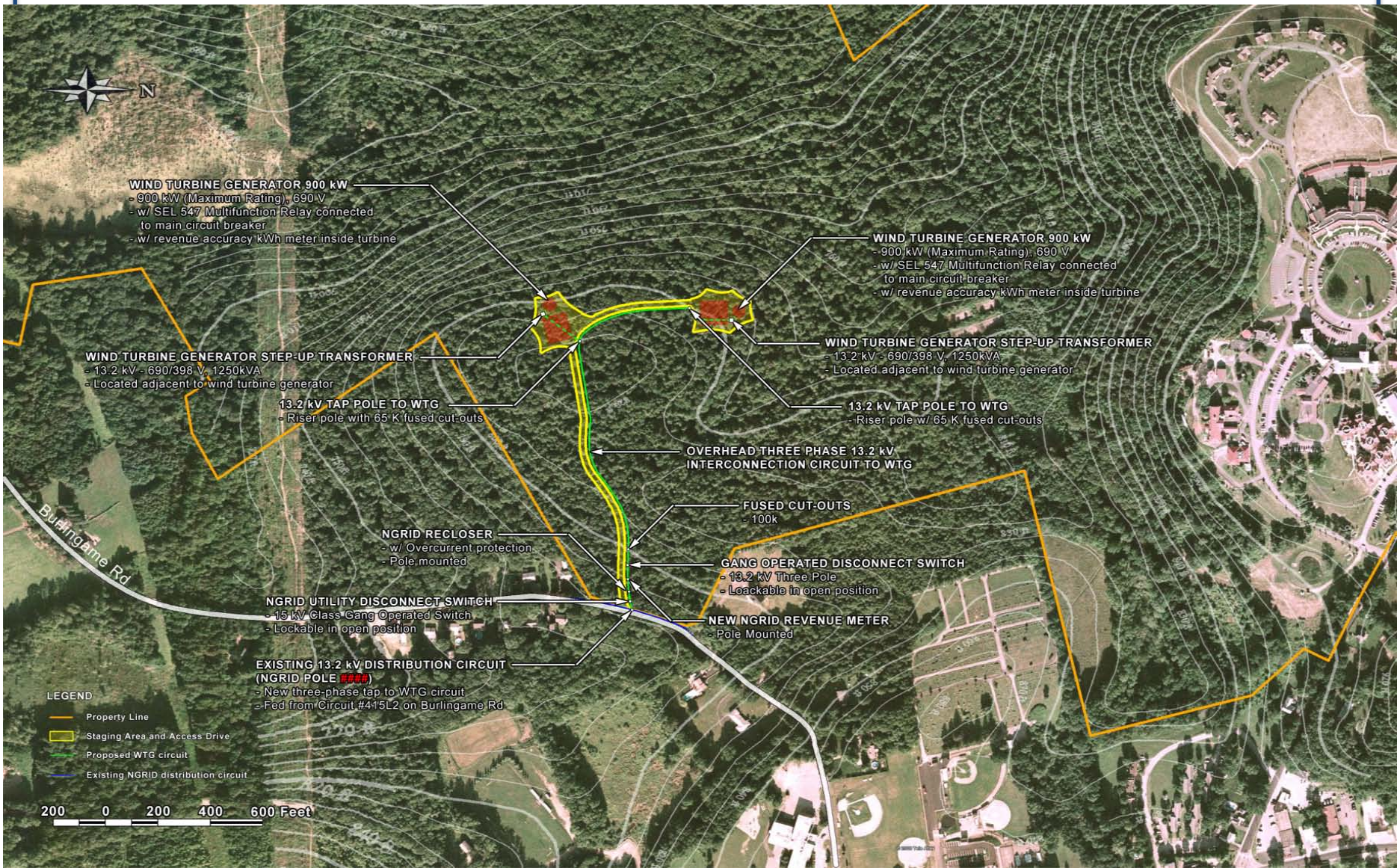
Permitting

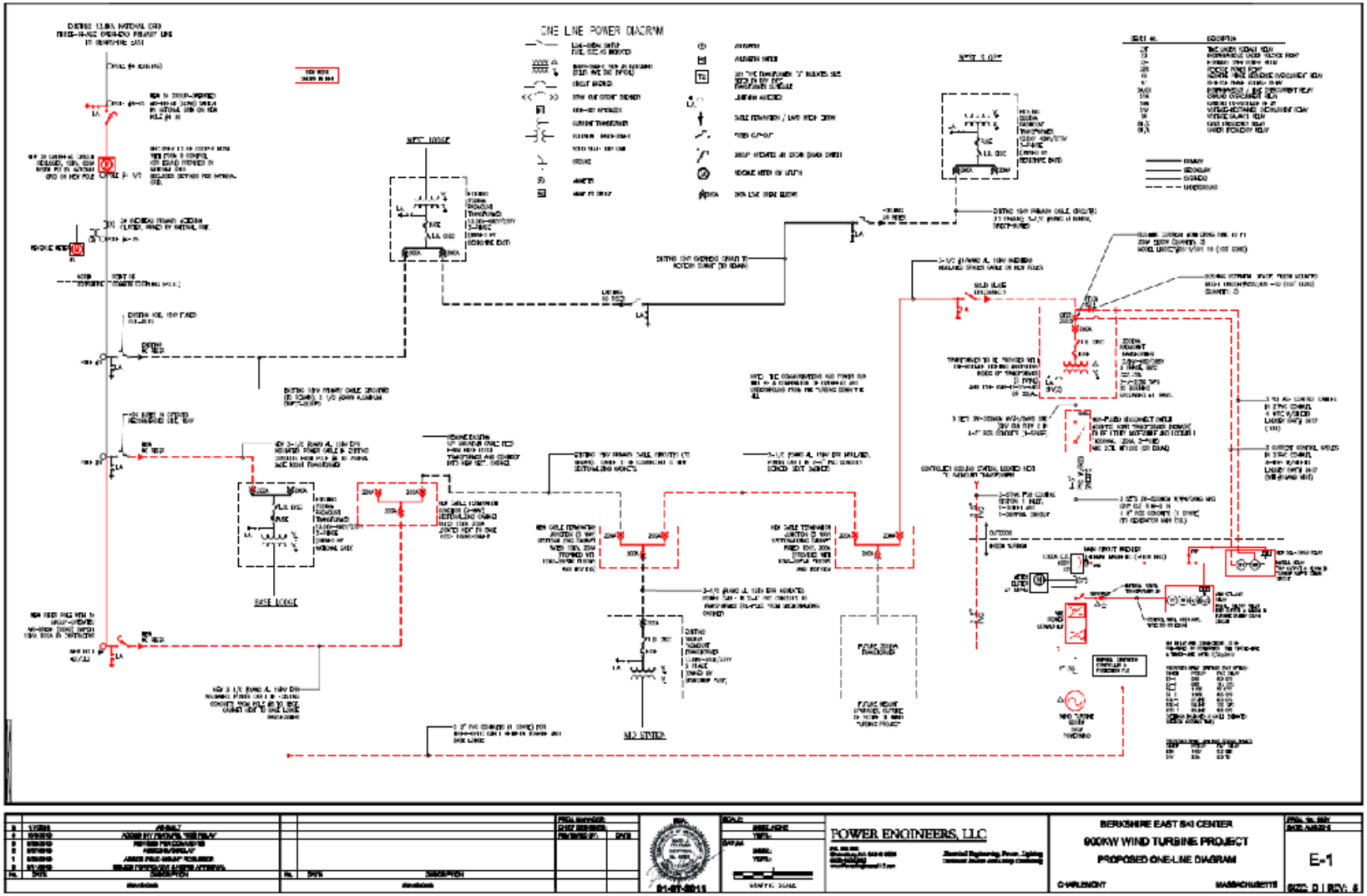
- Local
  - Local Zoning Variance and Special Permit
  - Building Permits
  - Storm water, Conservation Commissions, Historical etc
- State
  - Environmental – MEPA,SEQRA
  - Historical- SHPO, MHC
- Federal
  - FAA/FCC
  - NEPA, USFWS

Buildability

- Geotechnical Analysis
- Preliminary Foundation Design
- Staging Area Layout
- Transportation to and from the site



Electrical System Impact Study



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Wind Generated Electricity Value

To Grid

- Who Will Buy the Power
- Merchant v. PPA
- Renewable Energy Credits

On Site

- Analyze Electricity Bills
- Campus is averaging $0.? / kWh for x period of time
- Total Consumption approximately 4,500,000kWh per year
- Utility Tariff Analysis
- State Net Metering Law
- Analysis of production v. consumption

Project Economics

- Budget/Capital Costs/Timeline
  - Design Costs
  - Construction Costs
  - Maintenance Costs
  - Project Schedule
- Economic Analysis
  - Combining all of the sections above to understand payback period and rate of return
- Financing, Ownership and Operations.
  - Who owns it, how do they pay for it, how much value does it generate for me

Community Wind
On Site Projects - Development Challenges

- Wind Resource Assessment
  - Designing a more modestly priced WRA that meets needs of turbine vendors, financiers, owners and provides reasonably low uncertainty
- Permitting
  - Ensuring statewide, development rules or environmental procedures do not unnecessarily include CW
- Design
  - Replicating design in order to save cost
- Financing
  - Tax, Equity, Debt partners for investment size
- Interconnection
  - Dealing with non UL 1741 inverters.
  - Utilities are slow!
- Construction
  - Wind Power Fear – removing it from contractors
  - Establishing the right team
- Operation and Maintenance
  - Cost effectiveness?
  - Response Time?

Community Wind
To Grid Development Challenges

- Same issues apply as they do for on-site model
- Establishing a development entity – Who pays for Design, Development, Interconnection etc.
- Repaying development costs – how are the up front risk takers compensated through project life
- Maximizing local economic benefits – Independent of Ownership Model how are the profits distributed to the broader community
- Funding and Financing – government and institutional support can be more difficult to find for new business models

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Community Wind
To Grid Business Models

- **Public Ownership** – Ownership by a public entity such as a town, county, municipal electric utility or cooperative
- **Local Ownership** – Ownership by a group of local entities including, individuals, businesses, land owner groups etc.
- **Third Party Ownership** – Ownership by a third party developer with primary economic benefit retained locally
- **Flip Model** – Similar to third party ownership where the ultimate ownership of the project returns to a local group(public or otherwise) at some point during the life of the project

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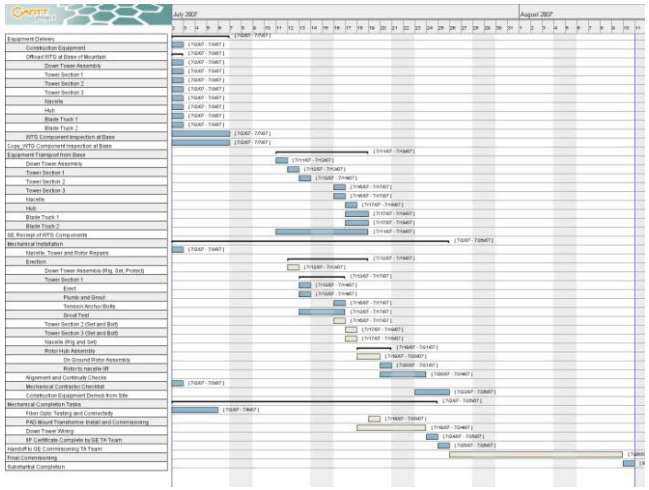
Project Construction

Transport and Logistics



Turbine Transportation
Offloading
Project Logistics and Scheduling

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Project Construction

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Operations And Maintenance

CRITICAL!!!!!!!!!!!!!!!!!!!!

- Who manages
- Who does it
- First responders
- Capital reserves

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University of Delaware - Lewes

- Project Technical Details:
- 2MW Gamesa G90 (First G90 in US)
- Interconnected June 2010
- Total Project Cost ~$6,250,000
- Annual Energy Production 5,500,000kWh/Yr
- Capacity Factor 31%

- Unique Aspects to the Project:
- Not for Profit Parent able to use both 1603 Grant and MACRS Depreciation
- Research and Development Joint Venture formed with Turbine Vendor
- Interconnection and Net Metering or Power Purchase Agreement made with Municipal Utility

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University of Delaware - Lewes

Commercial Structure

- University Starts Tax Blocker Corporation call Blue Hen Wind
    - Tax Blocker is a For Profit company wholly owned by a Not for Profit like a University. Allowed if profits go to the mission of the parent.
- First State Marine Wind is Joint Venture between Blue Hen Wind and Gamesa
    - Ownership at COD
        - 51%Gamesa
        - 49% Blue Hen Wind
    - Ownership After Grants and Incentives are Received
        - 70% Blue Hen Wind
        - 30% Gamesa
    - Ownership After MACRS Has expired
        - 97.5% Blue Hen Wind
        - 2.5% Gamesa

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County Line Wind

Project Technical Details:

- 900kW Powerwind PW 56
- Scheduled for Completion June 2011
- Total Project Cost ~$2,650,000
- Annual Energy Production 2,100,000kWh/Yr
- Capacity Factor 26.6%
- Location Current Price for Green electricity - $0.16

Unique Aspects to the Project:

- Third Party Ownership – Nex Gen
- Long Term Power Purchase Agreement to Local Industrial Park
  - 10 Years at $0.149/kWh fixed
- Power is shared to all businesses in Industrial Park.
- Park is owned by IDA can negotiate purchase of wind turbine after 10 year PPA

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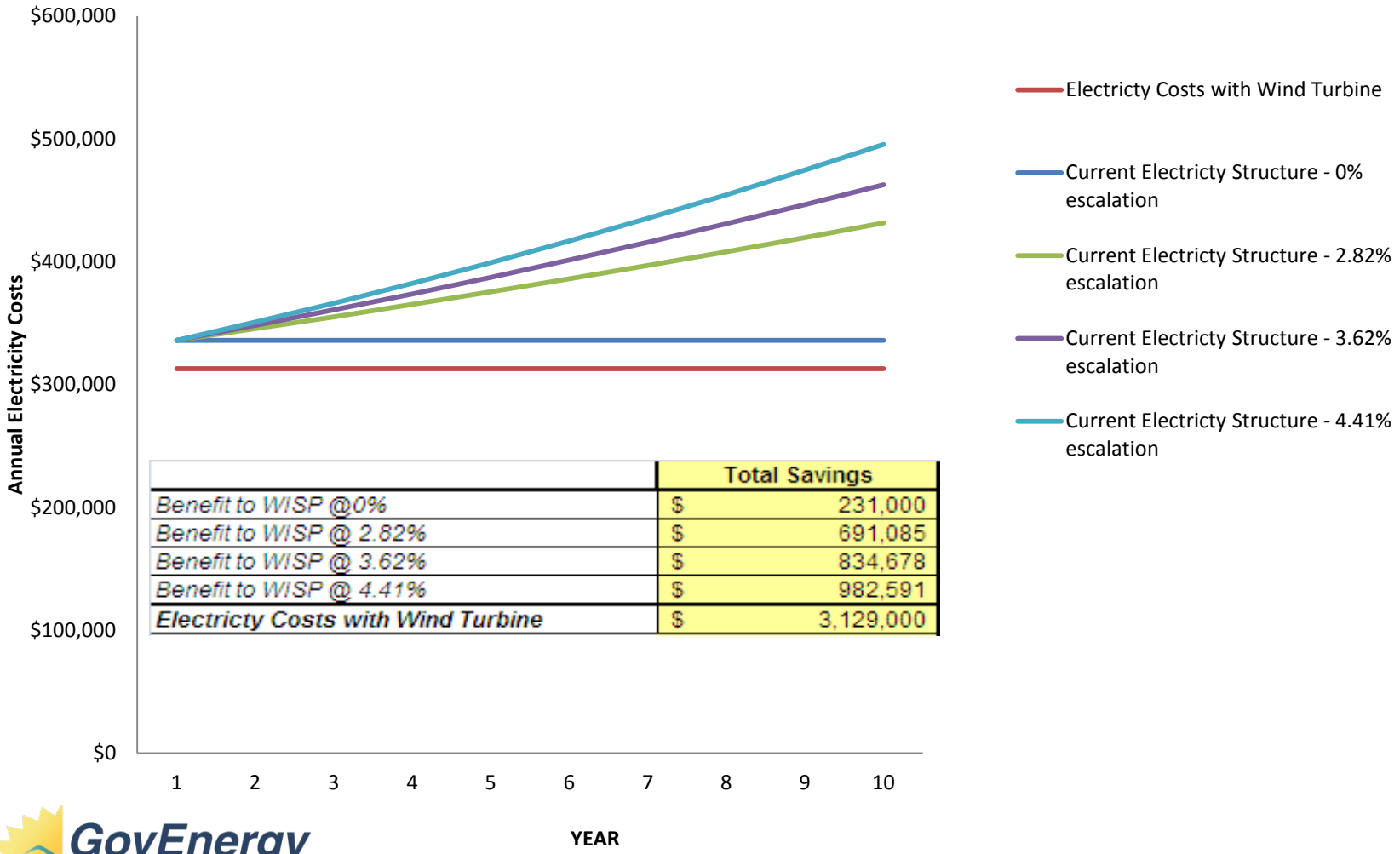
County Line Wind

Wind Turbine v. Current Electricty Costs



	Total Savings
Benefit to WISP @0%	$ 231,000
Benefit to WISP @ 2.82%	$ 691,085
Benefit to WISP @ 3.62%	$ 834,678
Benefit to WISP @ 4.41%	$ 982,591
Electricty Costs with Wind Turbine	$ 3,129,000

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Opportunities for Wind Energy in the Federal Sector

Robi Robichaud

GovEnergy
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Federal Wind

- Why do Federal Wind?
  - Background & Wind Industry
- What makes Federal Wind so Good to Do?
  - Background & State of Federal Wind - Progress to date
- What makes Federal Wind so Hard to Do?
  - Issues with Wind Projects, Lessons Learned & Challenges Ahead
- How to succeed in implementing Federal Wind
  - Form a Team
  - Hire 3rd Party Assistance
  - Be Willing to Listen & Compromise

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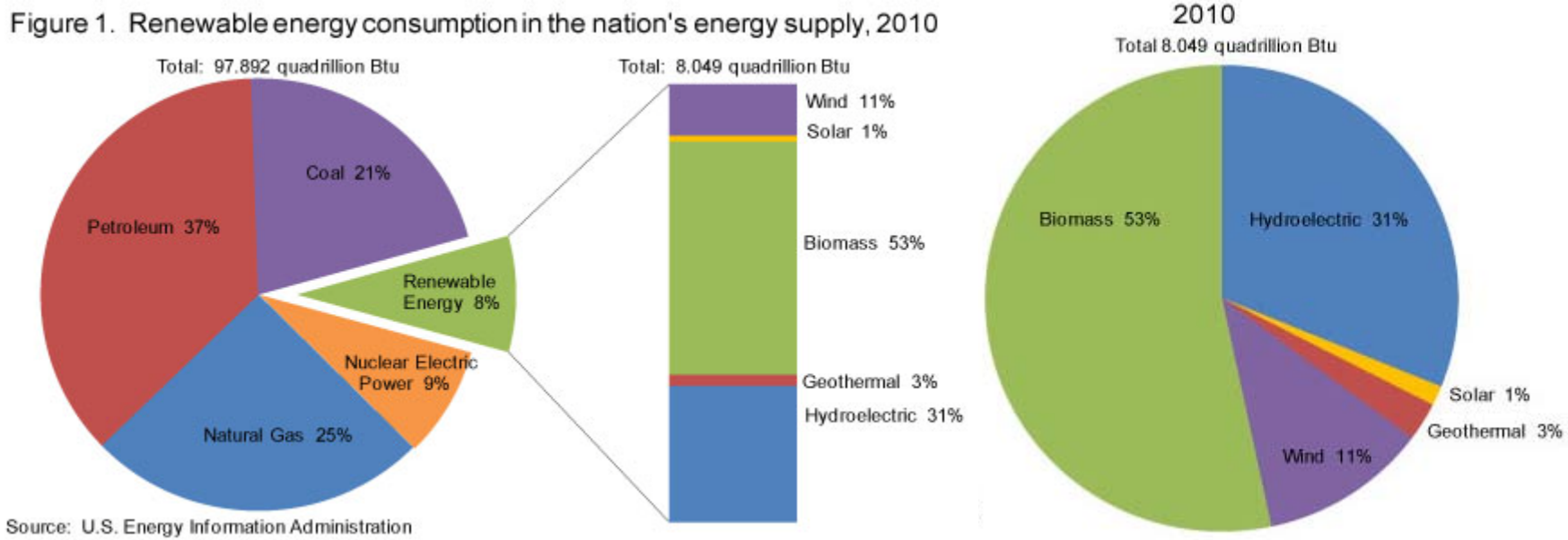
Why DO Federal Wind?

Rest of the Country and the World Is Doing Wind

U.S. Energy Use – 2010

U.S. Energy Use



Wind = 11% of Renewable Energy

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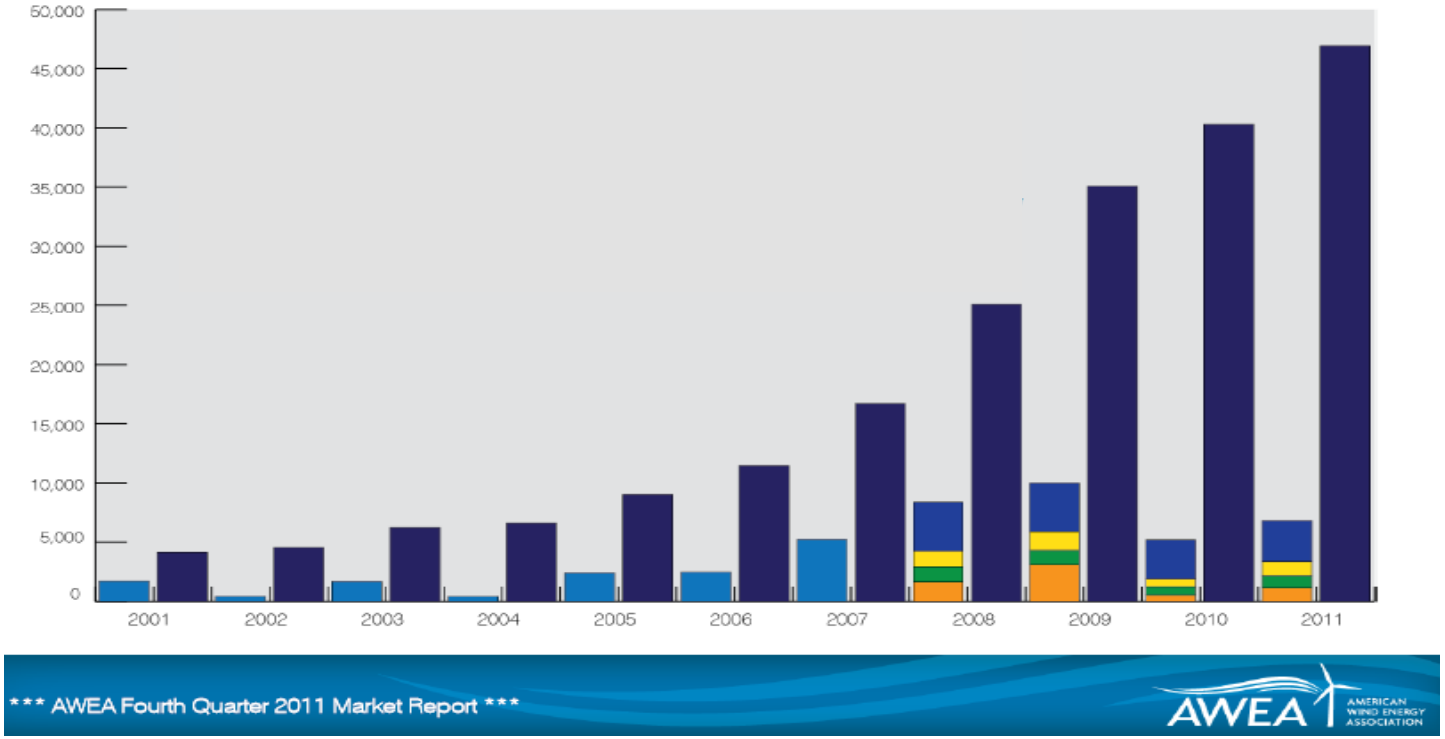
Source: http://www.eia.gov/renewable/annual/preliminary/

U.S. Annual and Cumulative Wind Power Capacity



- There have been 6,810 MW of wind projects installed in the U.S. in 2011, up 31% from 2010. Throughout 2011, over 45 projects have been brought online in 25 different states.
- The total U.S. installed wind capacity grew 17% and now stands at 46,919 MW.

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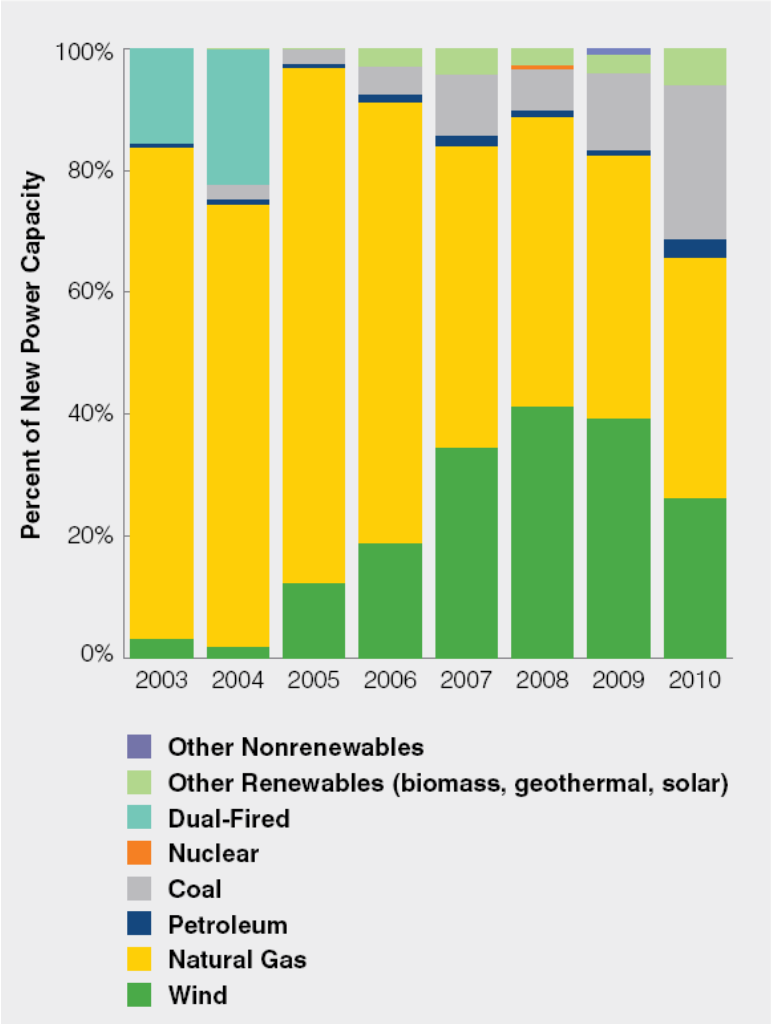
Annual US Electricity Generating Capacity Additions



Source: AWEA, Energy Information Administration, SNL, Solar Energy Industries Association

- New wind capacity represented 26% of all new capacity installed in 2010.
- Wind remained the second largest source of new installed capacity, second to natural gas at 40%.
- All renewable capacity combined represented nearly 33%.
- Over the past 4 years combined, wind represented 35% of all new generating capacity installed.

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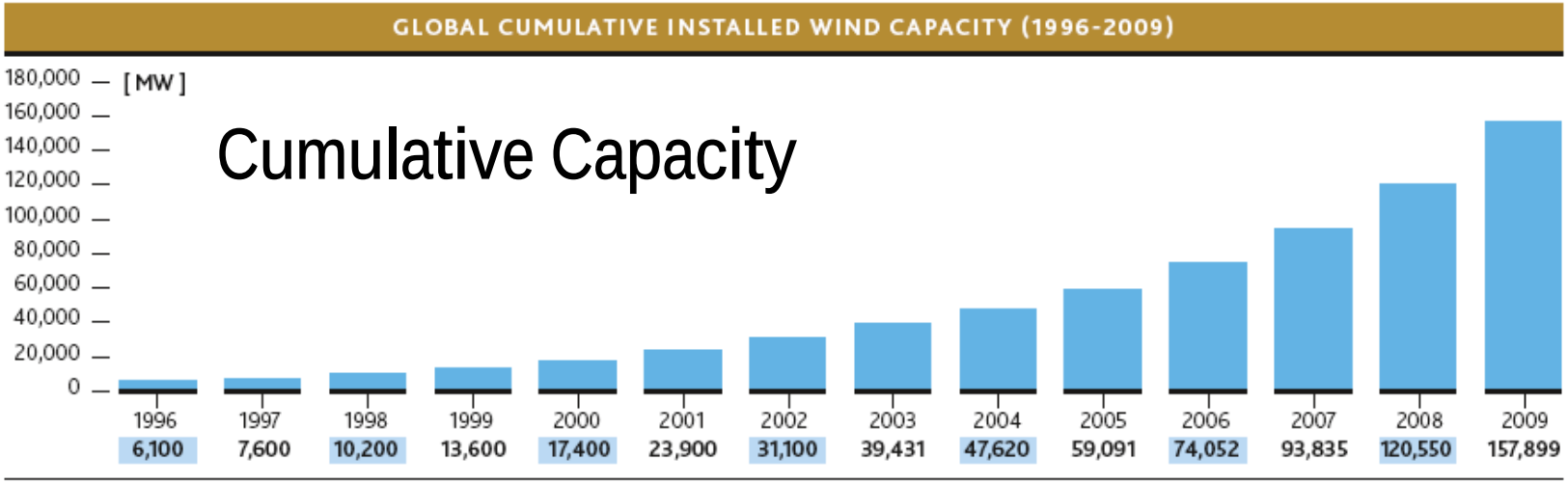
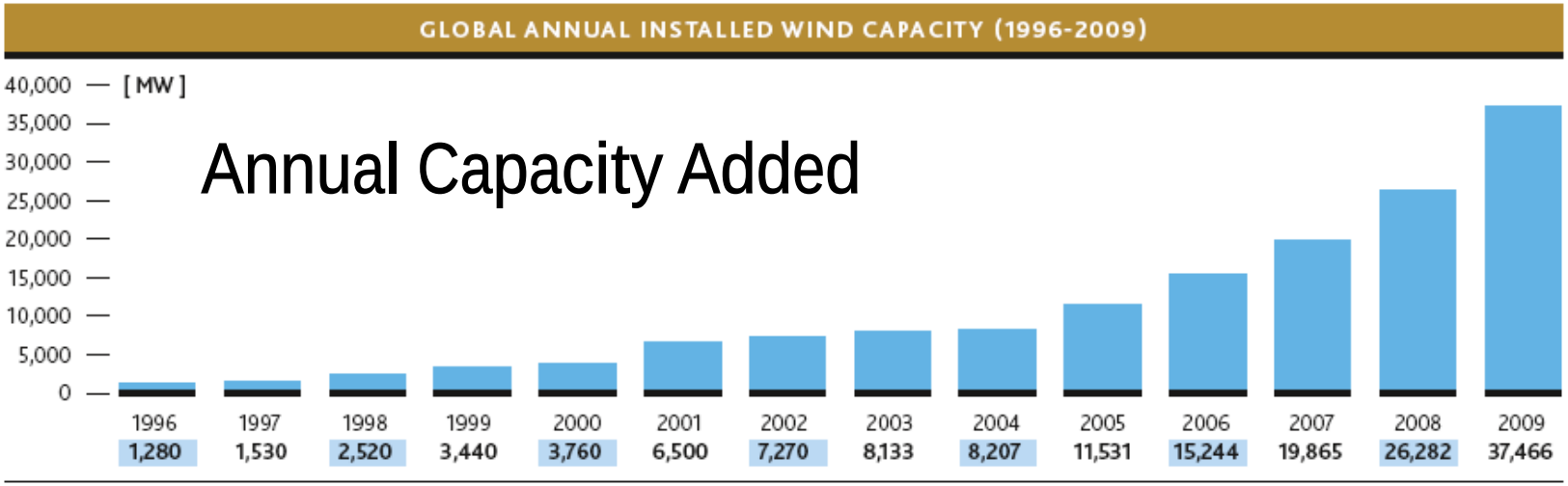
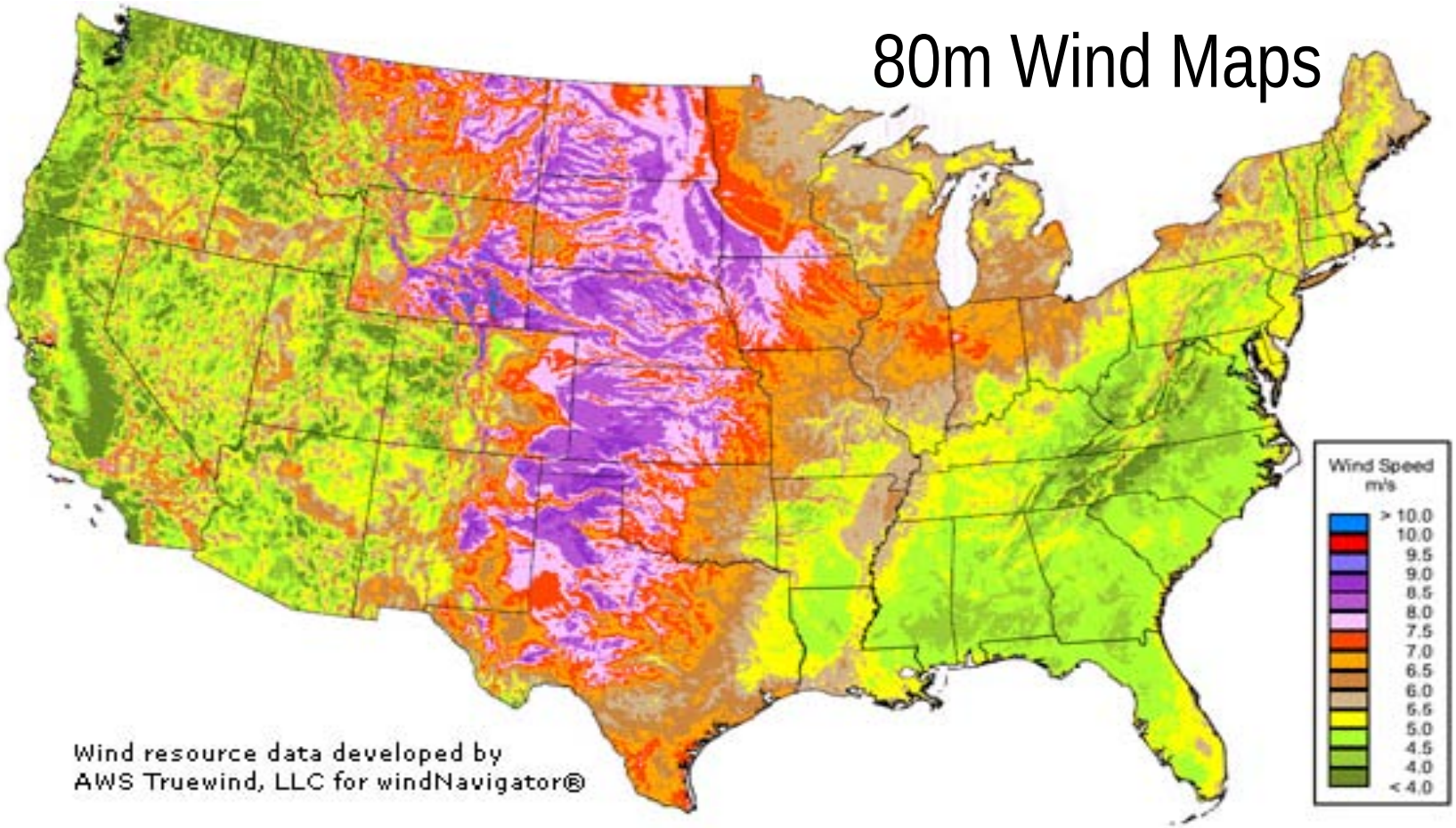
Worldwide Wind Trends





Why Federal Wind is So Good to Do?

We have a GREAT Wind Resource



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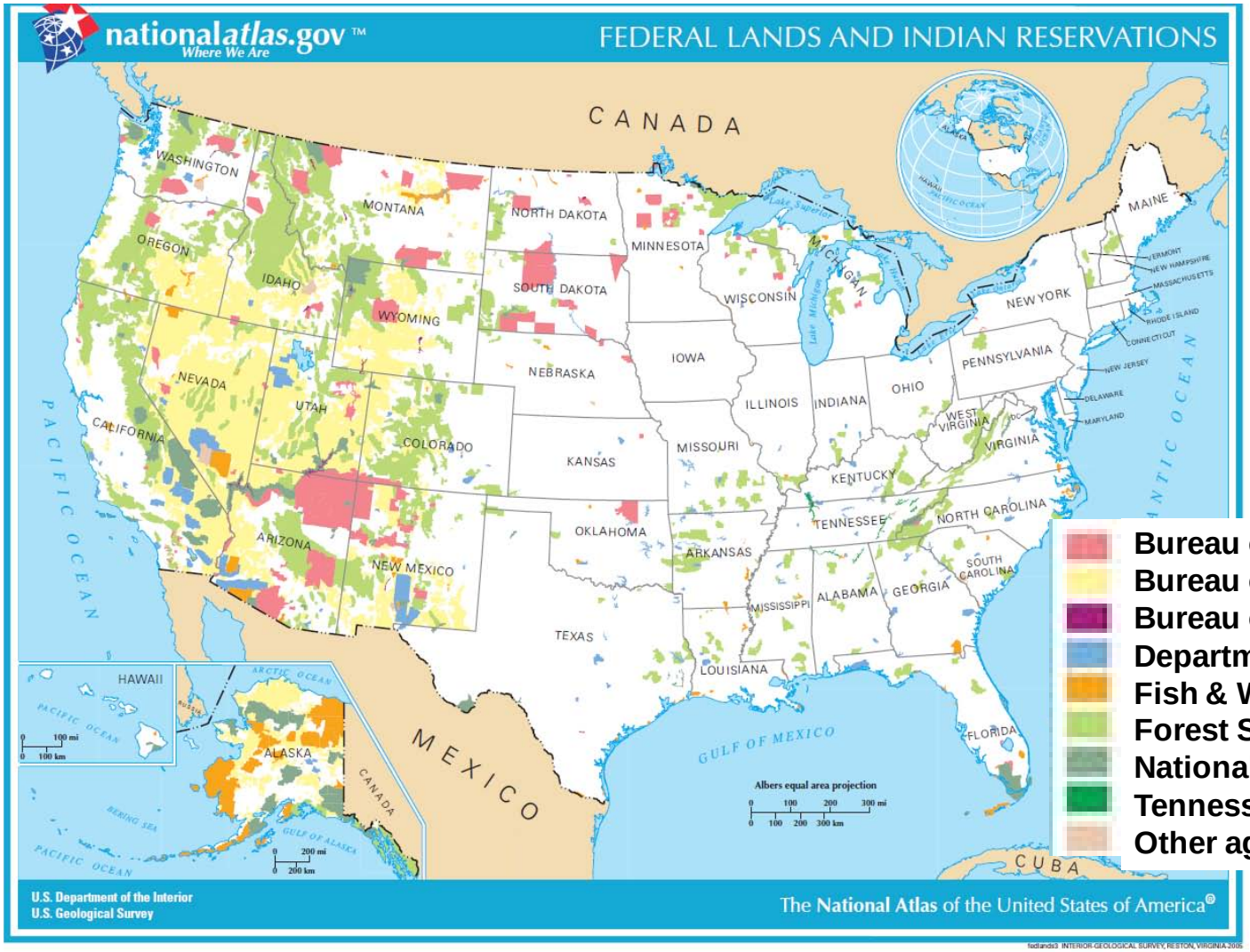
National Renewable Energy Laboratory
Innovation for Our Energy Future

We have a LOT of Federal Lands - ~30% of U.S.



NOT VISIBLE on Map:

- Many DOD Bases
- Border Stations
- EPA Sites

Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
Department of Defense
Fish & Wildlife Service
Forest Service
National Park Service
Tennessee Valley Authority
Other agencies

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We Have a Lot of Load

U.S. Government is the Largest Single Energy Consumer in the World –

- ~1 Quad Btu

Federal Wind … “State of the Wind”

- The Federal Rules for Feds
- Federal Wind Installed
- Federal Wind Issues
- Benefits of Wind

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Legislative Impetus for Federal Wind – "The Rules"

Federal Policy & Agency Drivers:

EPAct 2005

Federal electricity consumption from RE sources must reach

- 3%: FY 2007- FY 2009
- 5%: FY 2010 - FY 2012
- 7.5%: 2013 and thereafter.

Executive Order 13423

Renewable energy requirements – at least 50% from *new* RE, on-site if possible.

Federal Agency Goal Drivers

- DOE: 185 GWh/year of RE
- DOD: 25% of electricity from RE by 2025
- USCG: 15% energy from RE by 2015.

20% Wind by 2030

Wind industry target for the Federal sector:

~ 4,000 - 5,000 GWh/year of wind generation.

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Federal Wind Capacity

	Agency	Federal Wind Sites	# of Turb.	Hub Height	Rated Power	Wind Plant	Install Yr	Installed Cost	Est. Annual Energy
			[#]	[m]	[kW]	[kW]	[Year]	[$]	[kWh/yr]
1	DOE /	NWTC, Golden CO	2	60	600	1,200	1995		1,051,200
2	Air Force	Air Force Ascension Island,	4	30	225	900	1996		2,995,920
3	Navy	San Clemente Island, CA	2	30	225	450	1998	$195,700	985,500
4	Navy	San Clemente Island, CA	1	30	225	225	1999		
5	Army Nat.	Camp Williams, Riverton, UT	1	30	225	225	2000	$289,000	227,000
6	BLM	Rawlins FO, Cheyenne WY	1		20	20	2002		43,800
7	Air Force	Air Force Ascension Island,	2	30	900	1,800	2004		5,992,080
8	Navy	Guantanamo Bay, Cuba	4	60	950	3,800	2005	$12,000,000	8,322,000
9	BoP	Victorville Prison,Victorville CA	1		750	750	2005		1,314,000
10	Air Force	Warren Air Force Base WY	2	50	660	1,320	2005	$2,500,000	4,000,000
11	Army Nat.	Camp Williams, Riverton, UT	1	50	660	660	2005	$800,000	770,000
12	Marines	Marine Corps, Barstow, CA	1	70	1500	1,500	2008	$6,000,000	3,285,000
13	Air Force	AFCEE, Cape Cod MA	1	80	1500	1,500	2009	$5,320,000	3,800,000
14	Air Force	Warren Air Force Base WY	1	70	2000	2,000	2009	$6,000,000	6,000,000
15	DOE /	NWTC, Golden CO	1	80	1500	1,500	2009		1,314,000
16	DOE /	NWTC, Golden CO	1	80	2300	2,300	2009		2,014,800
17	DOE /	NWTC, Golden CO	1	80	3000	3,000	2010		2,628,000
18	BLM	Rawlins FO, Cheyenne WY	1	37	100	100	2010		219,000
19	Army	Fort Huachuca, AZ	1	70	1000	1,000	2011	$2,800,000	1,752,000
20	Air Force	AFCEE, Cape Cod MA	2	80	1500	3,000	2011	$9,620,000	6,754,000
		Total	**31**			**27,250**			**53,468,300**

Turbines	kW Installed	Est. kWh per Year

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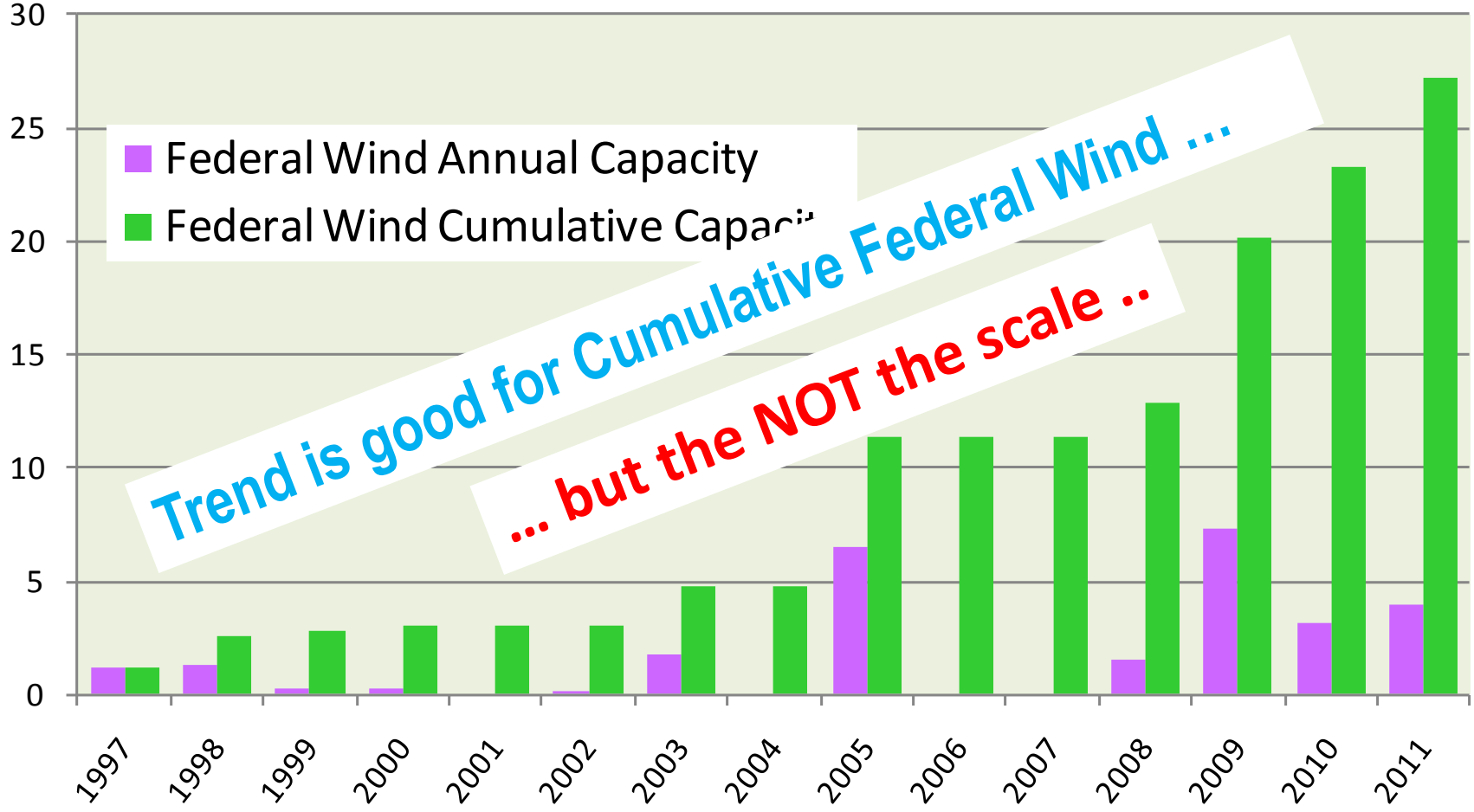
Federal Annual Wind Capacity & Cumulative Wind Capacity



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US Government Electricity

- Federal Electric Load: 55,800 GWh/yr
- Federal Wind Energy: 53 GWh/yr
- Federal Wind: 0.096% of Federal Electric Load

U.S. Wind: 2.3% of U.S. Electric Load

The Reality:
The US Wind Industry contribution to US electricity is 25 times greater that Federal Wind contribution to Federal electricity

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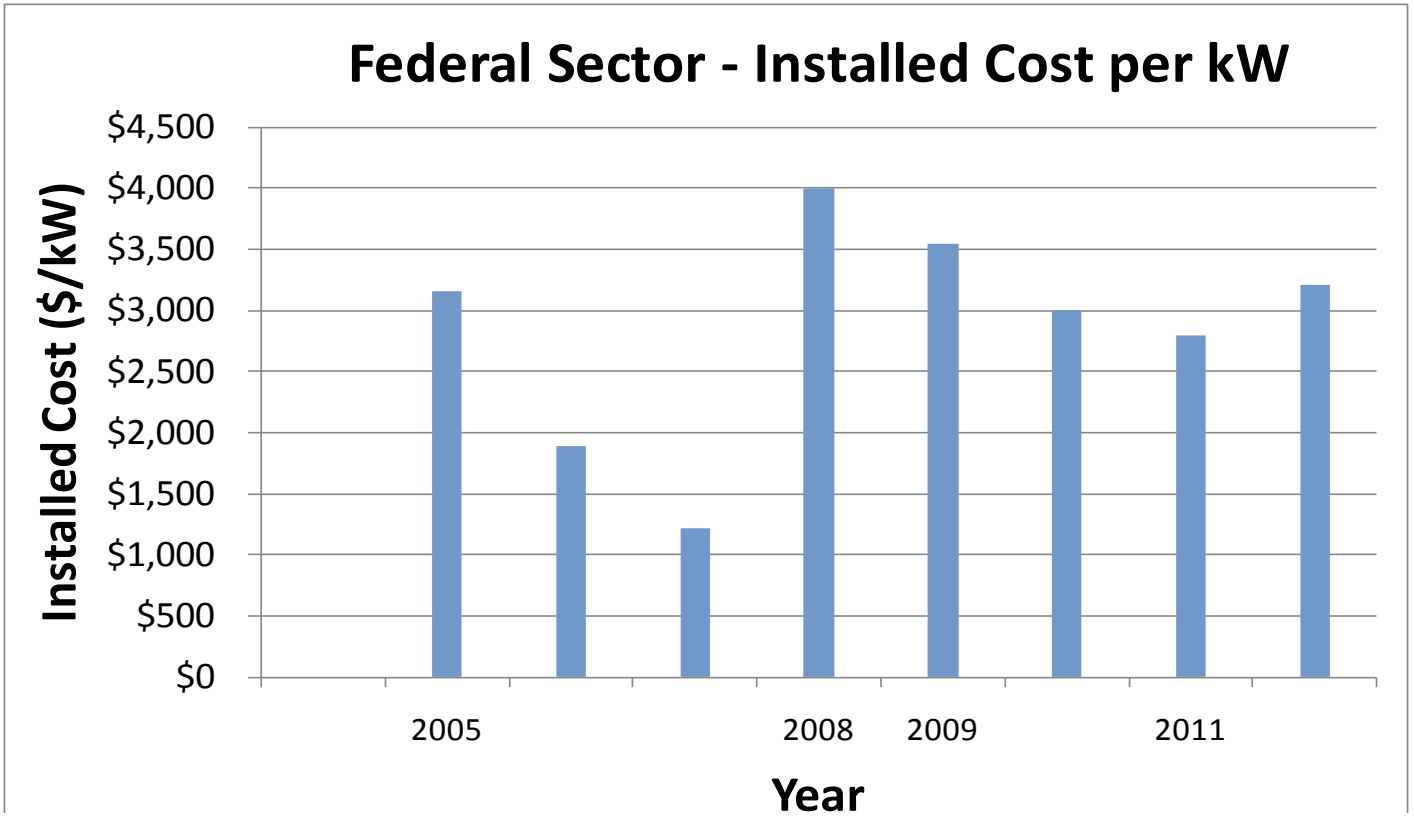
Installed Costs for Federal Wind



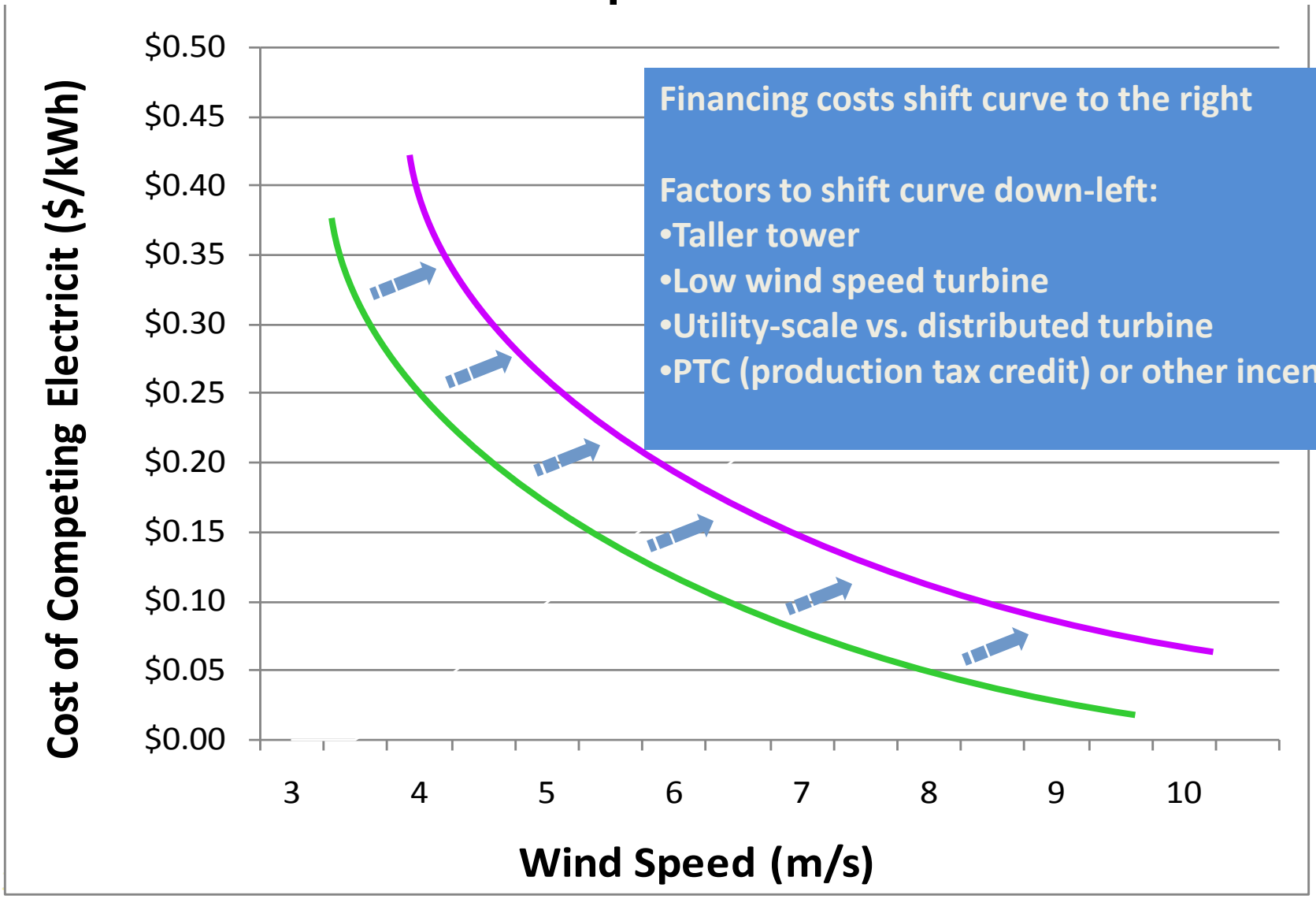
Key factors for high costs:

•SCALE: FEDS - 1-4 turbine projects vs. INDUSTRY - 30-300 turbines in wind industry – government does NOT get economies of scale

•LOCATION: FEDS - Several island locations vs. INDUSTRY - Great Plains

•FINANCING: FEDS - Financing costs can be higher than wind INDUSTRY

Cost of Competing Electricity vs. Wind Speed Curve



Financing costs shift curve to the right

Factors to shift curve down-left:

- **Taller tower**
- **Low wind speed turbine**
- **Utility-scale vs. distributed turbine**
- **PTC (production tax credit) or other incentives**

What Makes Federal Wind so Hard to Do?

Federal Wind Issues

- Funding sources
  - Project funding – not always resource assessment funding
  - Restrictive timelines
- Sites – not necessarily windy
  - Project economics – long paybacks
  - Smaller turbines make economics more challenging
- Timeline for project – funding must be obligated in 1 or 2 fiscal years
  - NEPA delays
  - Wind assessment approval delays
  - Lack of funding for the assessment
- Height and location restrictions
  - FAA – airports, runways, NEXRAD radar
  - DoD mission operations conflicts and radar
  - Neighbor sensitivity
- Existing contracts with utility – long term agreements in place

Funding Sources for Feds

DOD

Energy Conservation Investment Program (ECIP)

Military Construction Funding (MILCON)

Enhanced Use Lease (EUL)

Non-DOD… and DOD too

Acquisition and Construction (AC&I) – Congress approved projects

Operating Expenses (OE) - must be spent by end of FY AND fit within the budget

End of FY funds – must be obligated quickly – need a project "ready to go"

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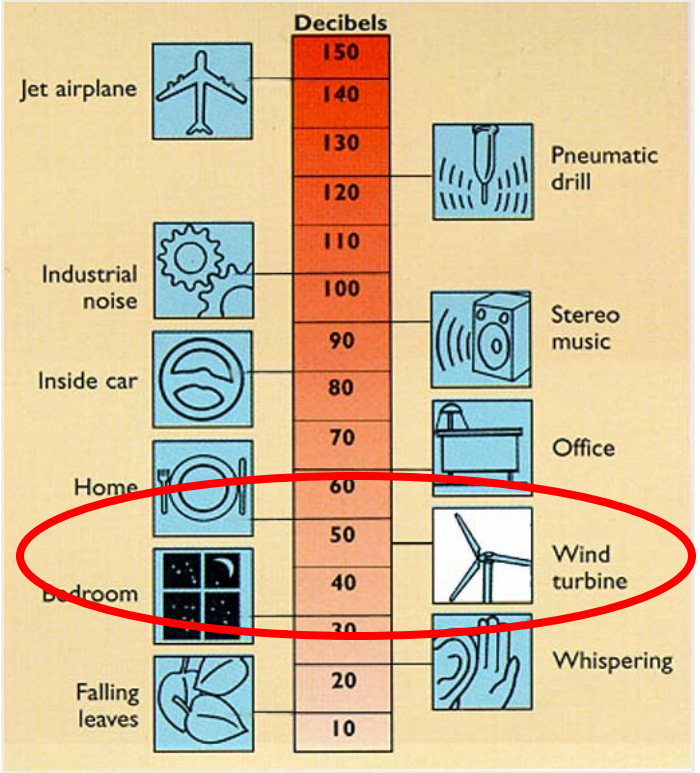
Funding Sources for Feds
All Agencies

- Energy Savings Performance Contracting (ESPC)
  - High transaction cost (mark-up) impact projects with tight margins to begin with
  - Limited experience in wind construction and O&M
- Utility Energy Service Contracting (UESC)
  - Need a cooperating utility with interest and/or experience doing wind
  - Tight project margins less appealing than other utility projects
- Power Purchase Agreement (PPA)
  - May be the option of choice moving forward as contracting precedence in the federal sector is established

Siting Issues

Visual Impact & Neighbors

Noise



Avian and other wildlife:

- Over 200 projects, three problem sites
- Biggest avian problem was in the Altamont Pass
- Managed by careful site selection
- 1 in 10,000 human caused bird deaths is due to wind turbines

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Importance of “Micro-Siting”

- Wind Turbine outside of Cleveland Stadium (July 2007)

4.4% capacity factor in first year of operation

PV has 18-22% capacity factor; wind farms have 30-45% capacity factor

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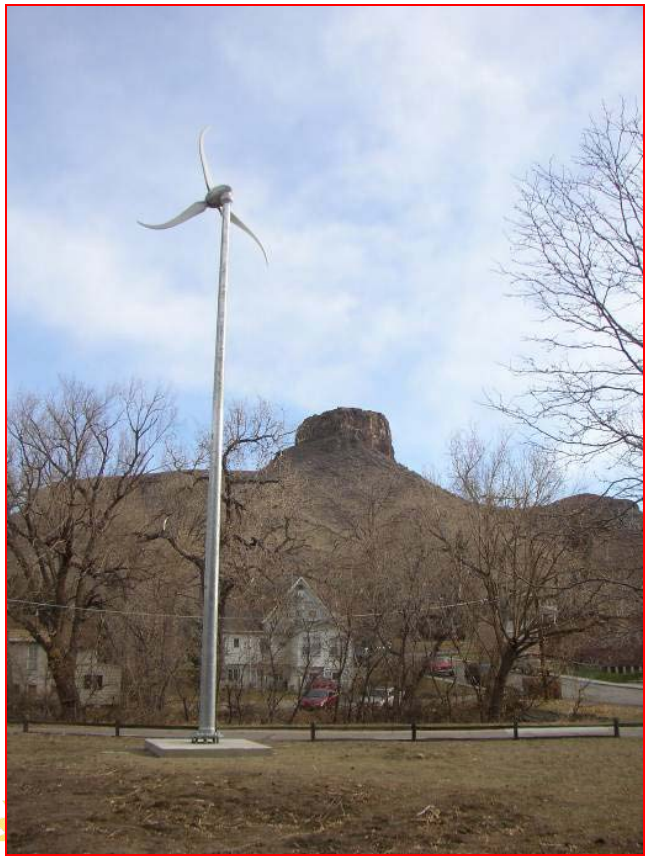
Importance of “Micro-Siting”

Estimated 7% capacity factor in first 5 months of operation
Golden CO Office (December, 2006 – April, 2007)



Wind and Radar Issues - FAA

EERE – Wind and Hydropower Program has Wind Siting Tool web page:

http://www1.eere.energy.gov/windandhydro/federalwindsiting/wind_siting_tools.html

Federal Aviation Administration

« OE/AAA

Evaluation

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DoD Preliminary Screening Tool

faa.gov Tools: Print this page

Disclaimer:

- The DoD Preliminary Screening Tool enables developers to obtain a preliminary review of potential impacts to Long-Range and Weather Radar(s), Military Training Route(s) and Special Airspace(s) prior to official OE/AAA filing. This tool will produce a map relating the structure to any of the DoD/DHS and NOAA resources listed above. The use of this tool is **100 % optional** and will provide a first level of feedback and single points of contact within the DoD/DHS and NOAA to discuss impacts/mitigation efforts on the military training mission and NEXRAD Weather Radars. **The use of this tool does not in any way replace the official FAA processes/procedures.**

Instructions:

- Select a screening type for your initial evaluation. Currently the system supports pre-screening on:
  -Air Defense and Homeland Security radars(Long Range Radar)
  -Weather Surveillance Radar-1988 Doppler radars(NEXRAD)
  -Military Operations
- Enter either a single point or a polygon and click submit to generate a long range radar analysis map.
- Military Operations is only available for a single point.
- At least three points are required for a polygon, with an optional fourth point.
- The largest polygon allowed has a maximum perimeter of 100 miles.

Screening Type: Long Range Radar **Geometry Type:** Single Point

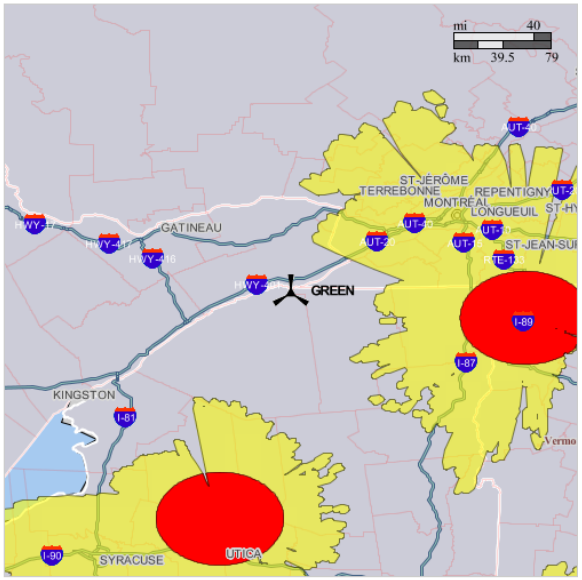
Point	Latitude Deg	Min	Sec	Dir	Longitude Deg	Min	Sec	Dir
1	44	58	43	N	74	44	32	W

Horizontal Datum: NAD83

Submit

Map Legend:

- **Green:** No anticipated impact to Air Defense and Homeland Security radars. Aeronautical study required.
- **Yellow:** Impact likely to Air Defense and Homeland Security radars. Aeronautical study required.
- **Red:** Impact highly likely to Air Defense and Homeland Security radars. Aeronautical study required.



https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showLongRangeRadarToolForm

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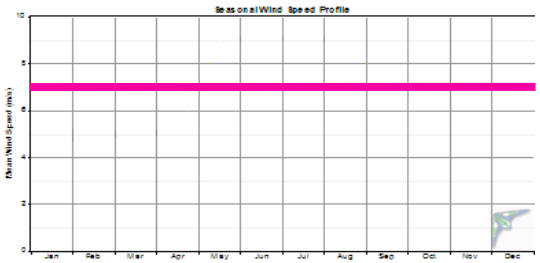
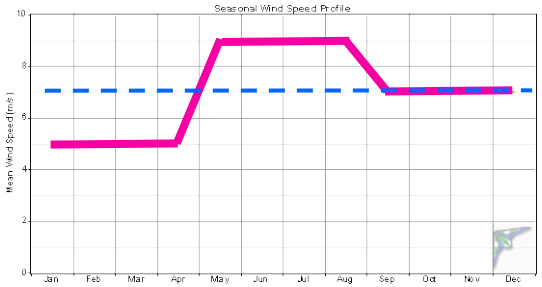
Large Wind Projects – Importance of Wind Resource Assessment

Mean Annual Wind Speed = 7 m/s

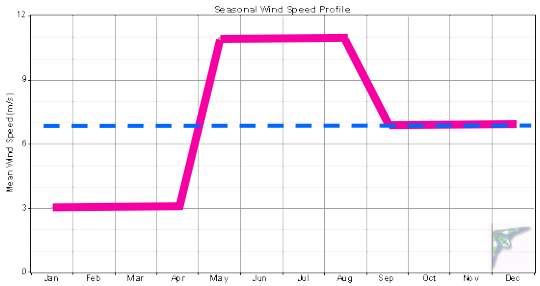
Steady 7 m/s



1/3 of year at 5 m/s
1/3 of year at 7 m/s
1/3 of year at 9 m/s



1/3 of year at 3 m/s
1/3 of year at 7 m/s
1/3 of year at 11 m/s



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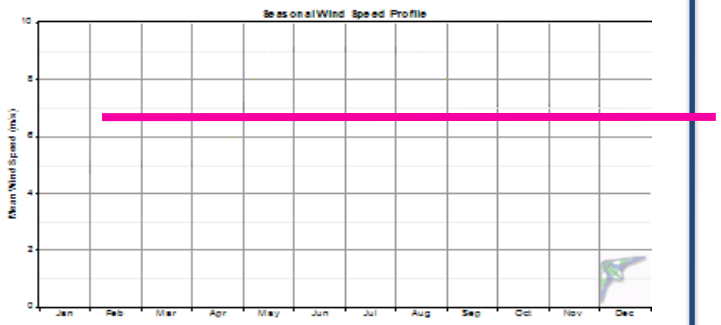
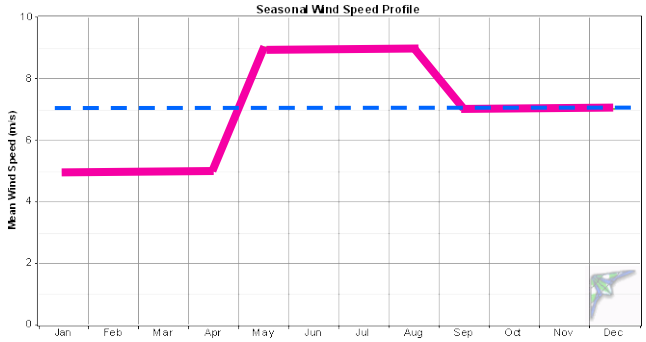
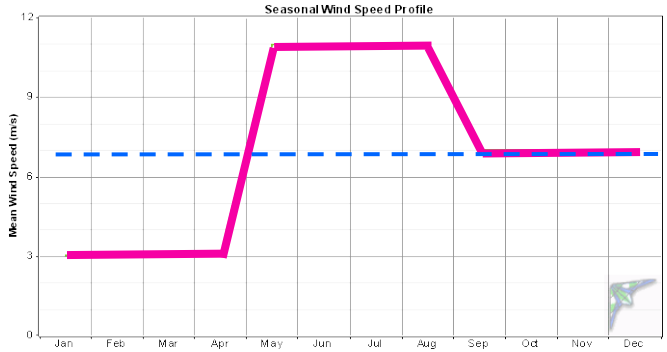
Not All 7 m/s Sites are the Equal !

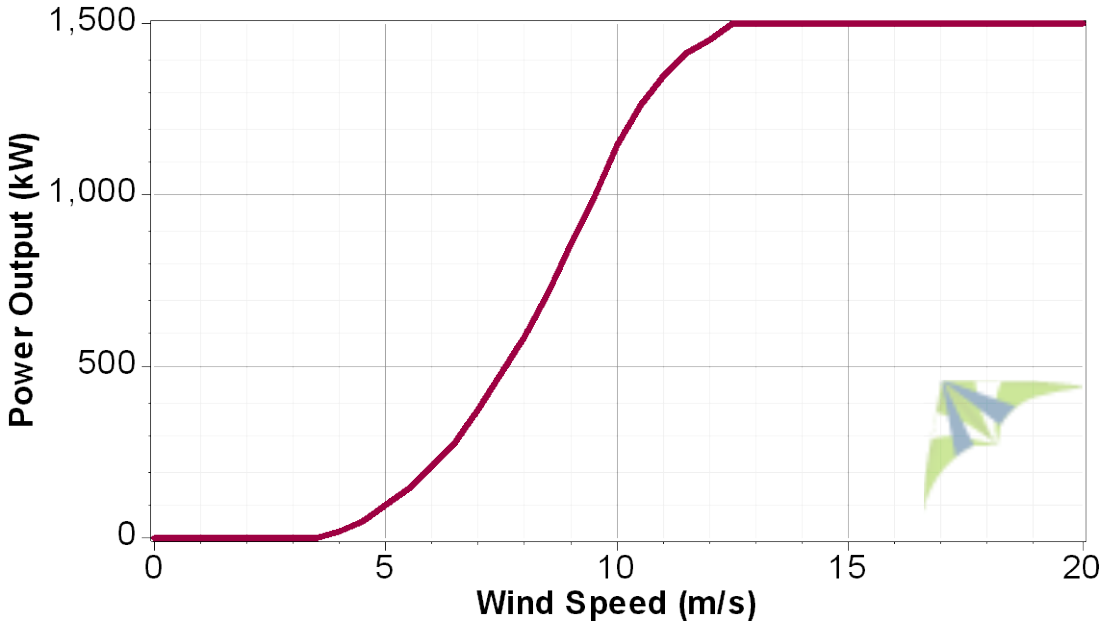
BASE CASE - STEADY WIND AT 7 M/S		
Annual Energy	1,878,107	kWh/yr
Annual Revenue/turbine	$112,686	$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	$22,537,284	$/yr/turb
WIND SPEED AT 3 - 7 - 9 M/S		
Annual Energy	2,466,956	kWh/yr
Annual Revenue/turbine	$148,017	$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	$29,603,471	$/yr/turb
Increase in Rev/Yr	$7,066,187	$/yr/farm
Energy & Rev Increase	31.4%	
WIND SPEED AT 3 - 7 - 11 M/S		
Annual Energy	3,912,763	kWh/yr
Annual Revenue/turbine	$234,766	$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	$46,953,158	$/yr/turb
Increase in Rev/Yr	$24,415,874	$/yr/farm
Energy & Rev Increase	108.3%	







Typical power curve for 1.5 MW wind turbine



Red – steady 7 m/s – turbine produces at 400kW all year

Blue – 1/3 at 5 m/s (100kW); 1/3 at 7 m/s (400 kW); 1/3 at 9 m/s (900 kW)

Purple - 1/3 at 3 m/s (0kW); 1/3 at 7 m/s (400 kW); 1/3 at 11 m/s (1350 kW)

If you have a 30% capacity factor at your site, your 1.5MW turbine will average producing 500 kW all year long. Working backwards that points to a mean annual wind speed of 7.5 m/s.

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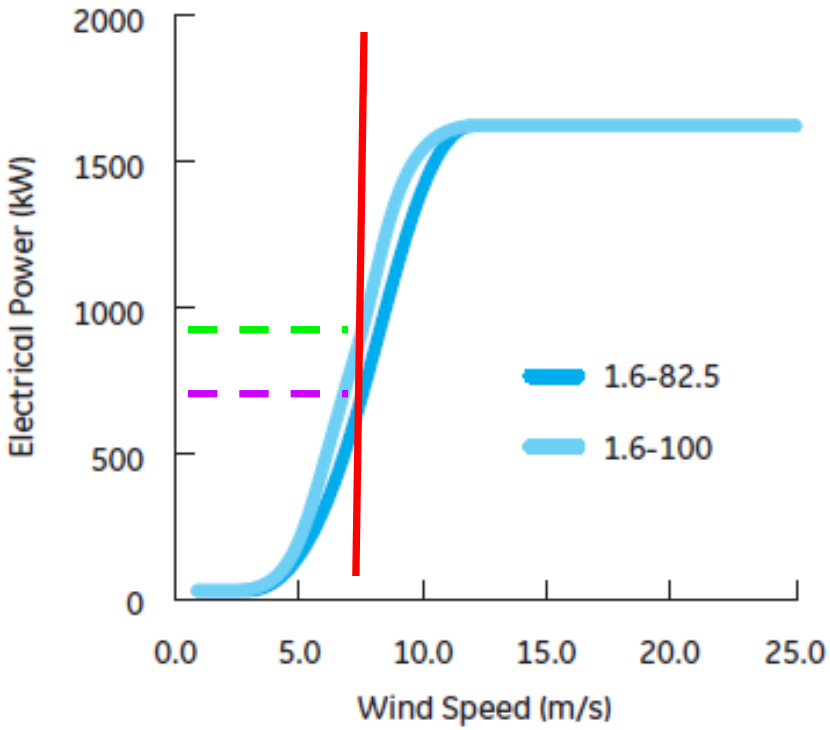
GE 1.6 MW wind turbine

1.6-100 Specifications

Power Curve Improvement



This graph is of the GE 1.6-100 1.6 MW with 100m rotor (low wind speed turbine – may be suitable for Tooele) and 82.5m rotor (suitable for sites without extreme wind or turbulence).

The enlarged rotor moves the power curve to the left so the turbine produces more power (and energy) at lower wind speeds. At 7 m/s, it might have produced ~500kW with 82.5m rotor, but with 100m rotor it will produce ~700kW – that is a 40% increase !! Over the course of a year, it really makes a difference.

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Class 3 vs Class 6 Wind Site

Class 3 – at 50m – wind speeds 6.4 – 7.0 m/s
Mean wind speed of 6.7 m/s used for calcs

BASE CASE - CLASS 3 WIND		
Annual Energy	2,085,849	kWh/yr
Annual Revenue/turbine	$125,151	$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	$25,030,184	$/yr/farm

What is means to BLM:
Class 3 site = 150 turbines
Class 6 sites = 58 turbines

Need 159% more wind turbines at Class 3 site

Class 6 – at 50m – wind speeds 8.0 – 8.8 m/s
Mean wind speed of 8.4 used for calcs

CLASS 6 WIND		
Annual Energy	5,025,063	kWh/yr
Annual Revenue/turbine	$301,504	$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	$60,300,755	$/yr/turb
Increase in Rev/Yr	$37,763,470	$/yr/farm
Energy & Rev Increase	167.6%	

The revenue "increase" at this Class 6 site is greater than "annual revenue" at Class 3 site !

2011 Activity - Rawlins Field Office – BLM Rawlins WY

Visual Simulation of Proposed Action

20 kW turbine – 2004

100 kW turbine - 2011

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2011 Federal Wind Activity – AFCEE MMR – Cape Cod MA

1.5 MW turbine – 2009 Two 1.5 MW turbines – 2011

Two more 1.5 MW turbines in 2012 !

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Benefits of Wind

- Environmental
  - Reduces emissions
  - Reduces water usage associated with fossil fuels & nuclear
- Minimize exposure to fuel price volatility
  - Opportunity to stabilize power prices
  - Minimizes exposure to volatile prices
  - Improves budgeting and forecasting
- Reduces dependence of fossil fuels
  - Reduces emissions
  - Minimizes exposure to carbon restrictions - policy hedge
  - Improves energy security

Wind – Environmental Benefits

- Emissions reductions vs coal electricity
- 20,000MW – offsets
- ~24 million tons of coal electricity
- equivalent to 80 million barrels of oil

And uses no water!

- 1.5MW wind turbine – offsets
- 1,800tons of CO2
- 14 tons of SO2
- 6 tons of NOx

Source: http://www.nrel.gov/data/pix/Jpegs/00560.jpg

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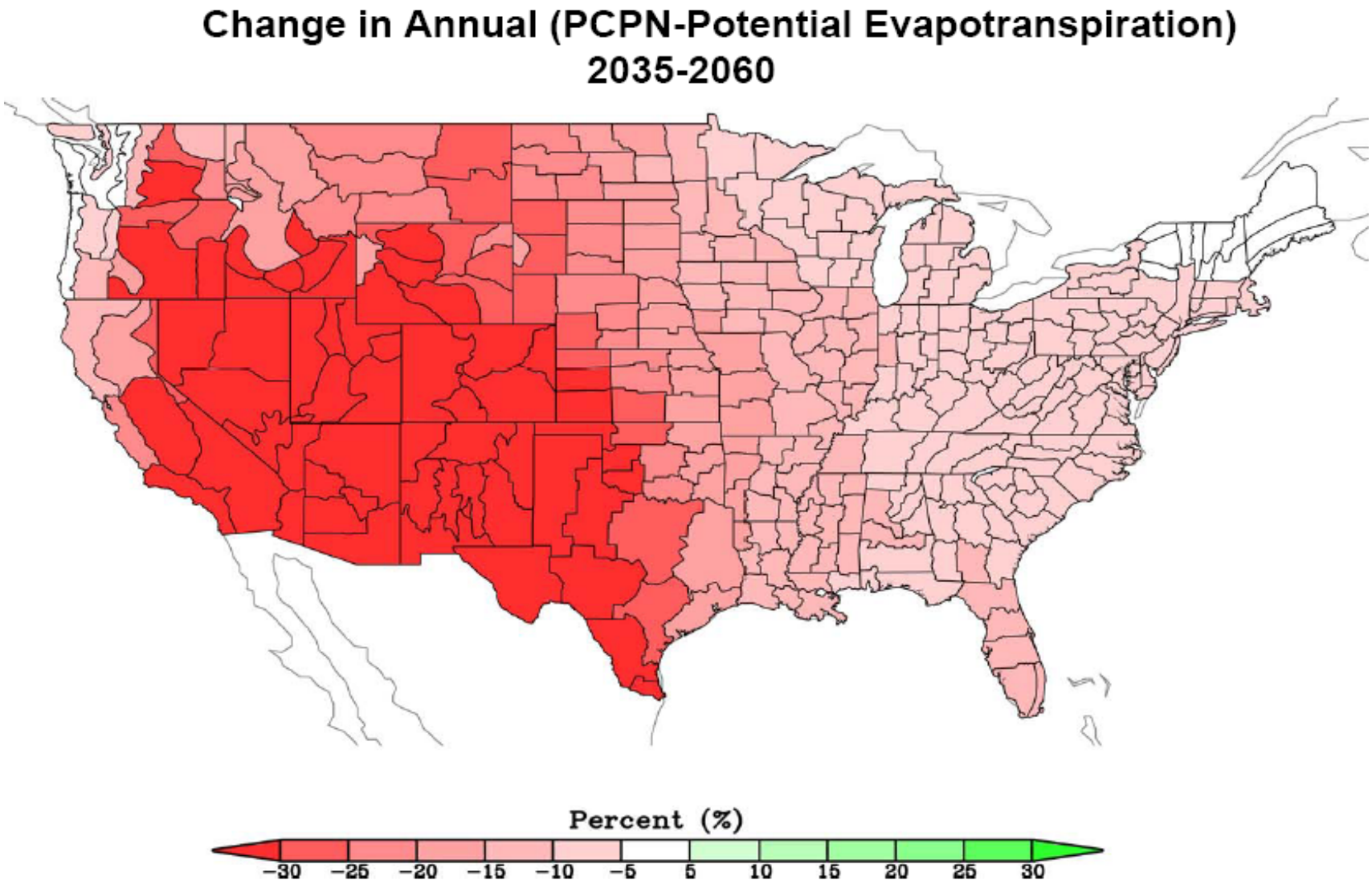
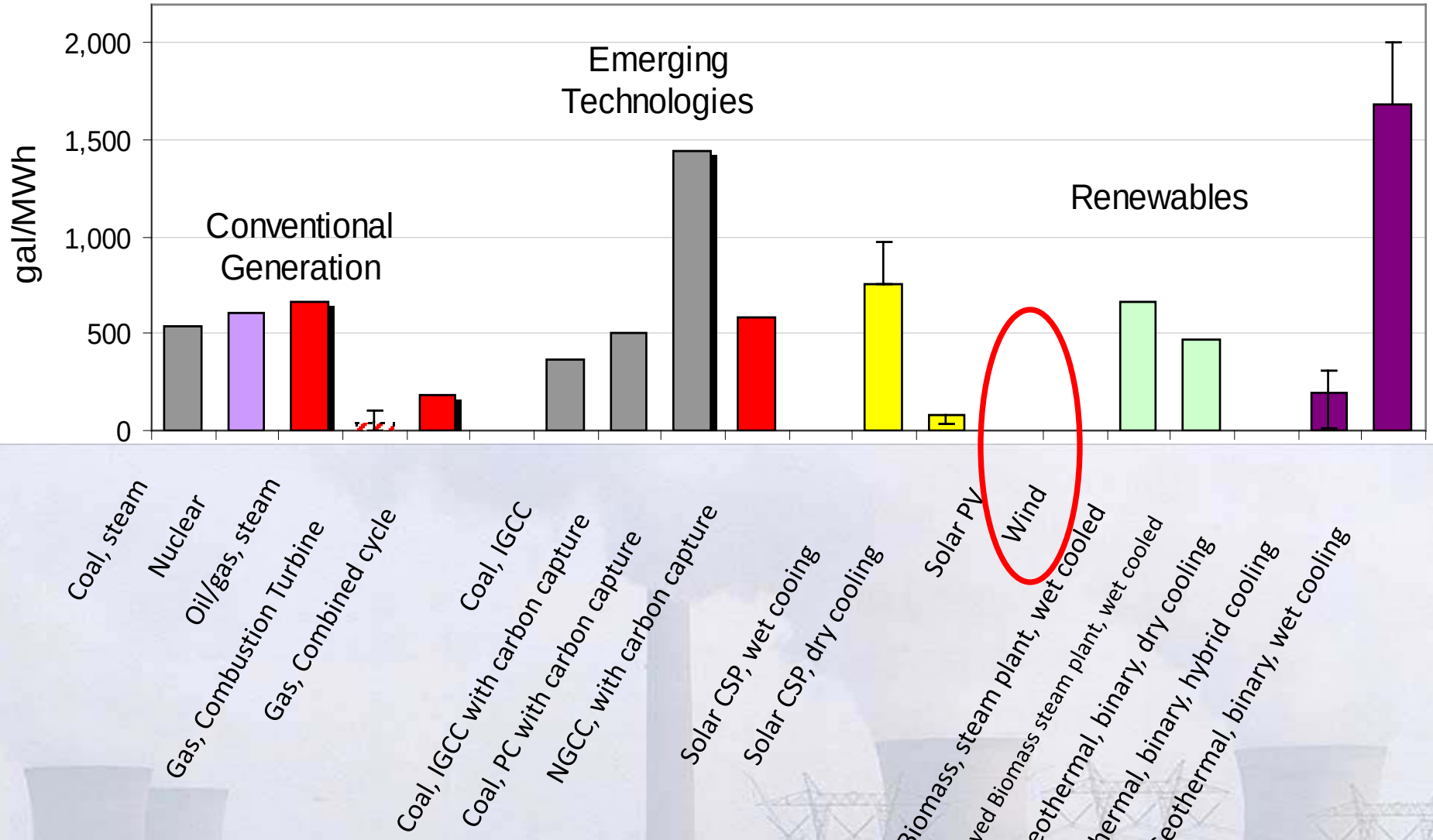
Potential for Competing Water Interests

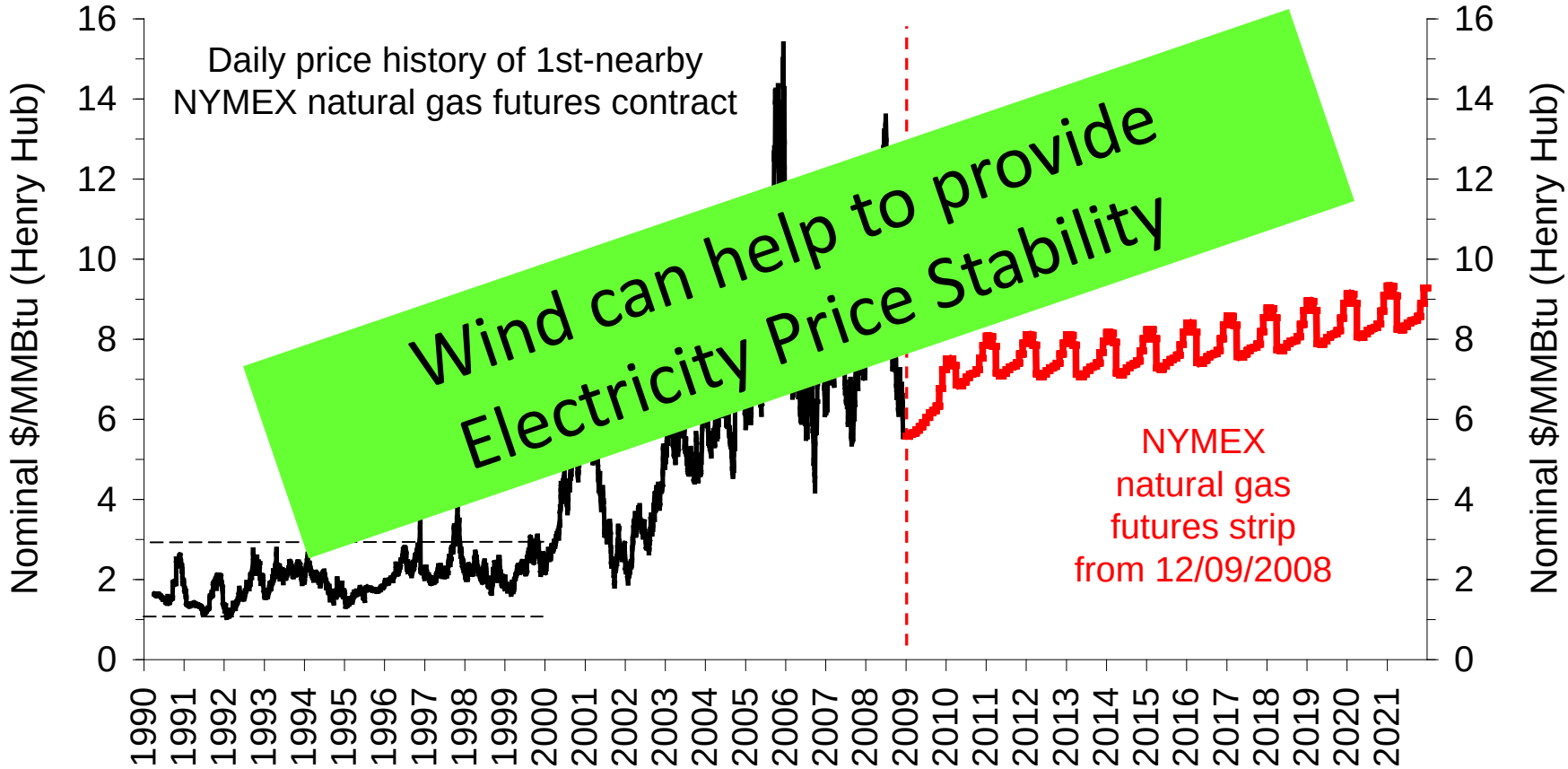


Water Intensity of Electricity Generation



Source: Western Resource Advocates
"The Energy-Water Nexus: A Case Study of the Arkansas River Basin" 2008

Natural Gas Price Volatility – Historic Prices vs. Future Prices



Source: LBNL

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National Renewable Energy Laboratory
Innovation for Our Energy Future

Form a TEAM for your Wind Project

- Contracts
- Site Operations
- Environmental
- Legal
- Public Relations
- Transportation
- Electrical / Utility

Keep management informed

Know your constraints:

- $ Funds?
- Height – FAA?
- Location?
- Neighbors ?

< Communicate Clearly and Often with the Public

< Build Partnerships and Alliances

< Be Willing to Inform, to Listen and to COMPROMISE

Hire a 3rd Party to Assist in Project Implementation

Out of the Box Ideas to Achieve Federal Wind AND Save $$

- Keep $$ Savings from Successful RE Project to Re-invest in On-Site Projects
  - As much as possible, pay cash – we do it for our buildings and backup diesel generators – do it for RE techs - keep timelines short, pay as little interest as possible

- **Aggregate Federal Loads in Regions and do Bulk Purchase**
  - GSA and DESC - purchasing agent
  - WAPA, Bonneville and TVA - enabling agent
  - Tribal Lands or other Fed land – enabling agent

- Fund REPI (Renewable Energy Production Incentive) – PTC for Feds

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Carpe Ventem !!

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www.windpoweringamerica.gov

How to Implement Distributed Wind Projects at your Federal Facility?

- At GOVENERGY 2012 Sunday, Aug 19th 10:00-4:00 pm

- FORMAT:
- Wind "Do's and Don't's" at Federal Facilities
- Case Studies of Successful Distributed Wind Projects – on and off grid
- Table Top Discussions with Wind Experts, Turbine Manufacturers, and Developers focused on the Distributed Wind Market

- PARTICIPANTS:
- Air Force, NREL, Bergey Wind, Sustainable Energy Development, Northern Power Systems and others

- No fee – but you must register
- Lunch will be provided

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For more info:

http://www.nrel.gov/wind/

http://www.windpoweringamerica.gov/

http://www.awea.org/

http://www.nrel.gov/wind/resource_assessment.html

Federal Wind Activities - WEST

Marines – Barstow CA 1.5MW 2008

BLM – Rawlins 20 kW 2002
100 kW 2010

Navy – Guam – MET –2009-11 4 MW for 2012

Navy– Yokusuka, Japan MET 2009-11

San Nicholas Island CA – MET towers

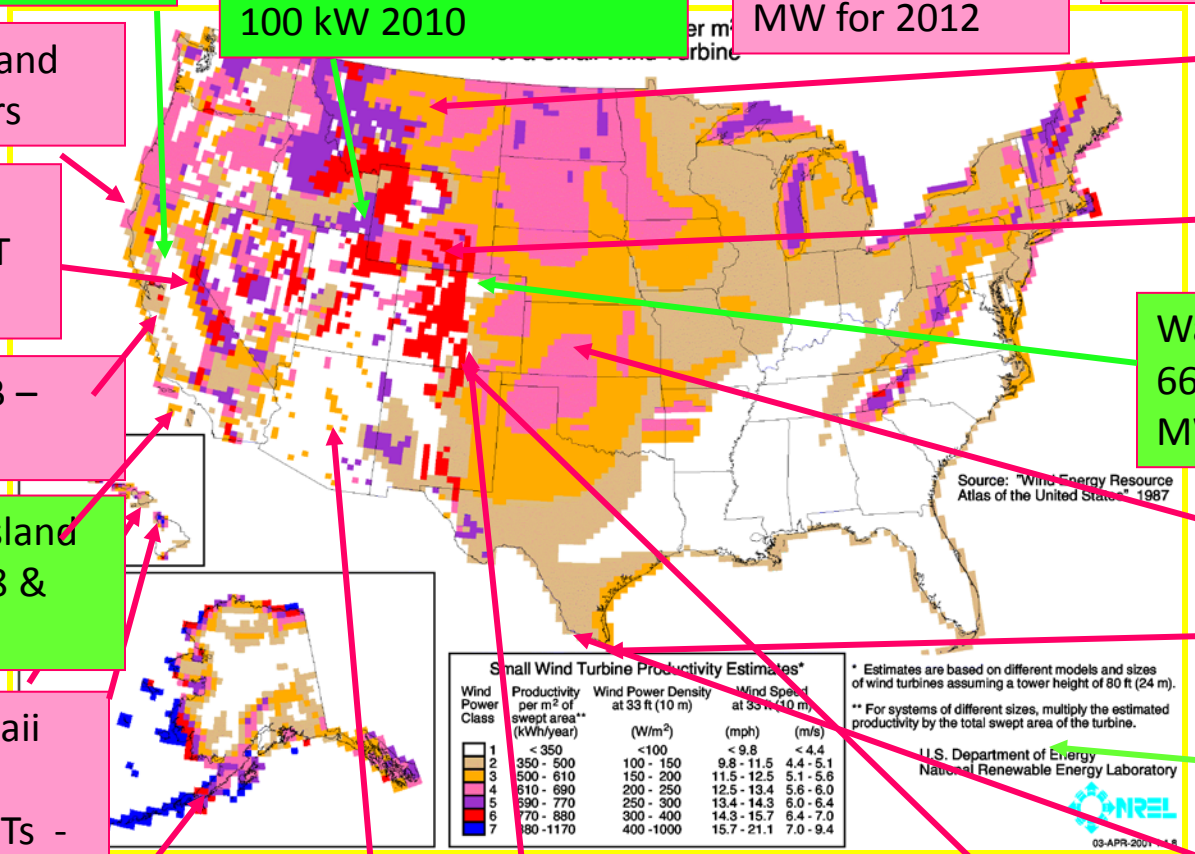
EPA – Anaconda MT MET 2009-11

EPA – Leviathan Mine CA MET –2010-11

EPA– Gilt Edge SD MET 2009-11

Vanderberg AFB – MET towers

Warren AFB Two 660kW – 2005 One 2.0 MW - 2009



McConnell AFB KS MET – 2010-11

San Clemente Island – 3 225kW 1998 & 1999

GSA – Donna TX MET — 2008-9

DOD/DOE -Hawaii Pearl City and Kanehoe - 2 METs - 2009-10

Guantanamo Bay 4 950kW - 2006

USCG – MET Kodiak AK 2005-8

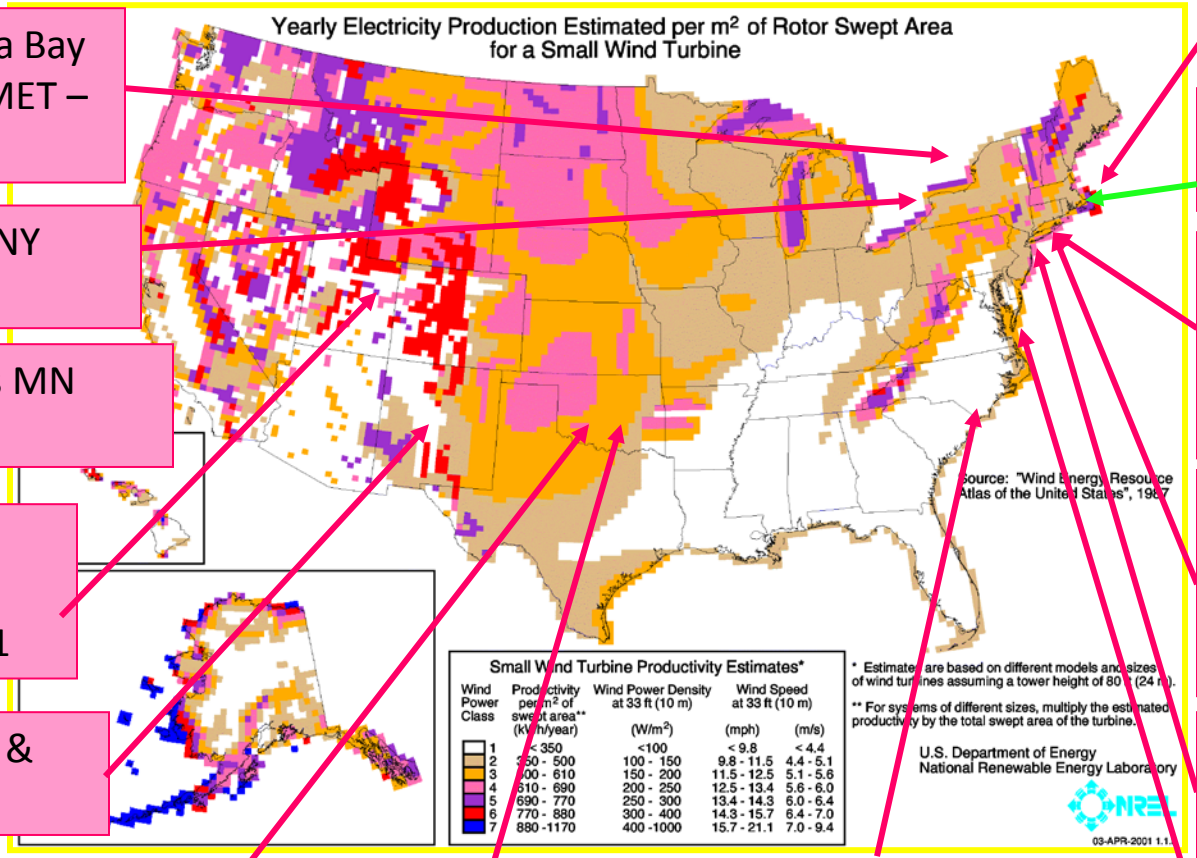
Sandia NL 2 MET & SODAR 2008-9

Fort Carson , Colo Springs CO MET & SODAR -– 2008-9

Schriever AFB MET - Colo Spgs CO-2007-9

GSA – MET – McAllen TX – 2008-9

Federal Wind Activities - EAST



GSA - Alexandria Bay NY MET – 2011-12

GSA – Messina NY MET –2011-12

EPA – Mille Lacs MN MET –2011-12

Idaho NL
2 MET &
SODAR 2008-11

Sandia NL MET & SODAR 2008-11

Altus Air Force Base OK MET –2009-10

EPA – Doepke KS MET –2010-11

NPS, Harkers Island NC 20m MET 2009-10 2.4 kW turbine 2011

AFCEE Cape Cod 2 1.5MW turbines 2011

AFCEE Cape Cod 1.5MW turbine 2009

Navy Newport RI MET & SODAR 2009-11
9 MW turbines 2012

Army Nat Guard – Sea Girt NJ
MET & SODAR –2008-9

USCG –Cape May NJ-TALL MET – 2007-9

NASA – 2006-7 Wallops Island VA

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August 19-22, 2012

15th Annual Workshop and Trade Show

THE GATEWAY TO

SMART ENERGY SOLUTIONS

AMERICA'S CENTER CONVENTION COMPLEX ▪ ST. LOUIS, MISSOURI

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May 22, 2012, 1:00pm - 3:00pm EST

Sign Up: www.GovEnergy.gov

Presenters

E.W. Dovel, Harris Lighting

Jim Dore, Servidyne

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Questions?

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