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and Trade Show for Federal Agencies

A River of Energy Solutions

Opportunities for Wind Energy in the Federal Sector

Robi Robichaud – National Renewable Energy Laboratory

Federal Wind

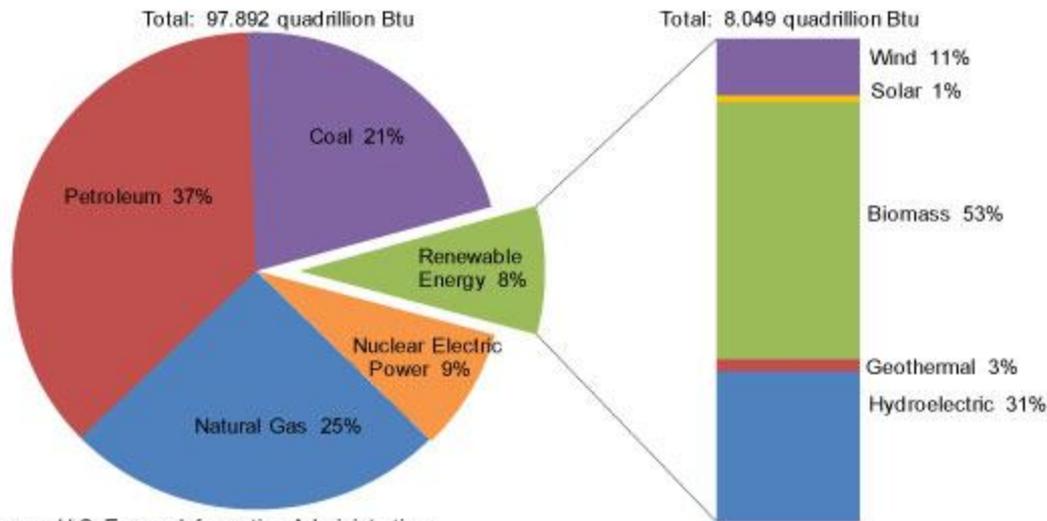
- Why do Federal Wind?
 - Background & wind industry
- What makes Federal Wind so good to do?
 - Background
 - Progress to date
- What makes Federal Wind so hard to do?
 - Issues with Wind Projects
 - Lessons learned
 - Challenges ahead

U.S. Energy – 2010

U.S. Energy Use

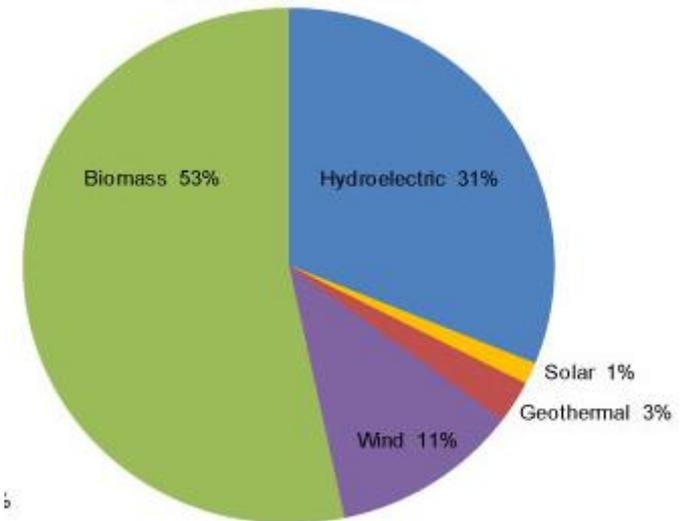
U.S. Renewable Energy Use

Figure 1. Renewable energy consumption in the nation's energy supply, 2010



Source: U.S. Energy Information Administration

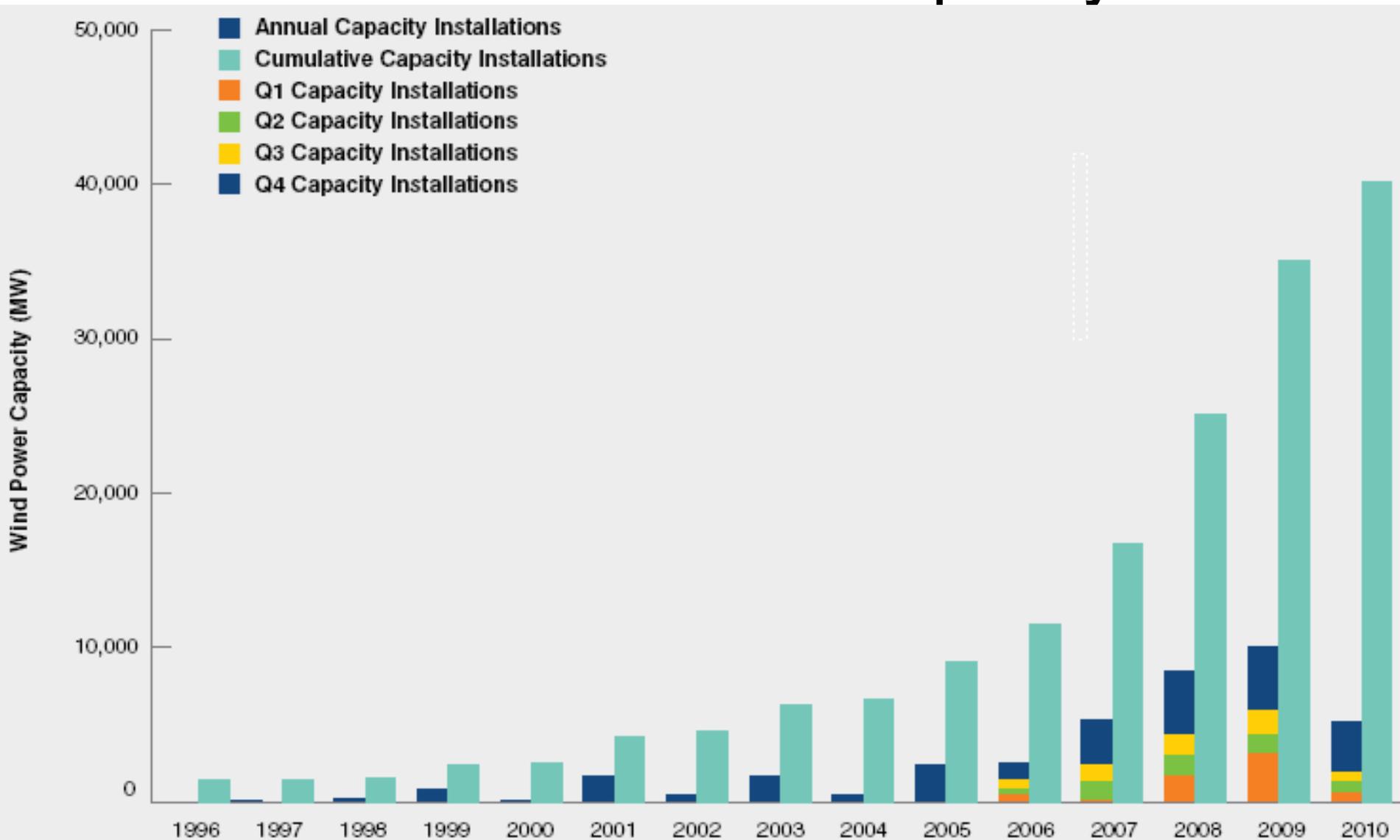
2010
Total 8,049 quadrillion Btu



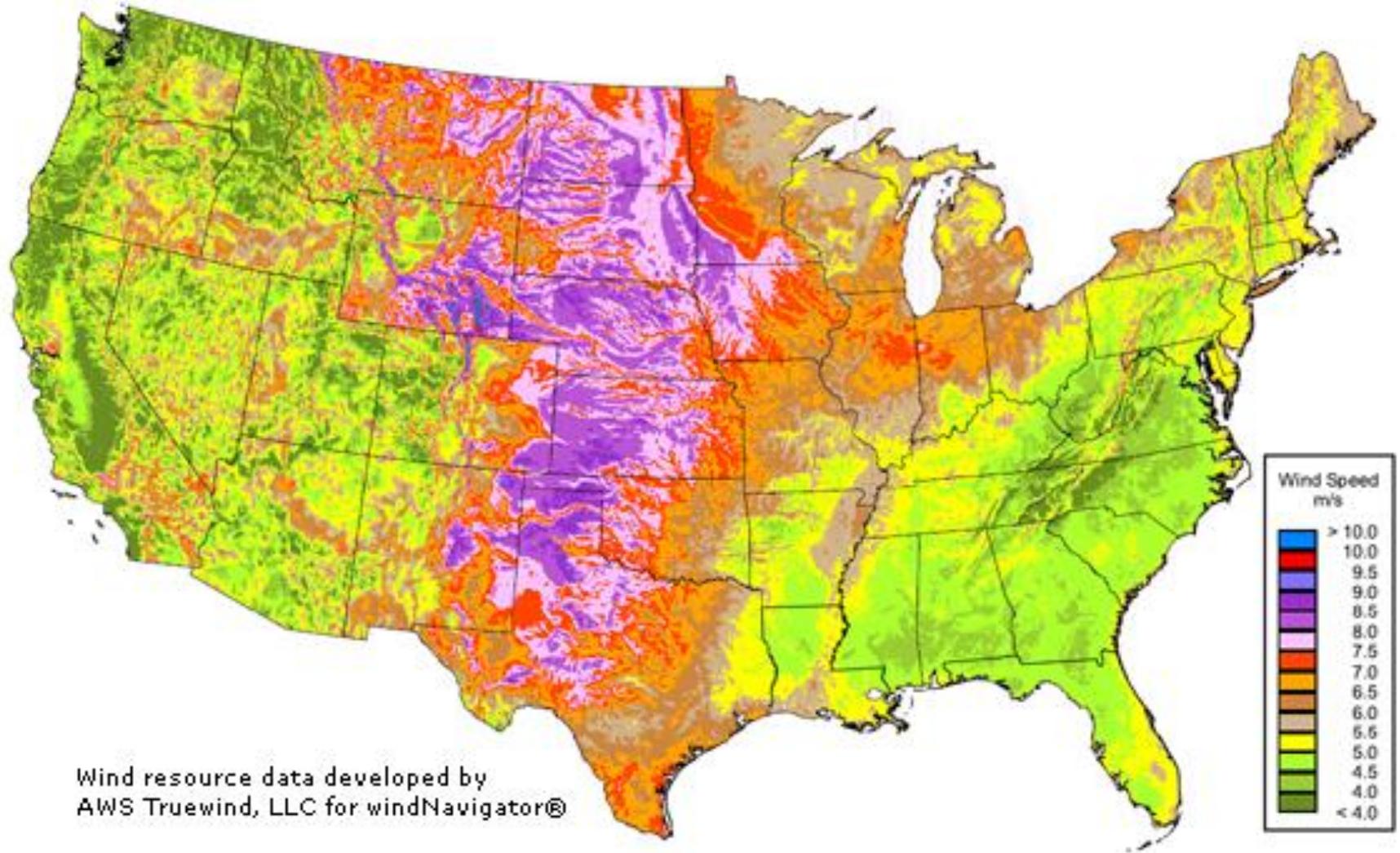
Wind = 11% of Renewable Energy

Wind = 2.3% of Electricity

US Annual Wind Capacity & Cumulative Wind Capacity



80m Wind Maps

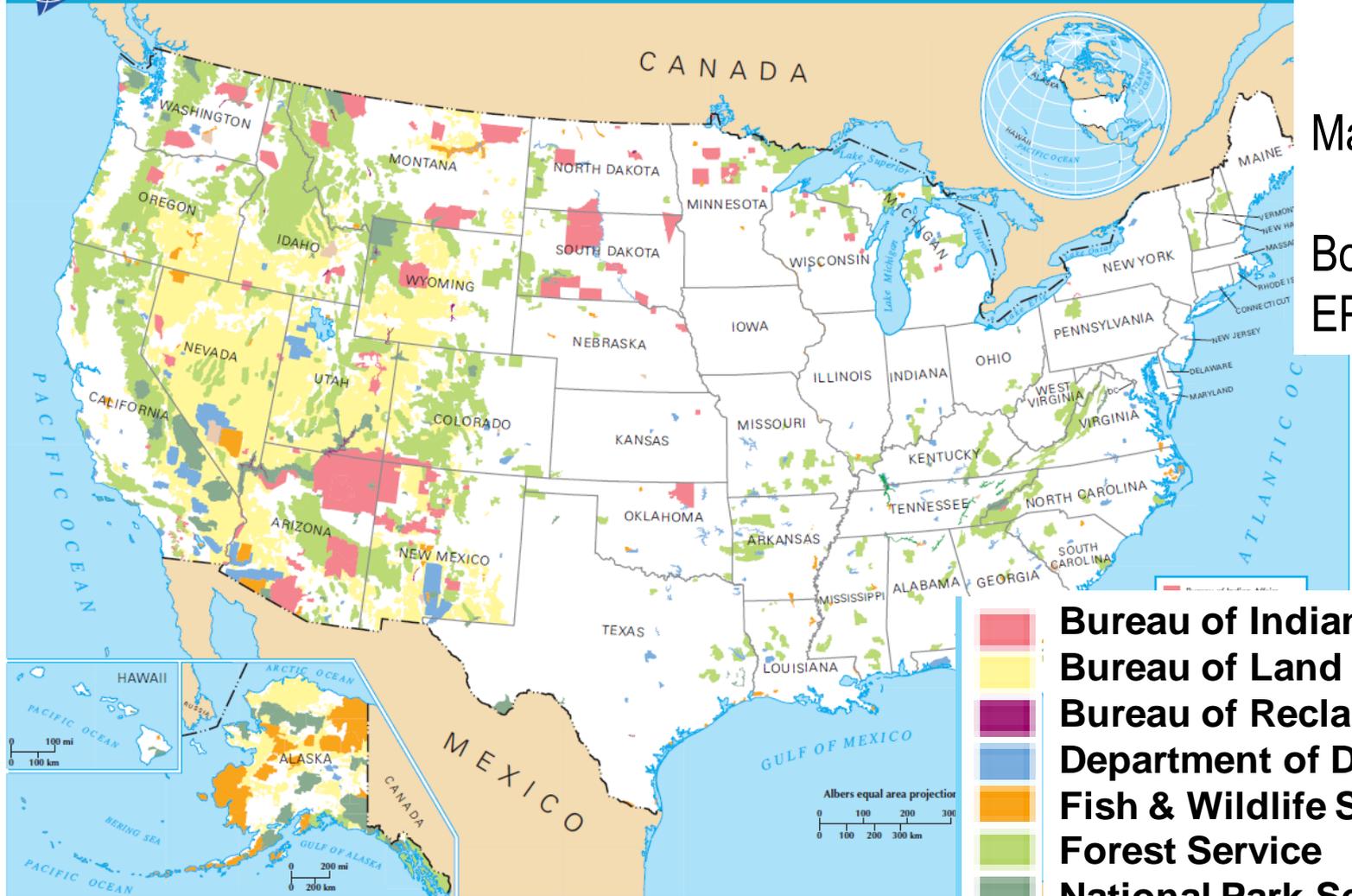


Federal Lands - ~30% of U.S.



nationalatlas.gov™
Where We Are

FEDERAL LANDS AND INDIAN RESERVATIONS



NOT VISIBLE:

- 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

U.S. Department of the Interior
U.S. Geological Survey

The Nation

Federal Wind ... “State of the Wind”

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

Legislative Impetus for Federal Wind

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:

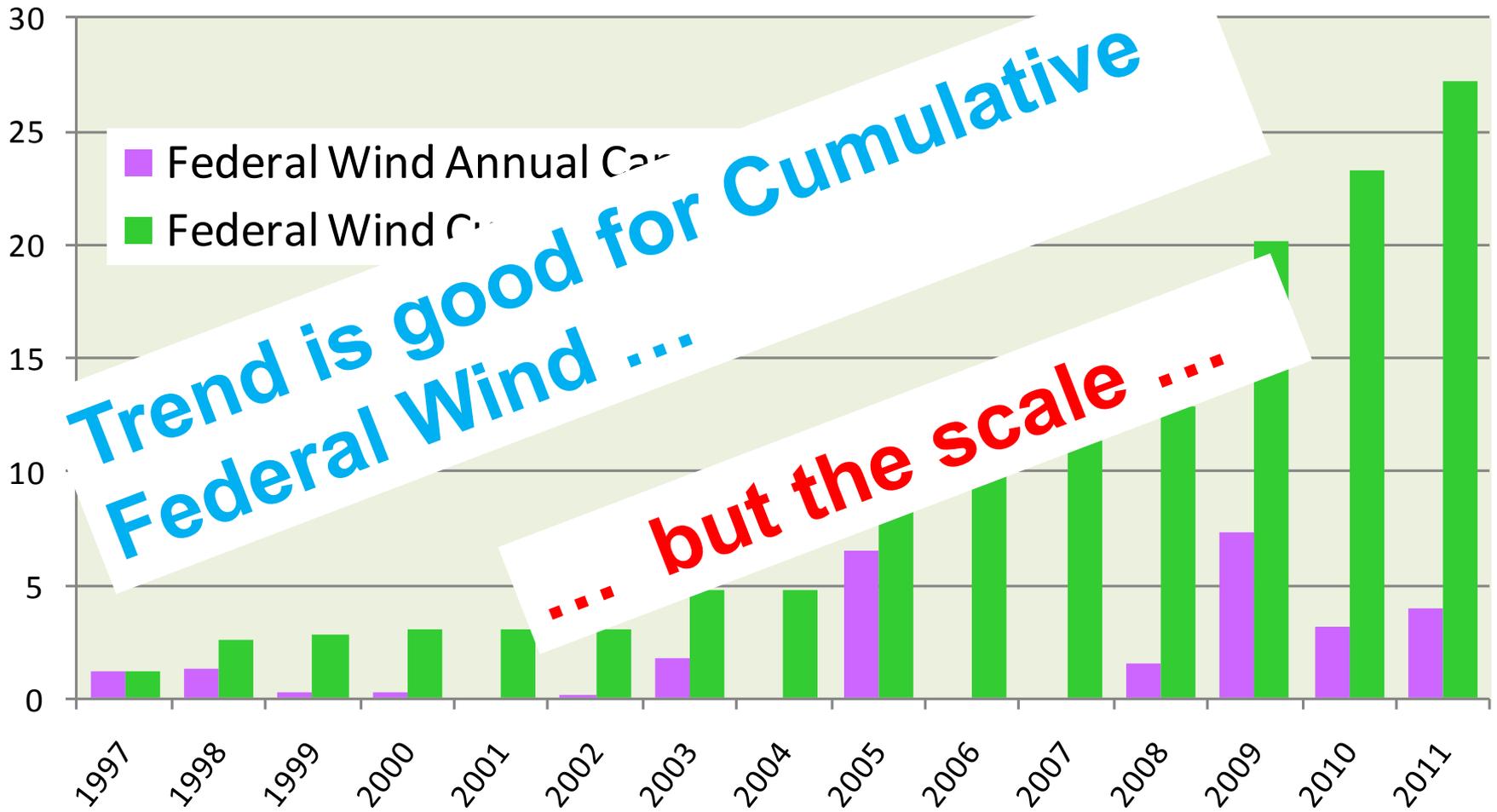
~ 4,000 - 5,000 GWh/year of wind generation.

These initiatives conform with a multitude of federal energy mandates, including the Executive Order (E.O.) 13514, Energy Independence and Security Act of 2007 (EISA 2007), E.O. 13423, Energy Policy Act of 2005 (EPAct 2005), and the National Energy Conservation Policy Act (NECPA).

Federal Wind Capacity

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

Federal Annual Wind Capacity & Cumulative Wind Capacity



US Government Electricity

Federal Electric Load: 55,800 GWh/yr

Federal Wind Energy: 53 GWh/yr

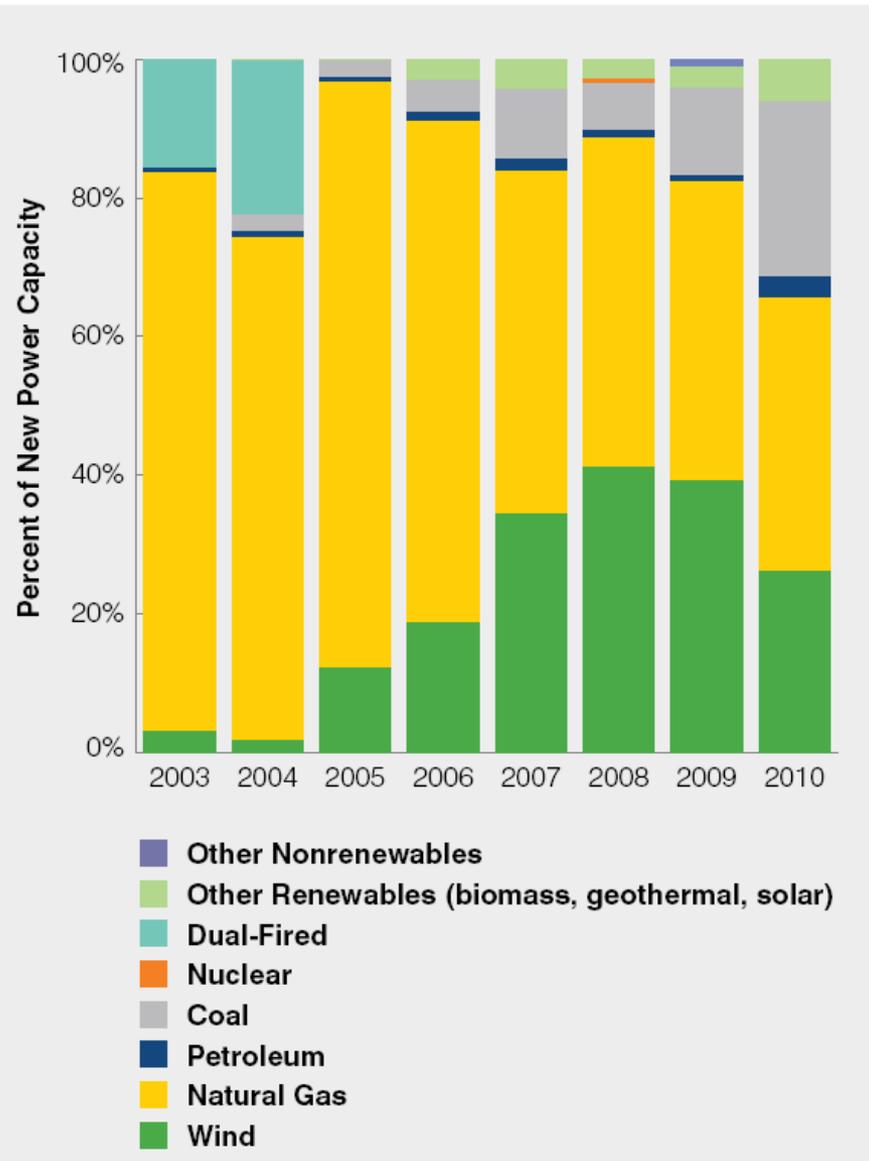
Federal Wind: 0.096%

U.S. Wind: 2.3% of Electricity

The Reality:

The US Wind contribution to US electricity is 25 times greater than Federal Wind contribution to Federal electricity

Annual US Electricity Generating Capacity Additions

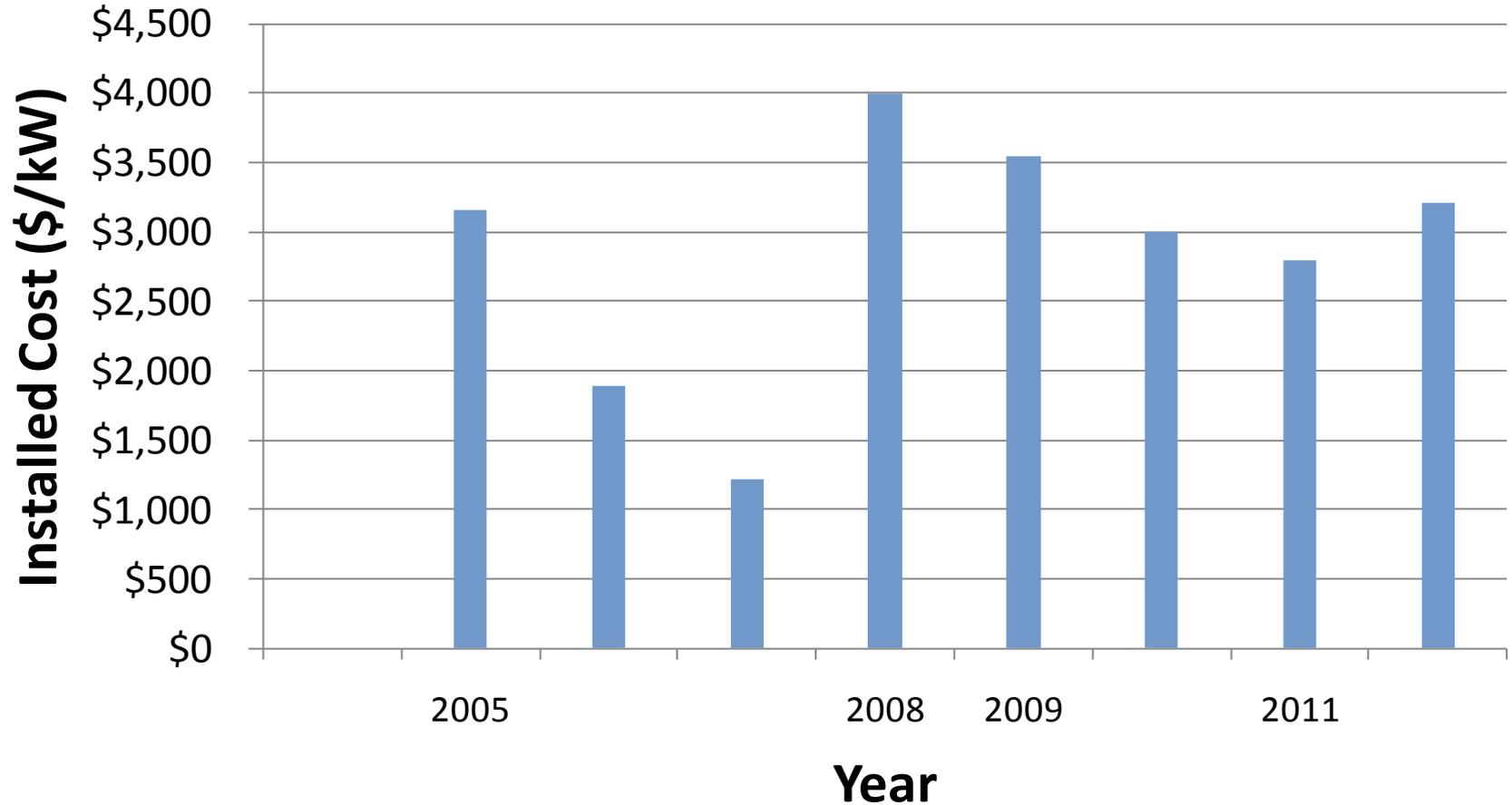


Source: AWEA, Energy Information Administration, SNL, Solar Energy Industries Association

- 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.

Installed Costs for Federal Wind

Federal Sector - Installed Cost per kW



Key

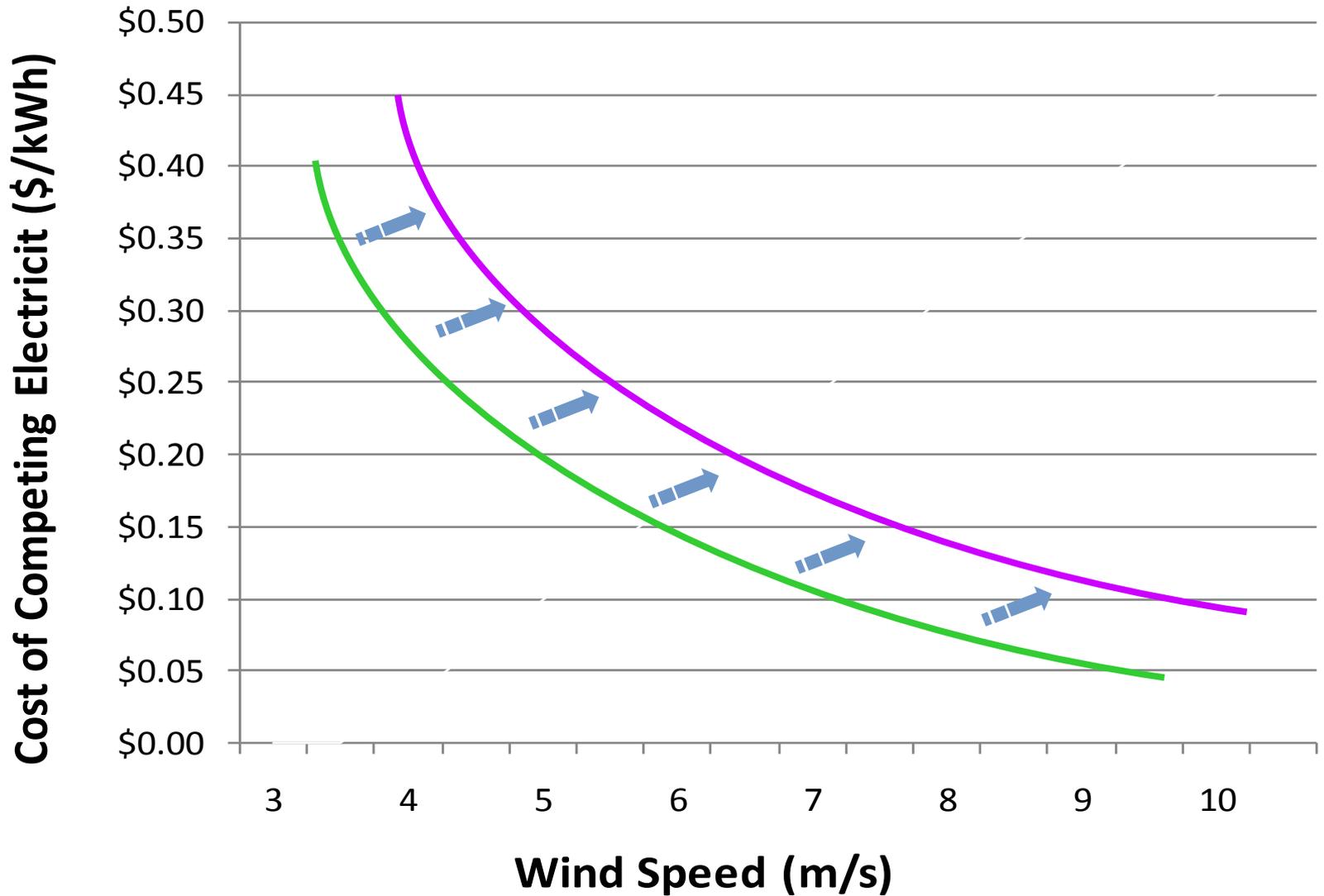
• SO

win

• LC

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

Cost of Competing Electricity vs. Wind Speed Curve



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 delays
 - Management approval delays
- Height restrictions
 - FAA
 - DoD mission operations conflicts
 - Neighbor sensitivity
- Existing contracts with utility – long term agreements in place

Funding Sources for Feds

DOD

Energy Conservation
Investment Program (ECIP)
\$750k limit/project

Military Construction
Funding (MILCON)

Enhanced Use Lease
(EUL)

Non-DOD... and DOD too

AC&I - Acquisition and
Construction – Congress
approved ‘projects’

OE - Operating Expenses -
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”

Funding Sources for Feds

All Agencies

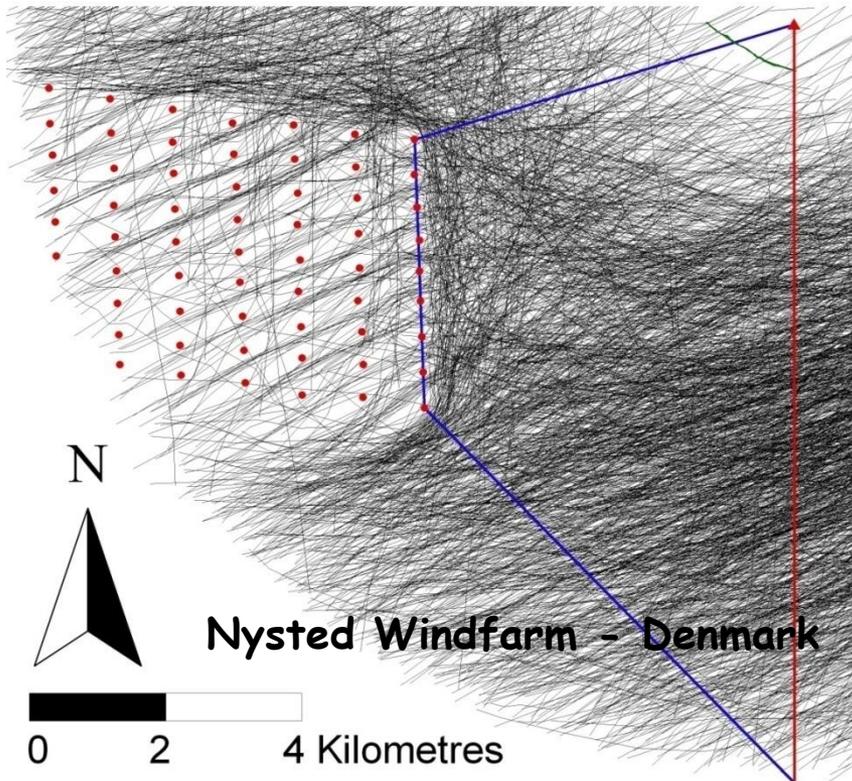
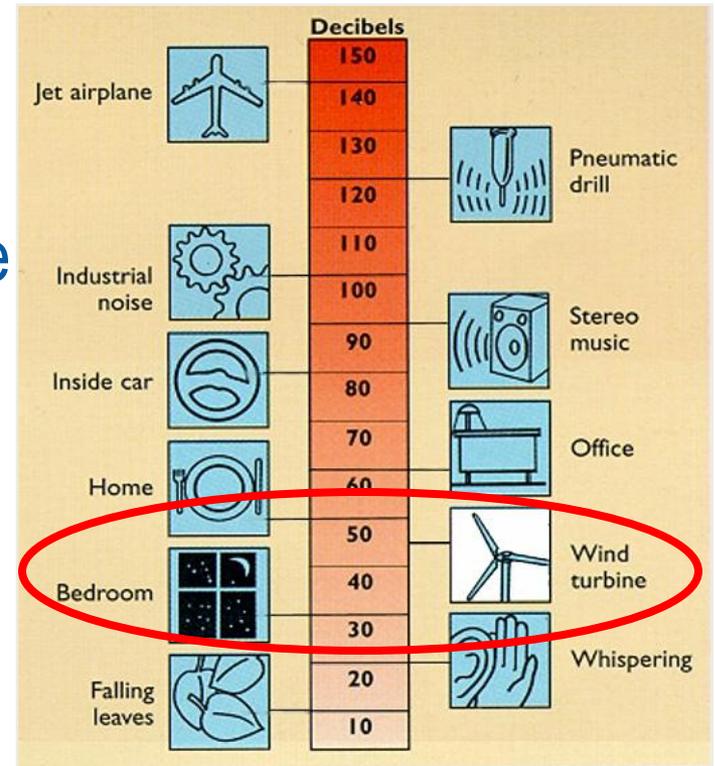
- **Energy Savings Performance Contracting (ESPC)**
 - High transaction cost (mark-up) impact projects with tight margins to begin with
 - Limited experience in wind construction and O&M
- **Utility Energy Service Contracting (UESC)**
 - Need a cooperating utility with interest and/or experience doing wind
 - Tight project margins less appealing than other utility projects

Siting Issues



Visual Impact & Land Ownership

Noise



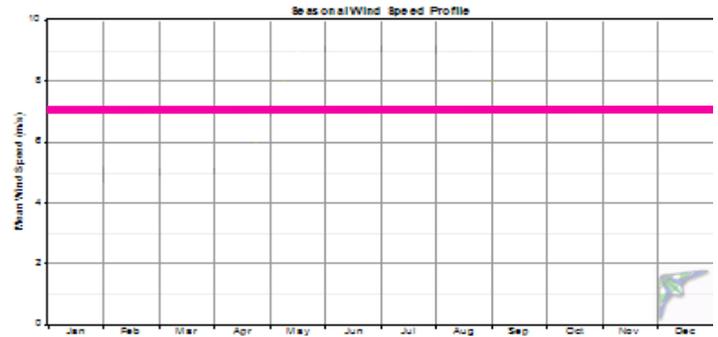
Avian and other wildlife:

- Over 200 projects, three problem sites
- Biggest avian problem was in the Altamont Pass
- Managed by careful site selection

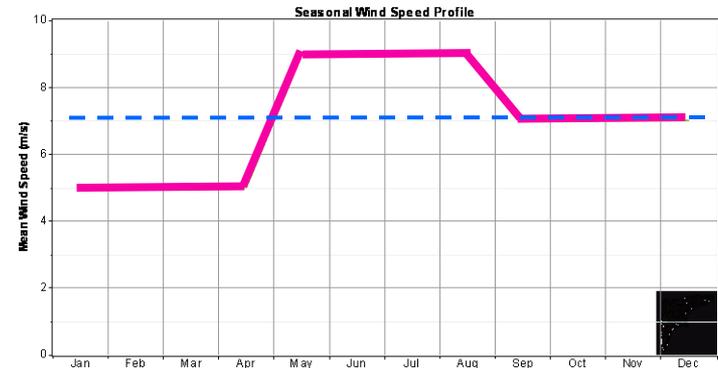
Importance of Wind Resource Assessment

Mean Annual Wind Speed = 7 m/s

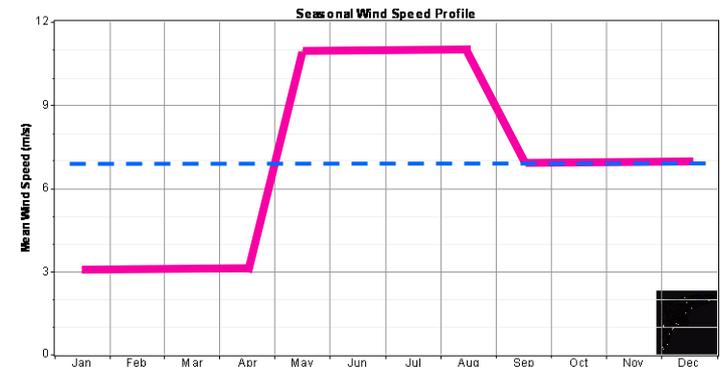
Steady 7 m/s



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

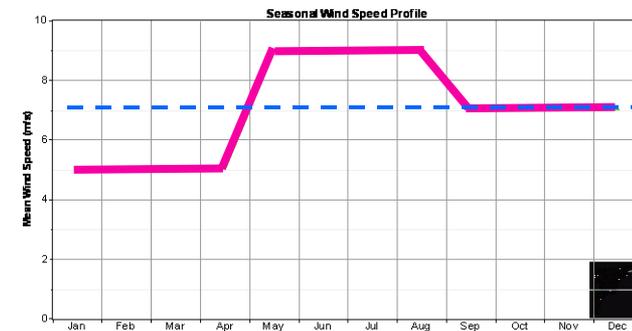


Not All 7 m/s Sites are the Equal !

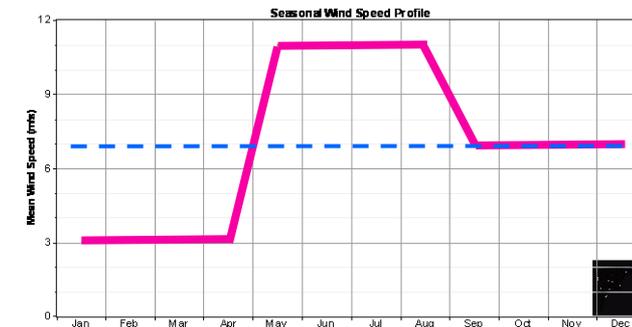
BASE CASE - STEADY WIND AT 7 M/S		
Annual Energy	1,878,107	kWh/yr
Annual Revenue/turbine	\$112,686	\$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	\$22,537,284	\$/yr/turb



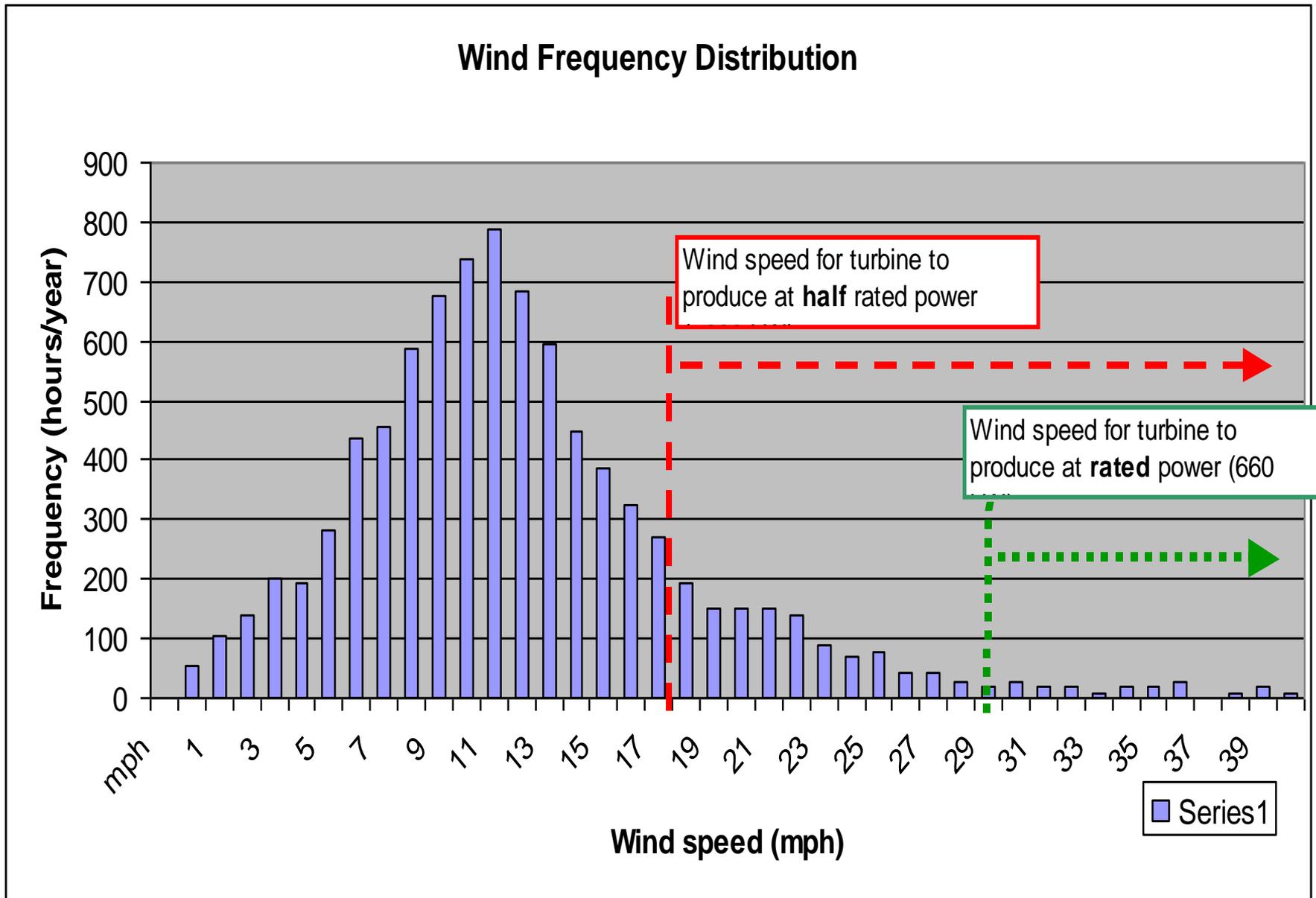
WIND SPEED AT 5 - 7 - 9 M/S		
Annual Energy	2,466,956	kWh/yr
Annual Revenue/turbine	\$148,017	\$/yr/turb
Wind Farm Size	300	MW
Annual Revenue/Farm	\$29,603,471	\$/yr/turb
Increase in Rev/Yr	\$7,066,187	\$/yr/farm
Energy & Rev Increase	31.4%	



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%	



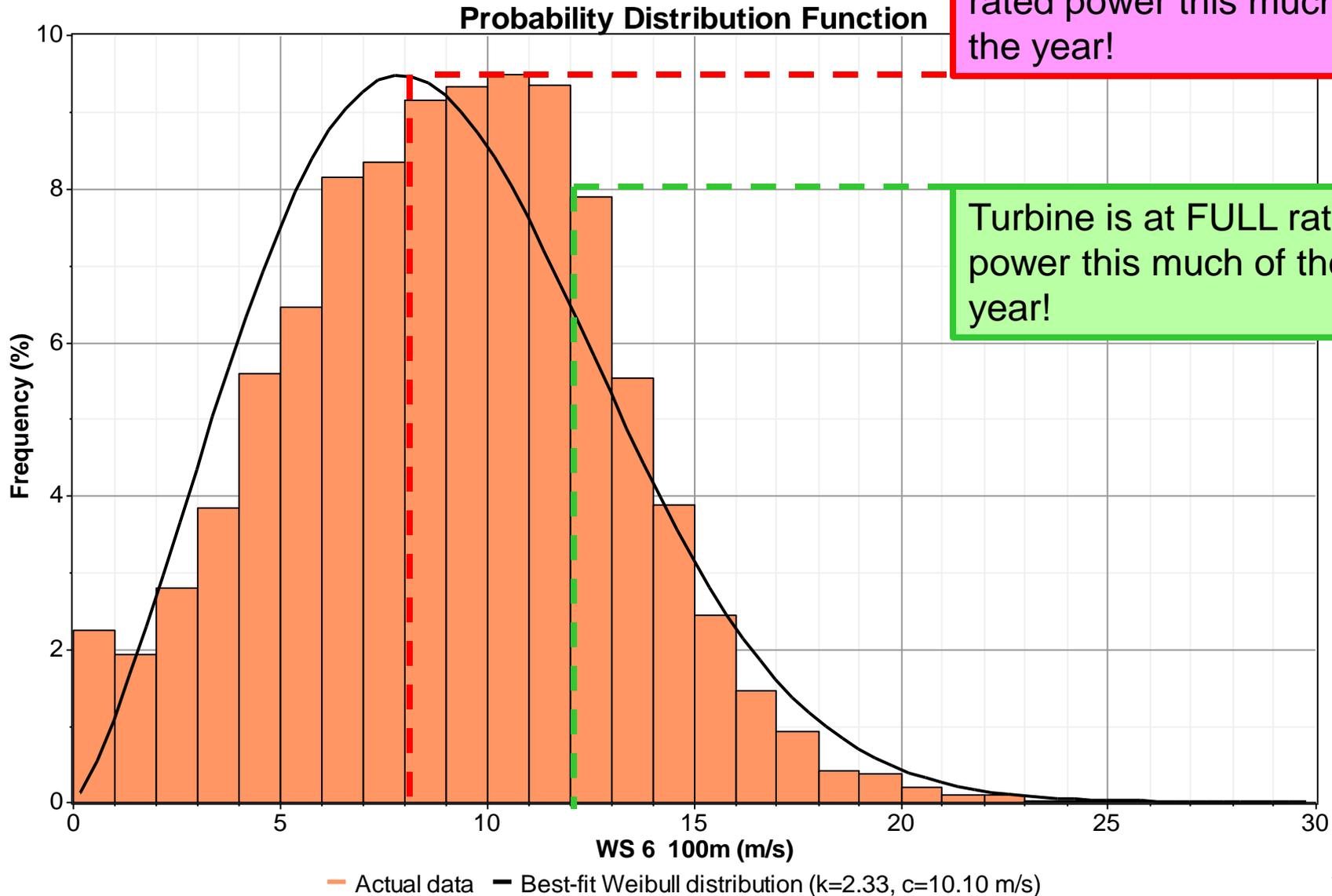
Low Wind Speed Distribution vs.



High Wind Speed Distribution!

Turbine is at least at half of rated power this much of the year!

Turbine is at FULL rated power this much of the year!



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 !

Federal Wind Activities - WEST

Marines – Barstow CA
1.5MW 2008

Navy – Guam –
MET –2009-11

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

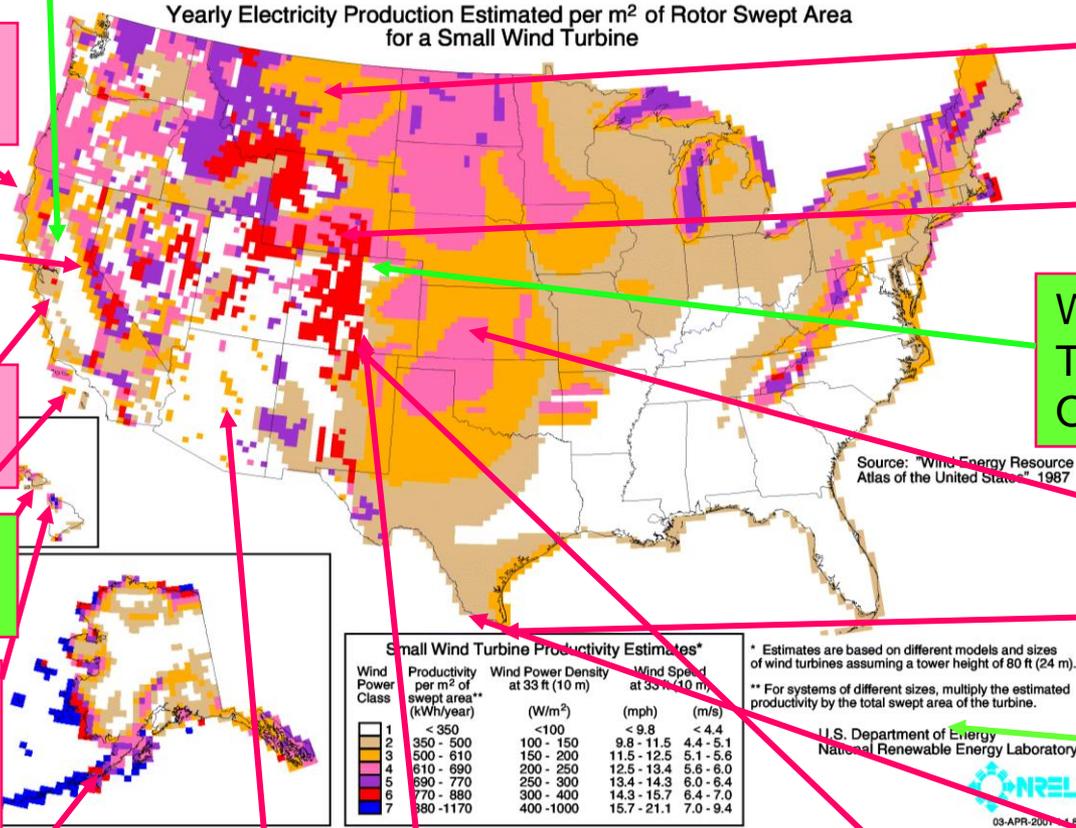
San Clemente
Island – 3 225kW

McConnell AFB KS
MET – 2010-11

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

GSA – Donna TX
MET — 2008-9

USCG – MET
Kodiak AK 2005-8



Sandia NL
2 MET &
SODAR 2008-

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

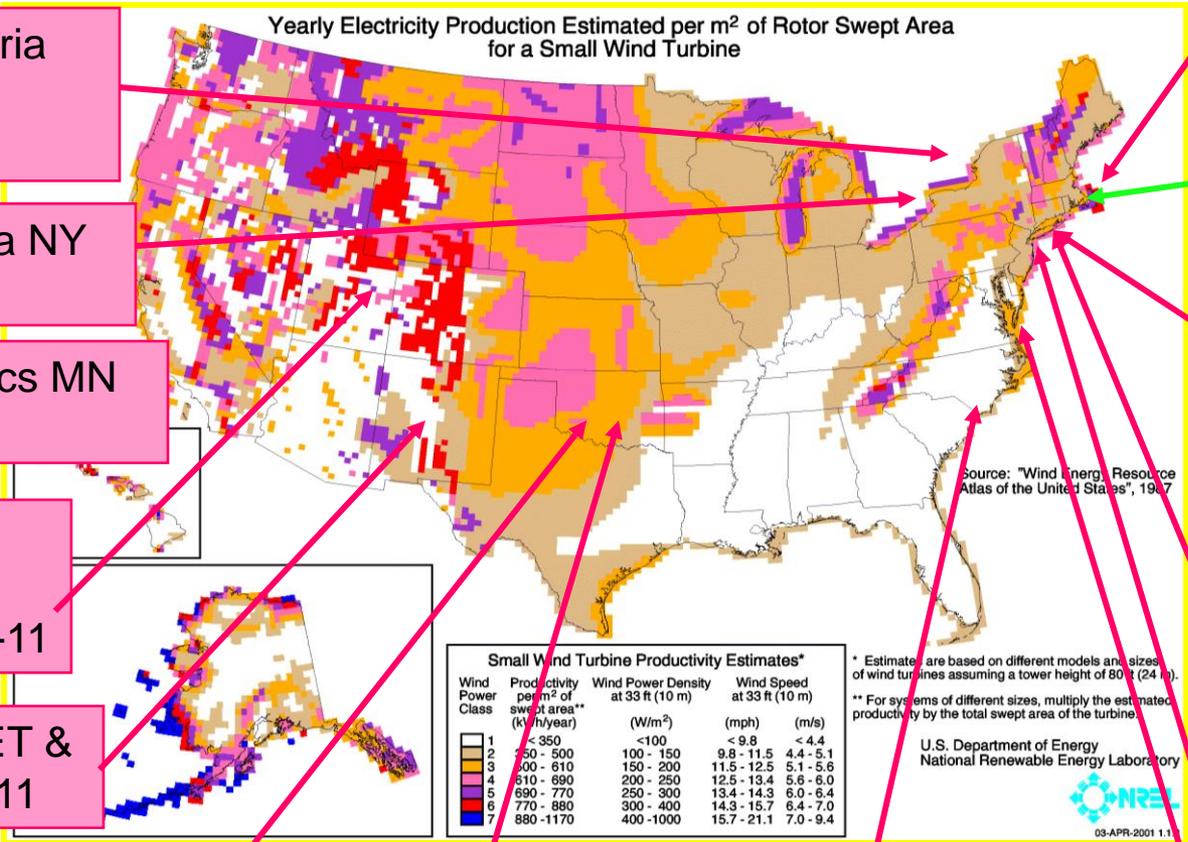
AFCEE Cape Cod
1.5MW turbine 2009

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



2011 Activity - Rawlins Field Office – BLM Rawlins WY



Visual Simulation of Proposed Action

20 kW turbine – 2004

100 kW turbine - 2011

2011 Federal Wind Activity – AFCEE MMR – Cape Cod MA



1.5 MW turbine – 2009

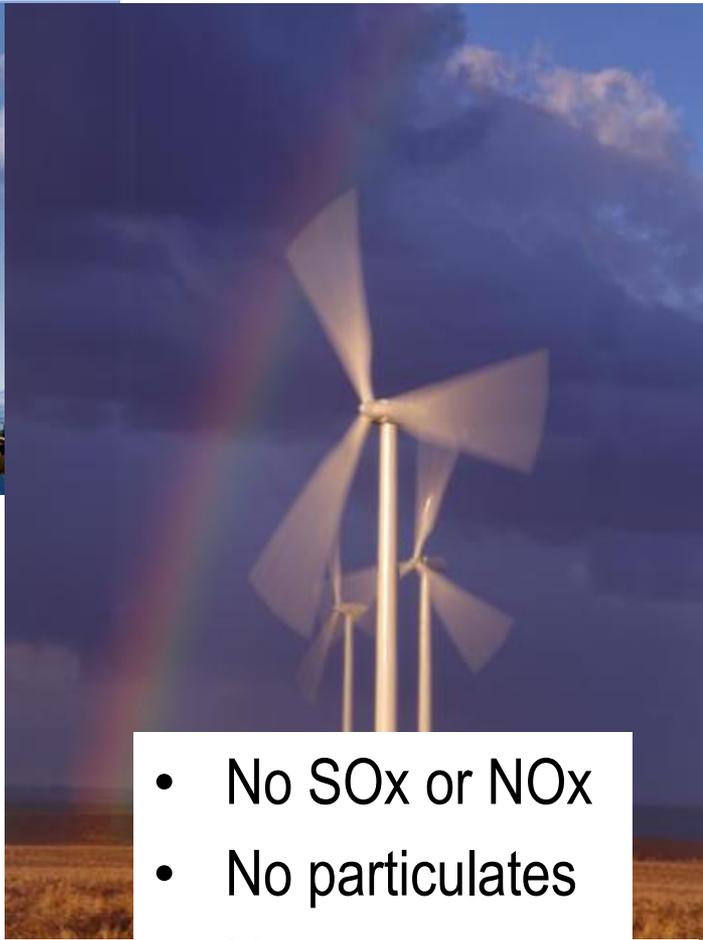
Two 1.5 MW turbines – 2011

Two more 1.5 MW turbines in 2012 !

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 supply chain vulnerability
 - Minimizes exposure to carbon restrictions
 - Improves energy security

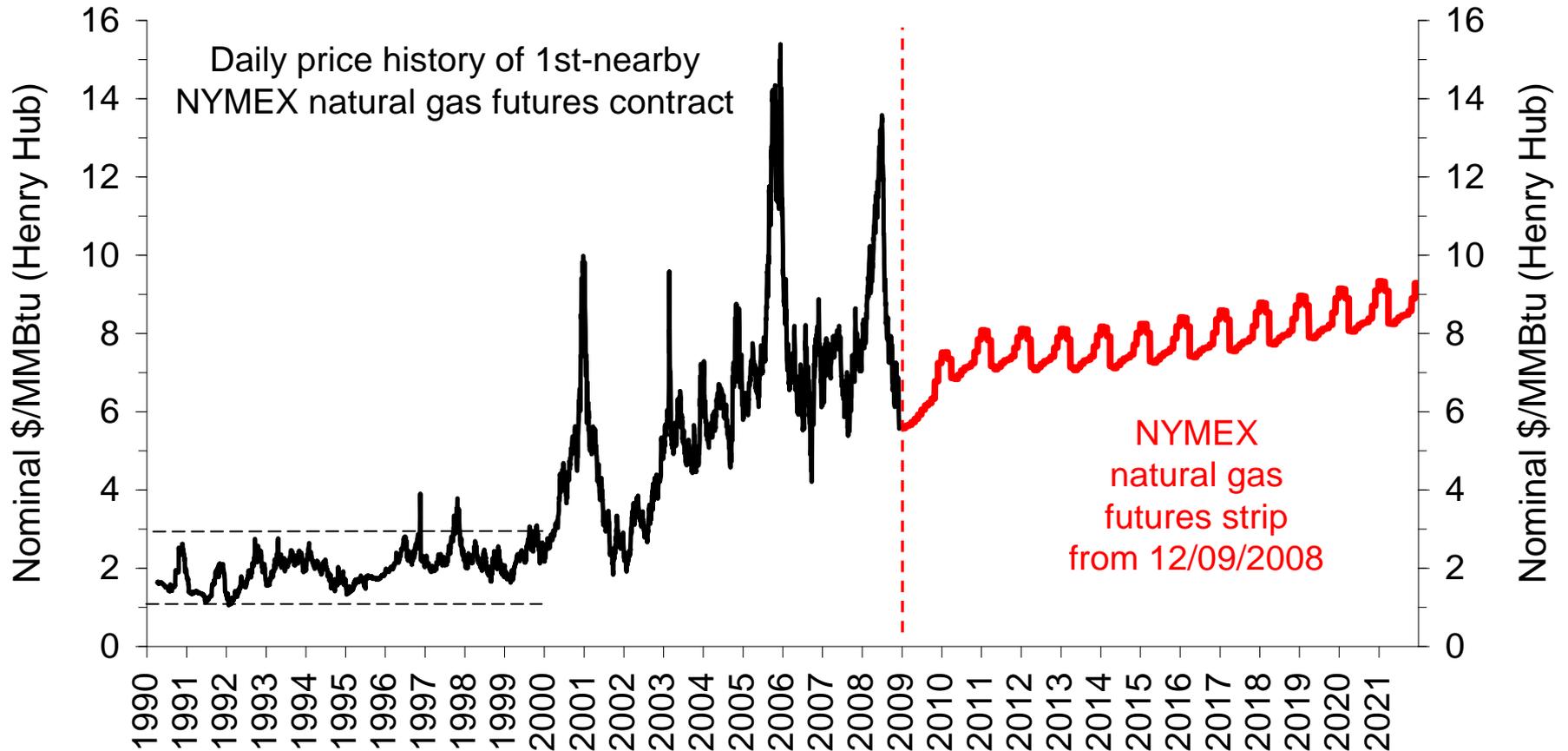
Energy-Water Nexus



- No SO_x or NO_x
- No particulates
- No mercury
- No CO₂
- **No water**

Natural Gas Price Volatility

– Historic Prices vs. Future Prices



Source: LBNL

FED WEATS I & II

3-day Training -- May 2008 - MMR - Cape Cod MA; Feb 2009 – NREL CO
3rd day included Industry Partners – connect Feds to industry

PARTICIPANTS:

- Air Force, Coast Guard, NOAA, Navy, Army National Guard, NPS, NSF, Marines, DESC, VA, FEMP, EPA, BLM, and NASA
- MA, NJ, RI, NC, VA, CO, ME, WY, OH, AK, CA, TX, FL, PR, DC, Japan

FEEDBACK

- The feds need more workshops like this, maybe a course for Federal leadership is in order.
- Excellent job of putting together key speakers with a wealth of knowledge on wind projects.
- Great info, well worth the time - Excellent course, could be a day longer
- Overall, the best collection of well prepared, knowledgeable, dynamic speakers of any conference I've attended.
- "FED-WEATS, is by far the absolute best training available (at essentially no-cost) for Federal employees involved in any way, shape or form, with wind energy projects on or near Federal lands". Bryan Long, Energy Engineer. NFESC
- This was an extremely informative and well organized event.
- Overall rating 4.9 on scale of 1 - 5

Carpe Ventem !!



www.windpoweringamerica.gov

Questions?

For more info:

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

<http://www.windpoweringamerica.gov/>

<http://www.awea.org/>

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

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