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Charting a Course to Energy Independence

Providence, RI
August 9-12, 2009

Federal Wind Energy Update

Andy Walker
Robi Robichaud
National Renewable Energy Laboratory
August 11, 2009

Federal Wind Energy Update

Andy Walker, PHD, PE

National Renewable Energy Laboratory

August 11 , 2009

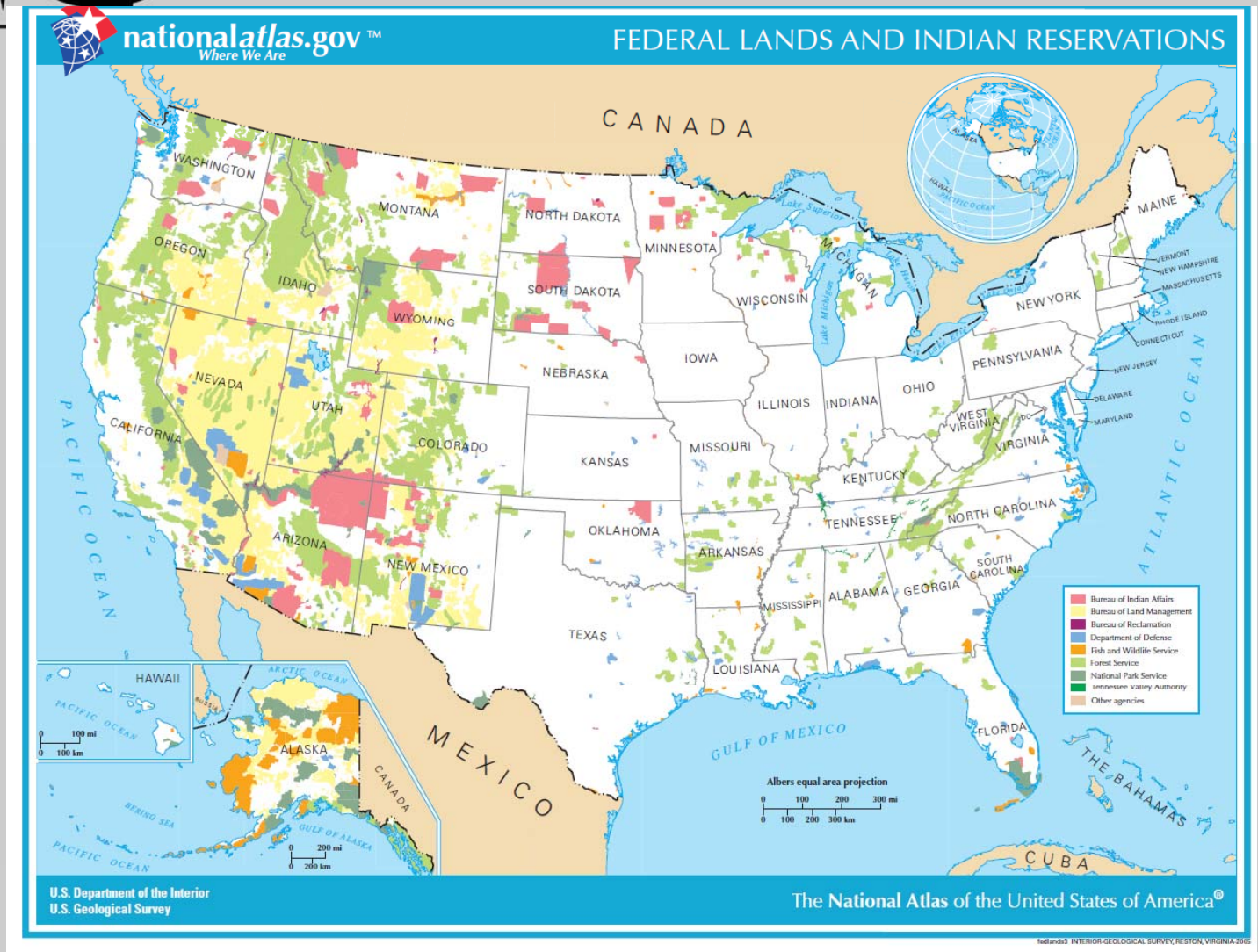
Federal Wind … "State of the Wind"

- The Federal Rules for Feds
- Federal Wind Installed
- Federal Wind Activities
  - Technical Assistance
  - Anemometer Loan Program
  - FED WEATS
- Basic Federal Wind Issues

Legislative Impetus for Federal Wind

- EPAct 2005
  - Federal electricity consumption from RE sources must reach:
    - 3%: FY2007 – FY2009
    - 5%: FY2010 – FY2012
    - 7.5%: 2013 and thereafter
- Executive Order 13423
  - Renewable energy requirements – at least ½ from *new* RE, on-site if possible
- Federal Agency Goal Drivers
  - DOE: 185 GWh/year for 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

Federal Lands - ~30% of U.S.



NOT VISIBLE:

- Many DOD Bases
- Border Stations
- EPA Sites

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Source: http://www.nationalatlas.gov/printable/fedlands.html

Federal Wind Capacity

Federal Wind Sites	# of Turbines	Turbine Size	Wind Plant Capacity	Install Year	Est. Annual Wind Energy
	[#]	[kW]	[kW]	[Year]	[MWh/yr]
San Clemente Island, CA	3	225	675	1998	1,537
Guantanamo Bay, Cuba	4	950	3,800	2005	9,986
Warren Air Force Base, Cheyenne, WY	1	2,000	3,200	2009	9,251
	2	600		2005	
Air Force Ascension Island, St Helena, UK Territory	4	225	2,700	1996	6,623
	2	900		2004	
Victorville Prison, Victorville, CA	1	750	750	2005	1,511
Camp Williams, Riverton, UT	1	225	225	1999	355
	1	660	660	2005	1,041
Fort Huachuca AZ	1	10	10	2002	16
BLM, Rawlins, WY	1	20	20	2006	61
Marine Corps, Barstow, CA	1	1,500	1,500	2008	2,628
Total	**22**		**13,540**		**33,009**

Federal Electric Load: ~55,600 GWh/yr
Federal Wind Energy: ~26 GWh/yr
Fed Wind % of Fed Load: 0.03%
Fed Contribution to US Elec: 0.000001%

Fed Lands Contribute:
43% of coal
32% of fossil fuels

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Federal Wind Activities - WEST

Navy -San Nicholas Island CA – MET towers

Marines – Barstow CA
1.5MW - 2008

Navy– Yokusuka, Japan
MET 2009-10

Air Force Vanderberg AFB – MET towers

Navy – Guam –
MET –2008-9

Army - Fort Irwin CA – MET feasibility proposal

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

Navy San Clemente Island – 3 225kW

GSA – Donna TX
MET — 2008-9

DOD-Hawaii – Pearl City and Kanehoe
2 METs - 2009-10

GSA – MET –
McAllen TX – 2008-9

Navy – multiple bases - 2 METs – Hawaii -2009-10

Guantanamo Bay 4
950kW - 2006

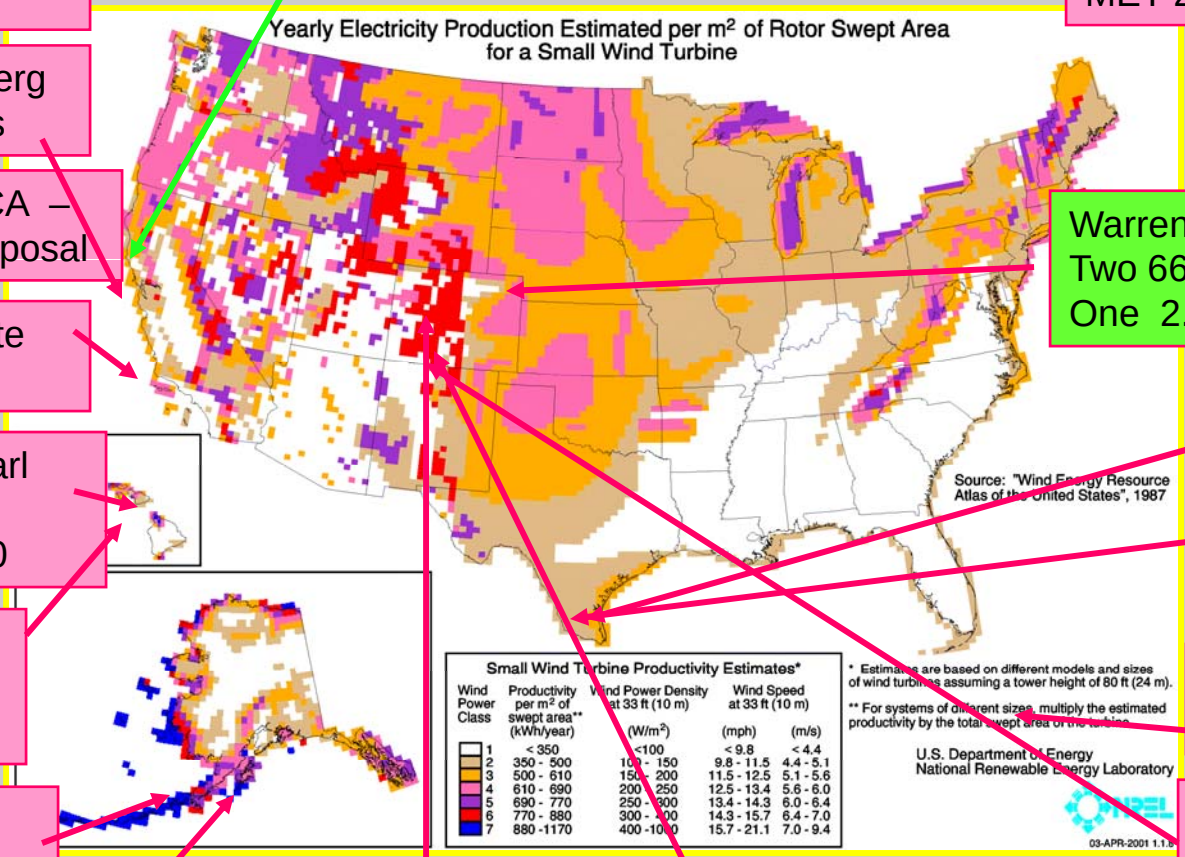
USCG – MET
Kodiak AK 2005-8

Schriever AFB MET -
Colo Spgs CO-2007-8

Fort Richardson – Elmondorf AFB – AK
3 MET towers – 2009-10

DOE - NREL Golden CO
One 1.5 MW – 2009
One 2.3 MW - 2009

Fort Carson, Colorado Springs CO
MET & SODAR - 2008-9



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Federal Wind Activities - EAST

GSA - Alexandria Bay NY
50m MET –2009-10

GSA – Messina NY
50m MET –2009-10

Idaho NL
2 MET & SODAR
2008-9

Sandia NL
2 MET & SODAR 2008-9

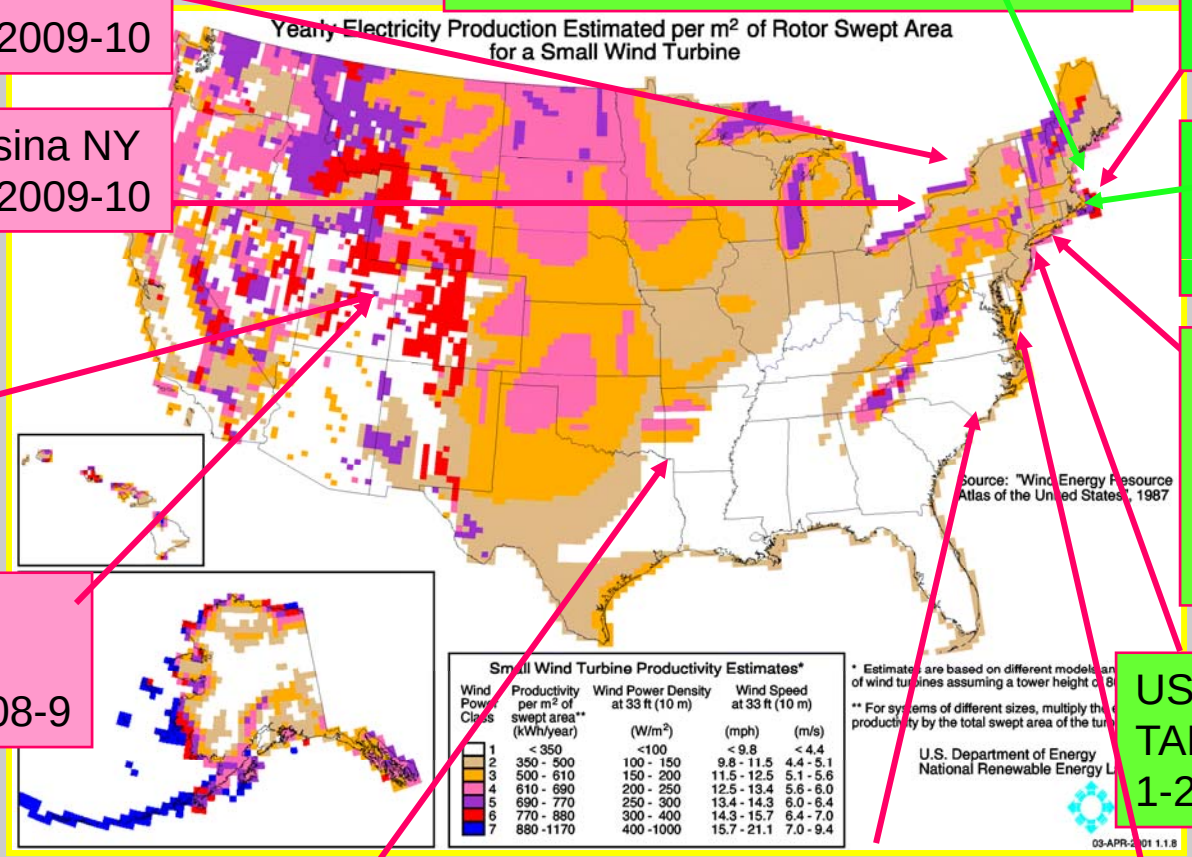
Nat Park Ser – Truro, Cape Cod
MET 2006-7 RFP 2009

Army NG Cape Cod 1-2 600kW turbines–2009-10

AFCEE Cape Cod
1.5MW turbine
2009

Army Nat Guard – Sea Girt NJ
MET & SODAR – 2008
GE 1.5MW - 2010

USCG –Cape May NJ-TALL MET – 2007-9
1-2 1.5MW 2009-10



Altus Air Force Base OK
34m MET –2009-10

NPS, Harkers Island NC
34m MET – 2009-10

NASA – 2006-7
Wallops Island VA
2 1.5MW – 2009-10

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San Clemente Island

3 NEG Micon 225kW

Installed in 1998

Funding Source:

- DOE and FEMP

NREL completed full wind assessment

Technical Assistance

- Provides 17% of the island's electricity
- Annual energy saving of $112,000

Utah Army National Guard
Camp Williams, Utah

Figure Vestas V-47 installation at Camp Williams in May 2005

NREL contracted with Vestas for installation of 660kW Vestas V-47wind turbine

Combined with existing 225kW NEG Micon
Total capacity = 885kW

Figure 2 Newly installed Vestas V-47 660kW wind turbine at left and NEG Micon 225 kW wind turbine at right.

Load:	5.5-6.3 GWh/yr
Wind Energy:	1.1-1.2 GWh/yr
COE:	$0.035/kWh (2004)
Annual Savings:	$40-45k/yr
Payback:	25-30 yrs

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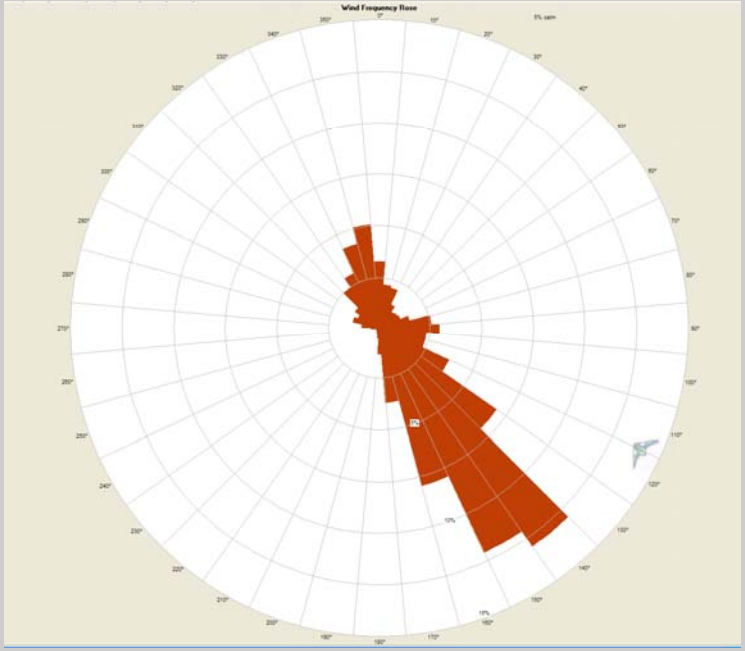
GSA – Border Stations

Anzalduas and Donna TX
Two 50m Met towers installed in Nov 2008

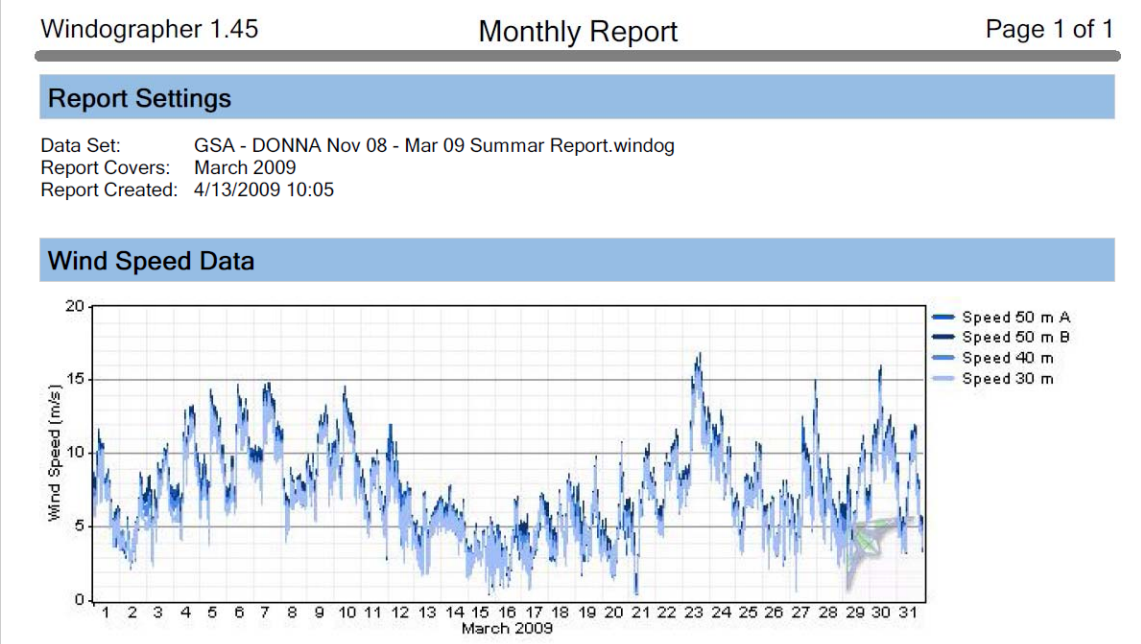
GSA – Donna TX

Monthly Wind Analysis Report

Wind Rose



Wind Speed Profile



Wind Rose shows predominant winds from south by southeast

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Army - Fort Carson CO

Fort Carson – 50m Met tower and Mini-SODAR

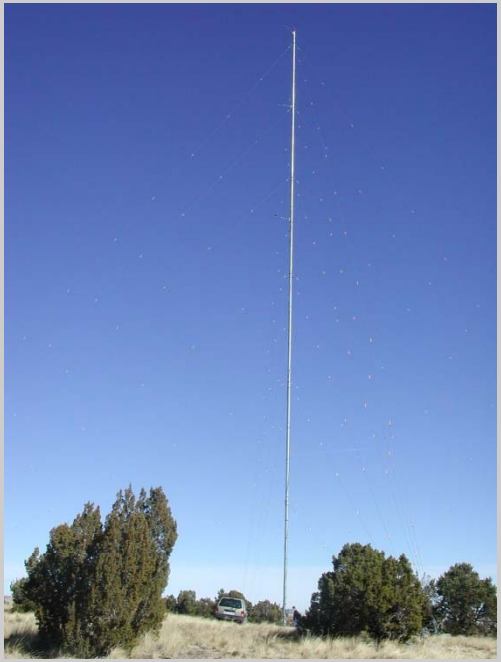
Ft. Carson Summary

Sodar

	40m	50m	60m	70m	80m	90m	100m
Data Points Recov	21193	21175	21078	20834	20398	19768	18909
Ave Spd All Data	5.32	5.65	5.94	6.18	6.40	6.58	6.74
Shear	n/a	0.27	0.27	0.26	0.25	0.25	0.22
Ave Spd January	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ave Spd February	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ave Spd March	5.96	6.37	6.70	7.03	7.33	7.63	7.88
Ave Spd April	6.02	6.42	6.72	7.00	7.26	7.49	7.68
Ave Spd May	6.29	6.69	7.00	7.28	7.50	7.70	7.83
Ave Spd June	4.98	5.29	5.54	5.80	6.00	6.19	6.39
Ave Spd July	4.57	4.84	5.09	5.27	5.41	5.53	5.61
Ave Spd August	4.68	4.98	5.27	5.51	5.71	5.90	6.04
Ave Spd Septemb	4.80	5.08	5.36	5.56	5.75	5.93	6.10

Tower

	30m	40m	50m	50m
Data Points Recov	21193	21193	21193	21193
Ave Spd All Data	5.42	5.72	5.86	5.73
Shear	n/a	0.24	0.13	0.01
Ave Spd January	n/a	n/a	n/a	n/a
Ave Spd February	n/a	n/a	n/a	n/a
Ave Spd March	6.08	6.42	6.60	6.56
Ave Spd April	6.16	6.51	6.66	6.63
Ave Spd May	6.46	6.84	6.97	6.88
Ave Spd June	5.15	5.39	5.52	5.42
Ave Spd July	4.72	4.95	5.13	4.96
Ave Spd August	4.71	4.98	5.13	4.93
Ave Spd Septemb	4.79	5.08	5.20	4.99

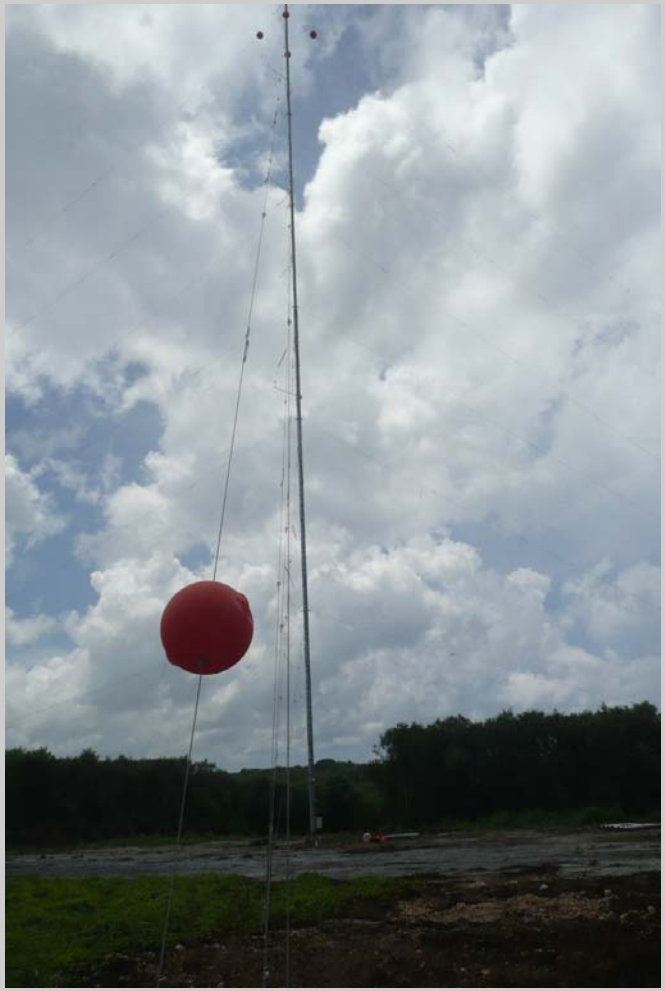


Navy

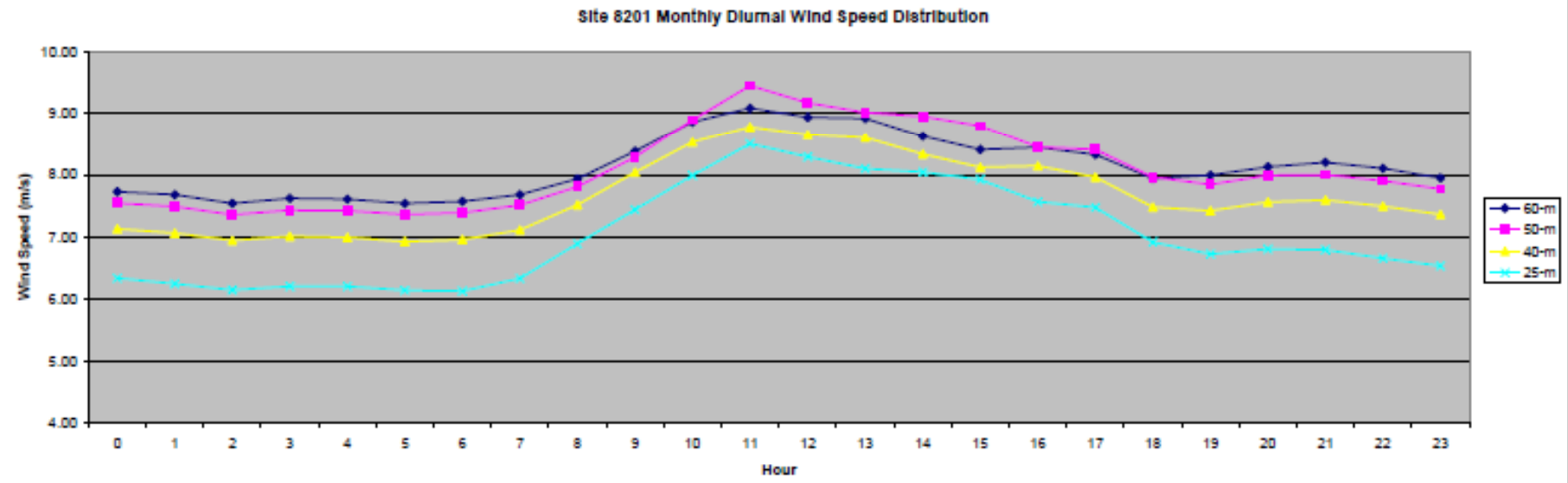
Project Site	FY08-10 Activity
Guam	60m Met
Yokosuka, Japan	60m Met
Okinawa, Japan	60m Met
Hawaii	Two 60m Met
Rota, Spain	80m Met
Newport RI	60m Met & SODAR

Navy - Guam

Guam Met tower site
TOPOGRAPHIC MAP
OF
GUAM
MARIANA ISLANDS

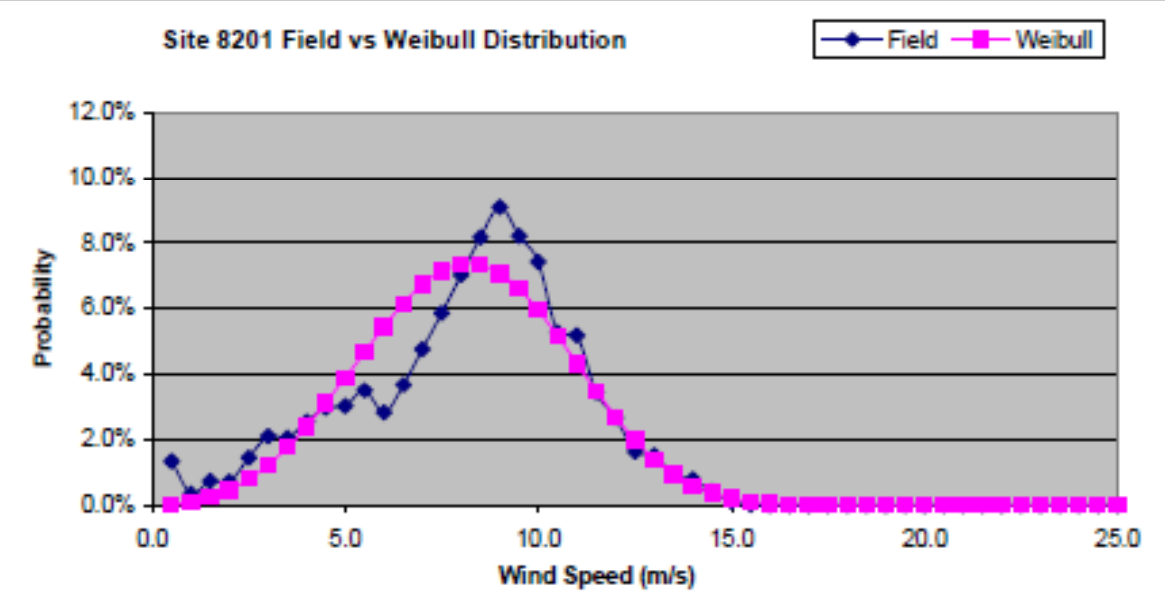


GUAM –
Diurnal Wind Profile & Distribution



Diurnal Wind Speed

Site data
vs.
Weibull Distribution



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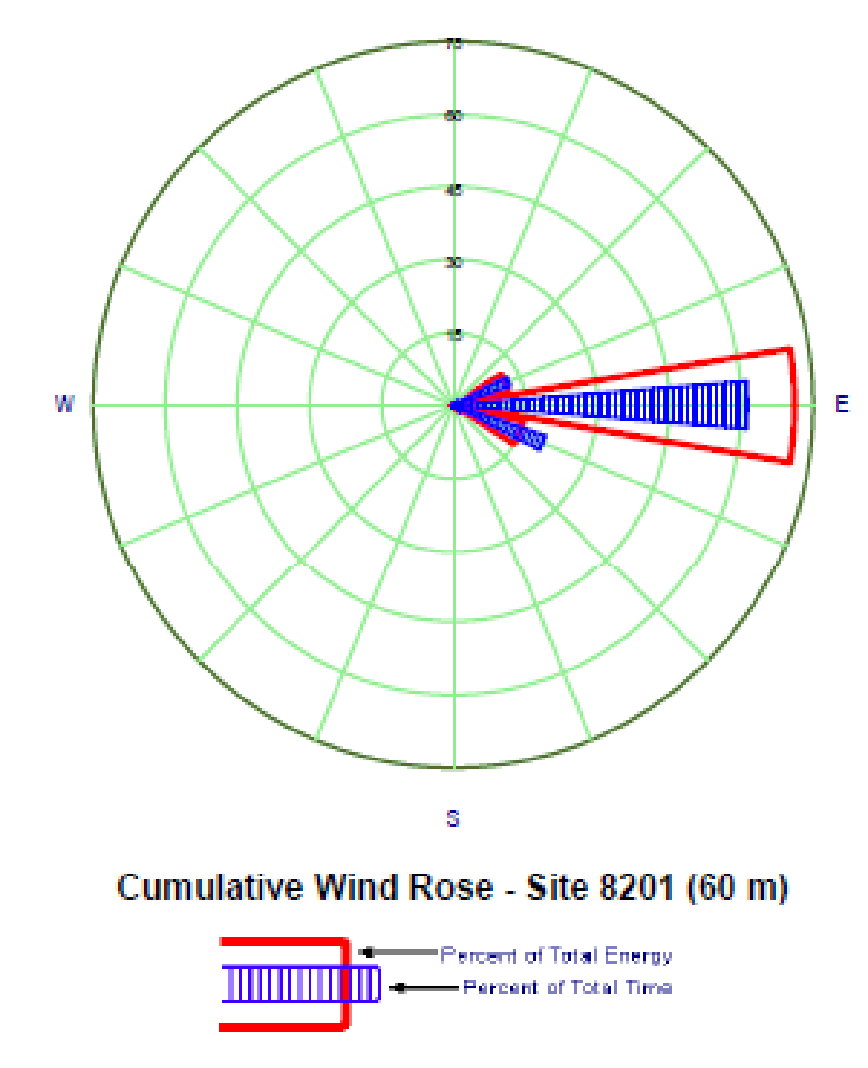
Guam Wind Report - Wind Rose

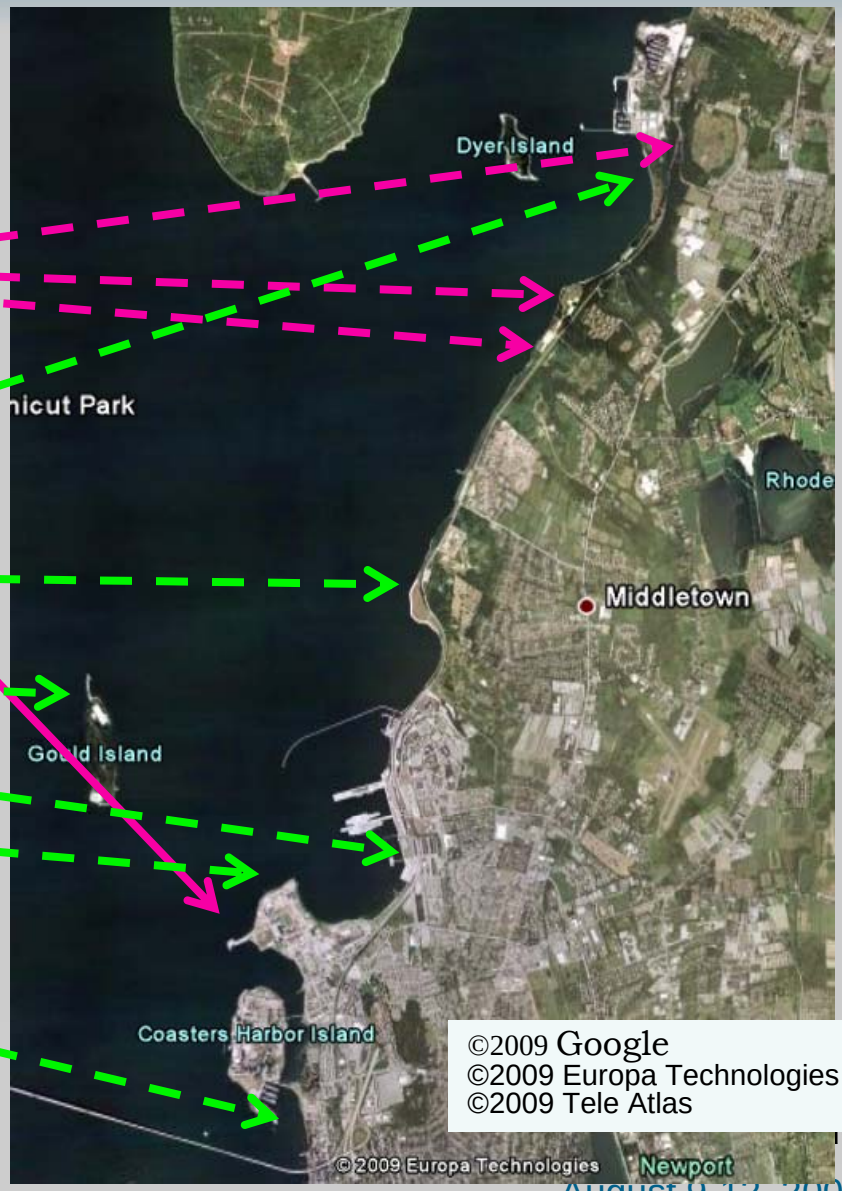


Wind rose profile – the wind only comes from the east!

Navy – Newport
Wind Assessment Area

- **MET tower sites**
- Coddington Point
- Either Tank Farm #4, #3, #2

- **Mini-SODAR sites**
- Tank Farm #4, #3, #2
- McCallister Point
- Gould Island
- Directors Shipyard
- Coddington Cove
- Helipad



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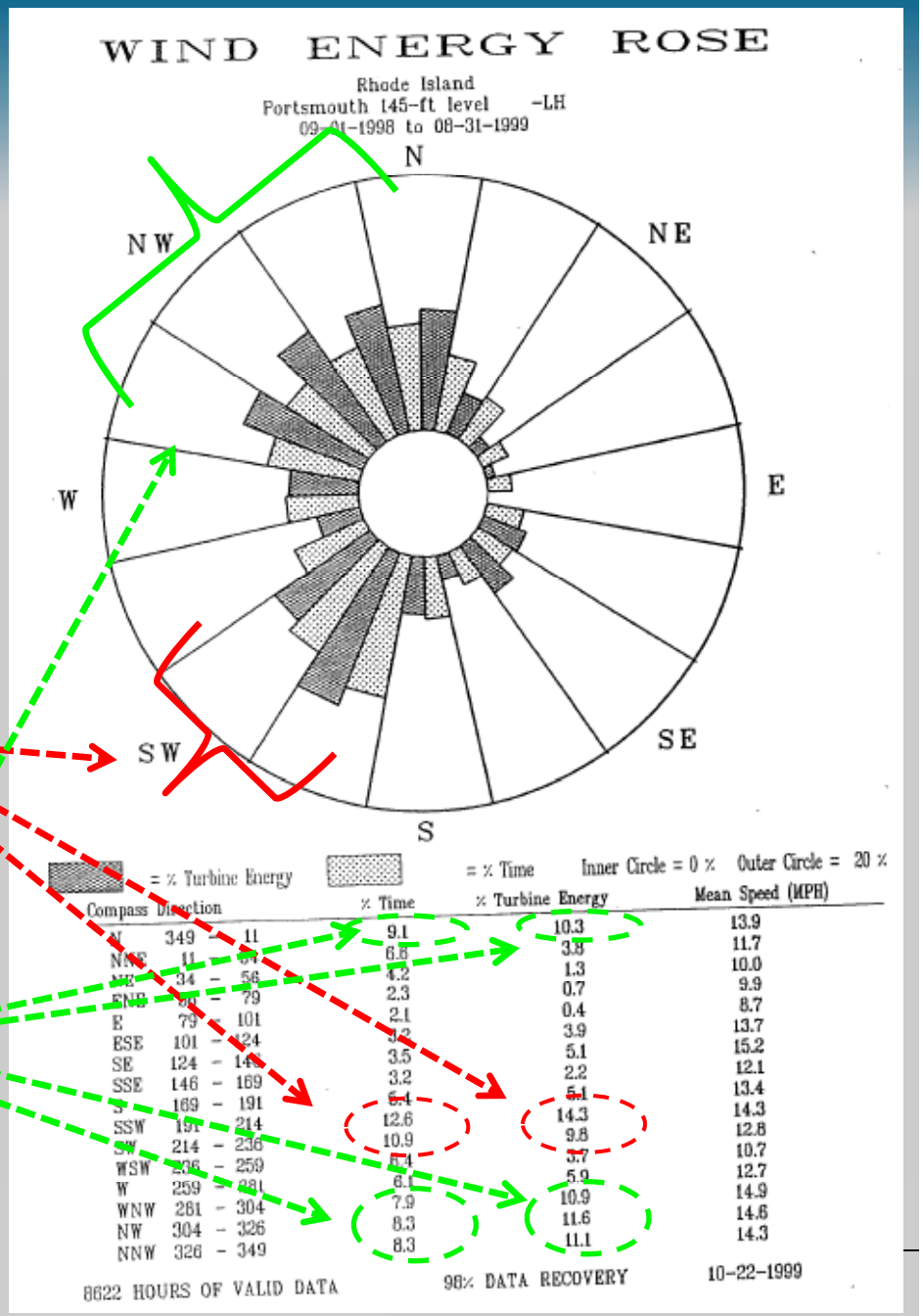
Pre-Site Visit Analysis

Portsmouth wind data
Sept/98 Aug/99

Summer winds - ~SW
23.5% of the time
23.8% of the wind energy

Winter winds - ~NW -> N
33.6% of the time
43.9% of the wind energy



Compass Direction		% Time	% Turbine Energy	Mean Speed (MPH)
N	349 - 11	9.1	10.3	13.9
NNE	11 - 34	6.6	3.8	11.7
NE	34 - 56	4.2	1.3	10.0
ENE	56 - 79	2.3	0.7	9.9
E	79 - 101	2.1	0.4	8.7
ESE	101 - 124	3.2	3.9	13.7
SE	124 - 146	3.5	5.1	15.2
SSE	146 - 169	3.2	2.2	12.1
S	169 - 191	6.4	5.1	13.4
SSW	191 - 214	12.6	14.3	14.3
SW	214 - 236	10.9	9.8	12.8
WSW	236 - 259	5.1	3.7	10.7
W	259 - 281	6.1	5.9	12.7
WNW	281 - 304	7.9	10.9	14.9
NW	304 - 326	8.3	11.6	14.6
NNW	326 - 349	8.3	11.1	14.3

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EPA

Wind Resource Assessments 2009-10
Gilt Edge SD
Anaconda MT

Provided Technical Assistance analysis - Eureka UT
Valley looks like natural “funnel” – why not more wind??

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BLM

Provide Technical Assistance to BLM Field Offices for Wind Resource Assessments applications from private sector:

- Prineville OR
- Searchlight NV
- Kemerer WY

NREL hosted BLM Field Managers for wind training in ~2004

BLM – Rawlins WY Field Office

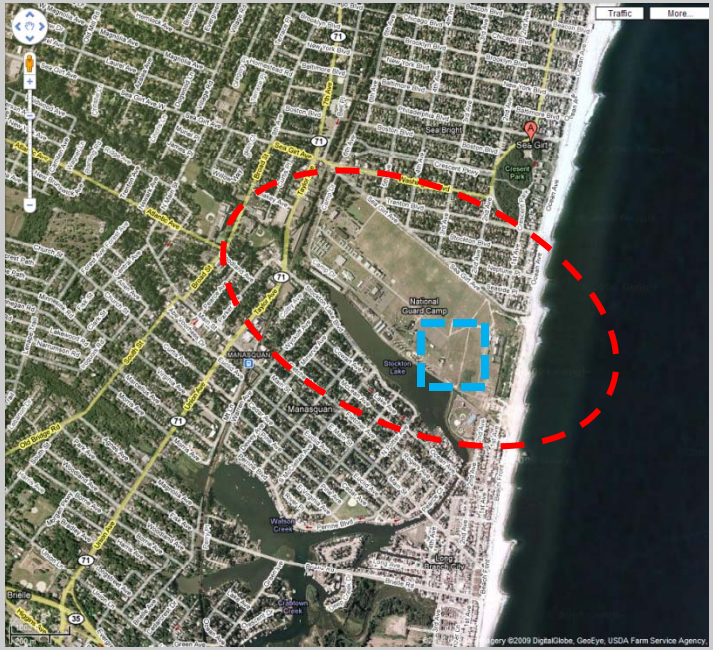
Rawlins Field Office
– TA for large proposed project
•How much wind it "too much"
•What will be the impacts on wildlife and recreation?

BLM installed 20kW wind turbine at Rawlins Field Office in 2006

National Guard - Sea Girt NJ

- Provided presentation and facts on wind turbines in public kick-off meeting between state officials, environmental interests, officials of bordering towns, National Guard

- Technical Assistance on Met tower and SODAR siting



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National Park Service

Technical Assistance for Truro MA Training Facility
Class 4 wind site – probably best on-shore in MA

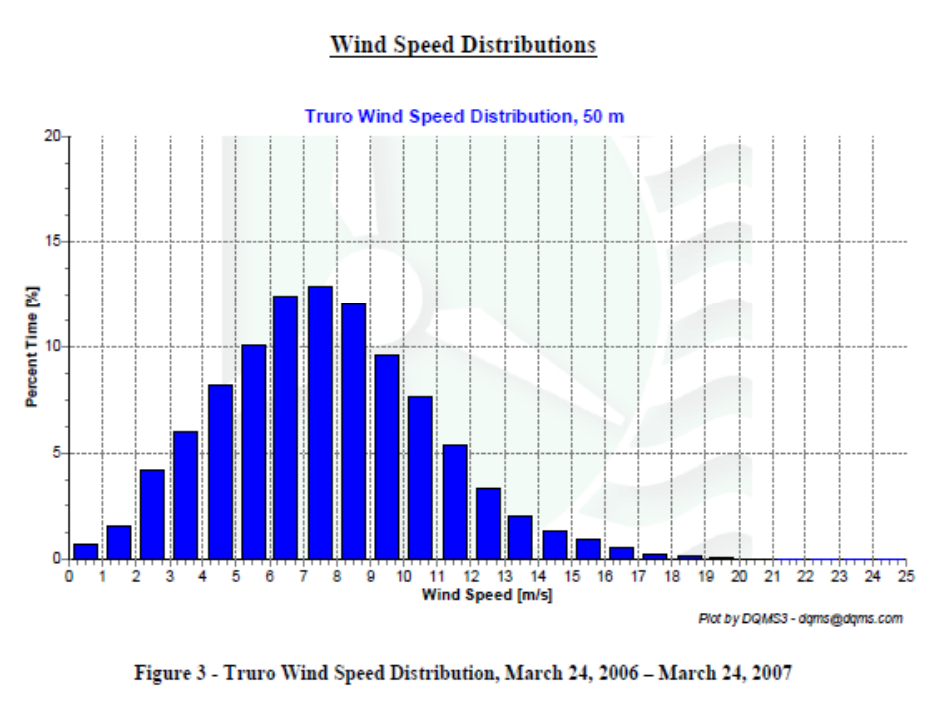

Figure 3 - Truro Wind Speed Distribution, March 24, 2006 – March 24, 2007

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USCG – Cape May NJ

105m Tower

Anemometers at 97, 74, 44, 30 m

Complex flow regimes – lattice tower

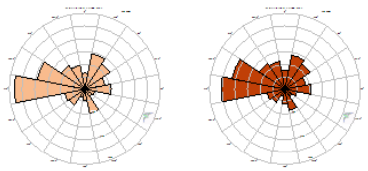


Figure 6 Wind frequency rose by direction for May 2008 at 30.2m (left) and 44.5m (right).

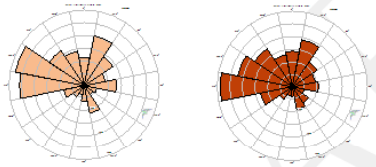


Figure 7 Wind frequency rose by direction for May 2008 at 74.4m (left) and 96.9m (right).

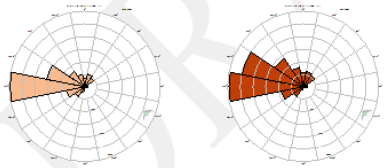


Figure 8 Wind frequency rose by direction for July 2008 at 30.2m (left) and 44.5m (right).

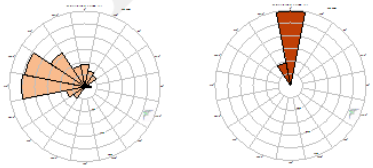
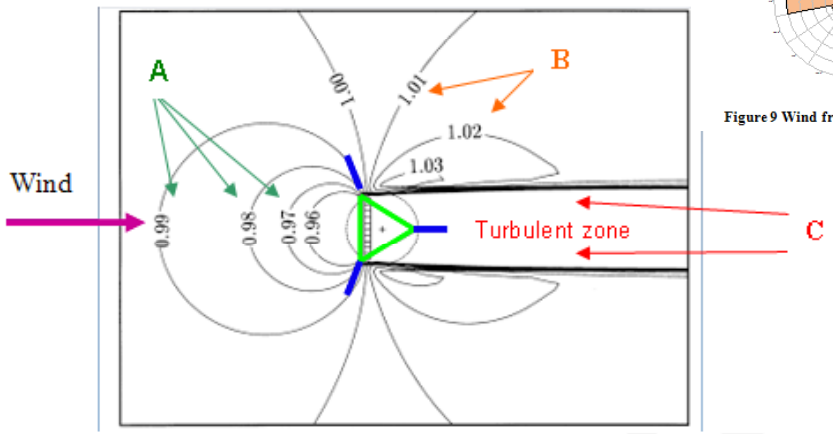


Figure 9 Wind frequency rose by direction for July 2008 at 74.4m (left) and 96.9m (right).

DRAFT



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Federal Anemometer Loan Program

20m MET towers – USCG 3 sites on Kodiak Island

50m MET towers
- **Army – Fort Carson**
- **Idaho National Lab**
- **Sandia National Lab**

34m MET towers
- **NPS – Cape Lookout, SC**
- **Altus AFB, OK**

Mini- SODAR
Army – Fort Carson
FY09-10 – Navy – Newport RI
GSA – Alexandria Bay and Massena NY

ESPC Proposal Review

Guantanamo Bay

Four 950kW wind turbines
Projected at 25% of load
$3.2 mil annual savings
14 yr payback

Funding source: ESPC

Victorville Prison

750kW turbine
Projected 8% of load

Funding source: ESPC

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FED WEATS I

- 3-day Training - Federal Energy Managers, Engineers
- 3rd day includes Industry Partners – connect Feds to industry
- May 2008 - MMR – Cape Cod MA
- Air Force, Coast Guard, NOAA, Navy, Army National Guard, NPS, NSF, and NASA from MA, NJ, RI, NC, VA, CO, ME, OH, AK, PR, DC
- **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.
  - This was an extremely informative and well organized event.

FED WEATS II

- 3-day Training - Federal Energy Managers, Engineers,…
- 3rd day includes Industry Partners – connect Feds to industry
- February 2009 - NREL – Golden CO
- Marine Corps, GSA, Navy, DESC, NOAA, BLM, VA, Air National Guard, FEMP, Air Force, EPA, Army from MA, WY, HI, VA, CA, TX, FL, CO, DC, Japan
- FEEDBACK
  - "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
  - Overall rating 4.9 on scale of 1 - 5

The Wind Development Process

- **Site Selection**
- Land Agreements
- **Wind Assessment**
- **Environmental Review**
- **Economic Modeling**
- **Interconnection Studies**
- **Permitting**
- **Financing**
- **Sales Agreements**
- **Turbine Procurement**
- **Construction Contracting**
- **Operations & Maintenance**

Federal Issues

- Site assessment – not necessarily windy
  - Project economics – long paybacks
  - Smaller turbines make economics more challening
- Timeline for project – funding must be obligated in 1 or 2 fiscal years
  - NEPA delays
  - Wind assessment delays
  - Management approval delays
- Funding sources
  - Project funding – not always resource assessment funding
  - Restrictive timelines
- Wind turbine availability issues
- Height restrictions – mission conflicts, neighbor sensitivity
- Existing contracts with utility – long term agreements in place

Site Assessment

- Basic steps to select a site:
  - Prospecting – evidence of significant wind
  - Transmission/distribution lines?
  - Road access?
  - Environmental concerns?
  - Receptive community?

Wind Assessment

- Siting MET tower(s)
  - As close to turbine location as possible
  - As close to turbine height as possible/affordable

- Correlation to long term wind data

Site estimated production: 100,000 kWh/yr

+/- 15% variation in wind:

Annual production: 61,000 kWh/yr

Or 150,000 kWh/yr

NEPA

Must be addressed every time

– can be costly and time consuming - BUT IT IS NECESSARY

Permitting

- Local, State and Federal rules/laws may apply
- FAA – apply for permit for MET tower and wind turbine
- Public land vs. Private land – different issues and development costs and timelines
- Land Use Permit
- Building Permit

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

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

Funding Sources for Feds

- **Energy Savings Performance Contracting (ESPC) – high transaction cost (mark-up)**

- **Utility Energy Service Contracting (UESC) – need a cooperating utility with wind interest**

Carpe Ventem

www.windpoweringamerica.gov

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