



• August 15-18, 2010 • Dallas, Texas •
• Dallas Convention Center •



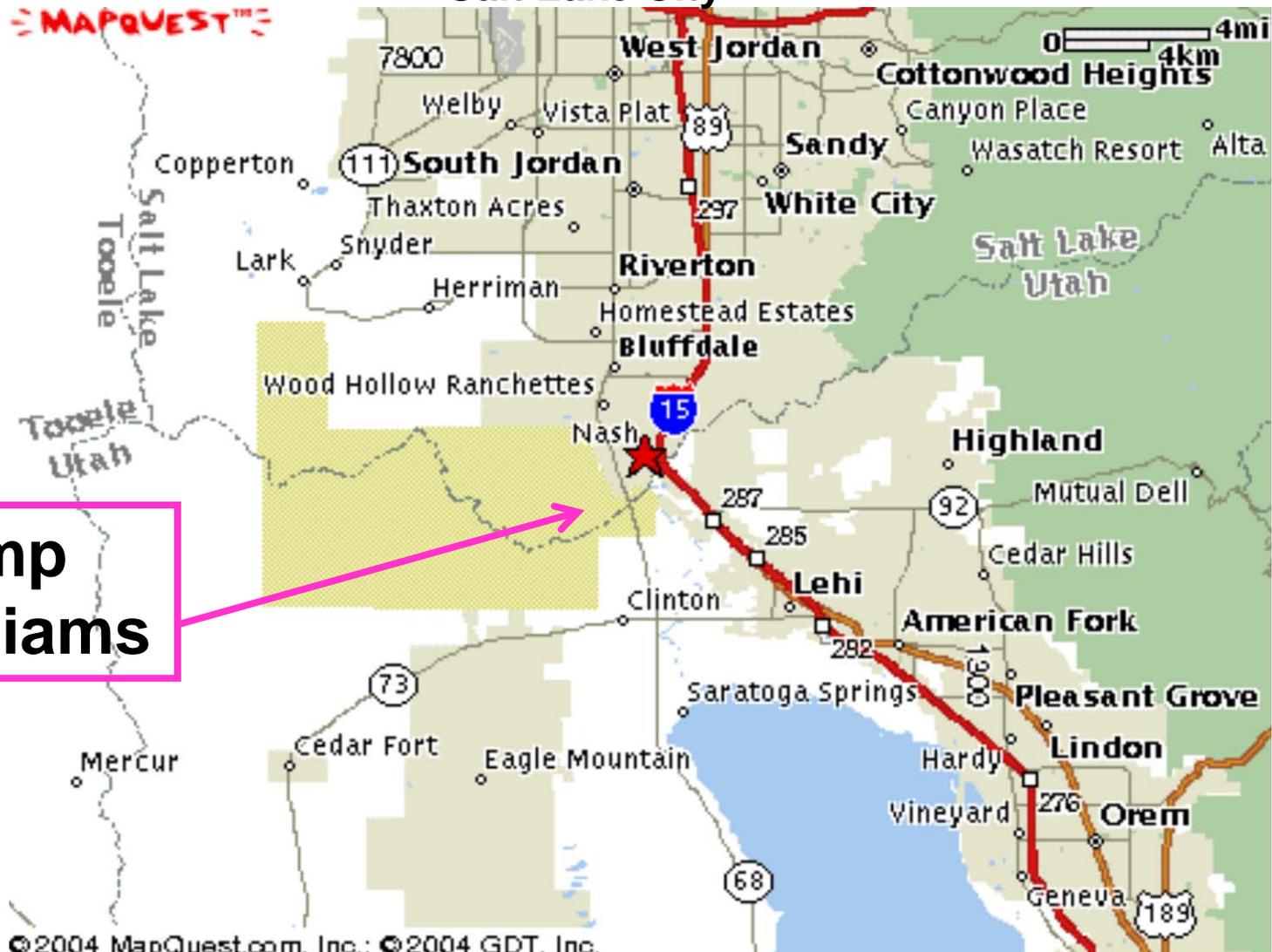
Camp Williams Wind Turbine Project
Robi Robichaud - NREL

Camp Williams Topic Outline

- Camp Williams Army National Guard Site
 - 1st Wind Turbine
 - 2nd Wind Turbine
- Site/Wind Assessment
- Electric Load
- Permitting – NEPA, FERC, Electrical, FAA, DoD
- RFP
- Construction
- Lessons Learned

Camp Williams – Riverton, Utah

Salt Lake City



Camp Williams

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GovEnergy 2010

CAMP WILLIAMS – “THE CHALLENGE”

There was no reliable wind data, only:
Simple hard copy summary report

The existing turbine – NEC Micon 225kW - had never worked well – so Camp Williams wanted NREL to purchase and install the new turbine and get the existing turbine operational

The ECIP funds were already sent via MIPR to DOE

NREL is not a “Defense lab” – do not normally take in MIPRs nor purchase wind turbines for anyone

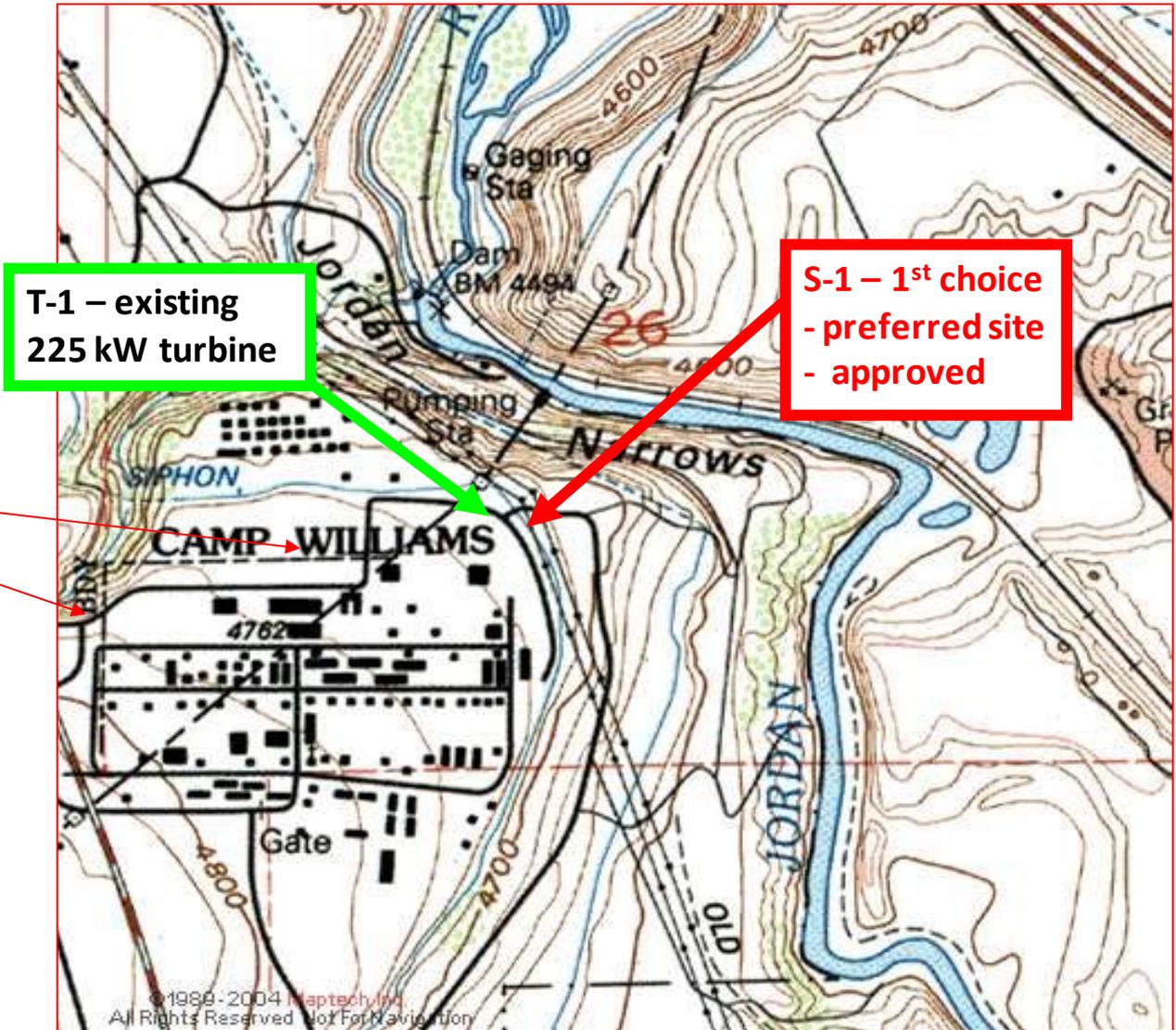
Camp Williams – Riverton UT

Proposed siting
for turbine:

S-1 – preferred
site – approved

T-1 – existing
225 kW turbine

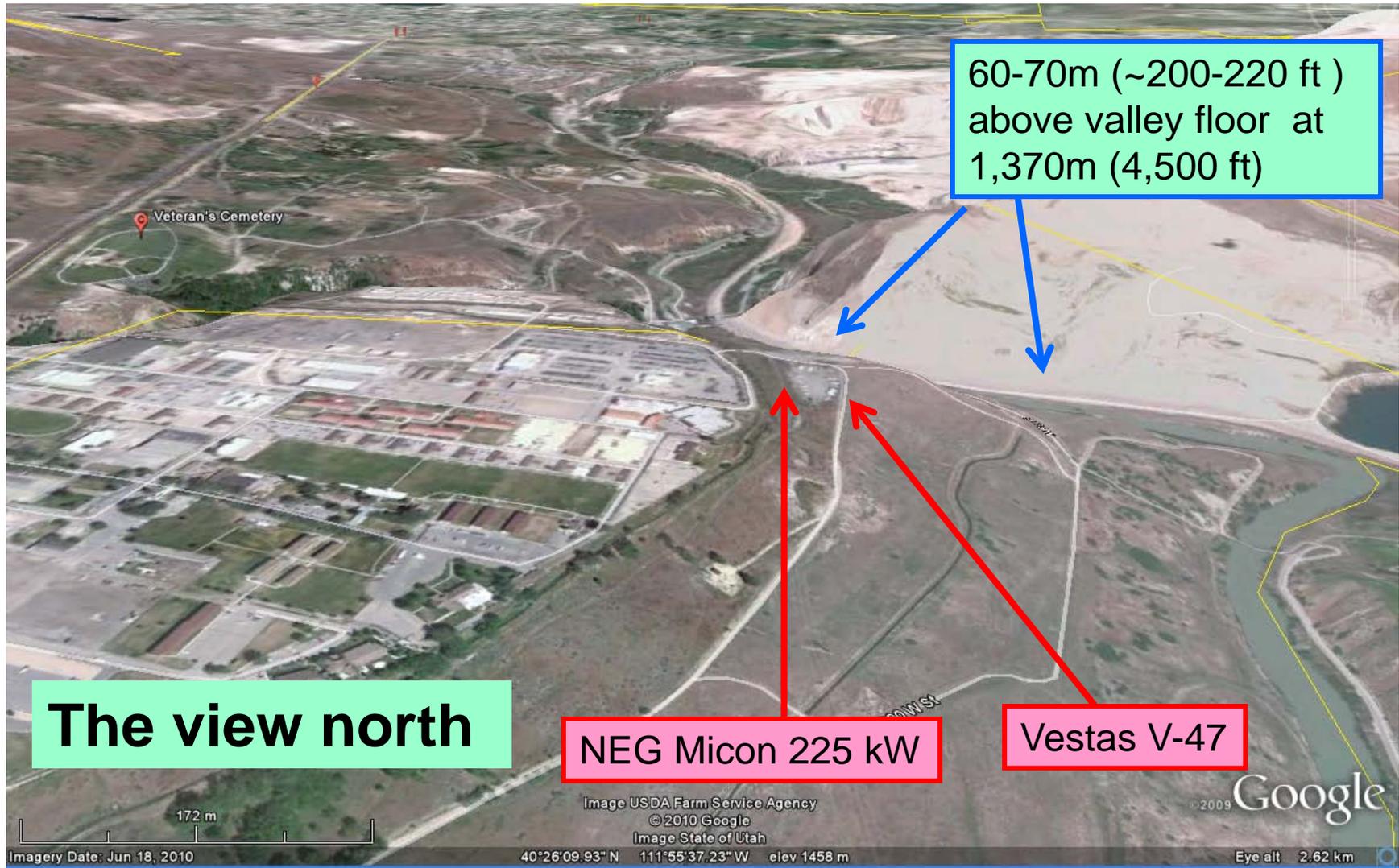
Black lines are
existing roads



T-1 – existing
225 kW turbine

S-1 – 1st choice
- preferred site
- approved

Camp Williams - Topography

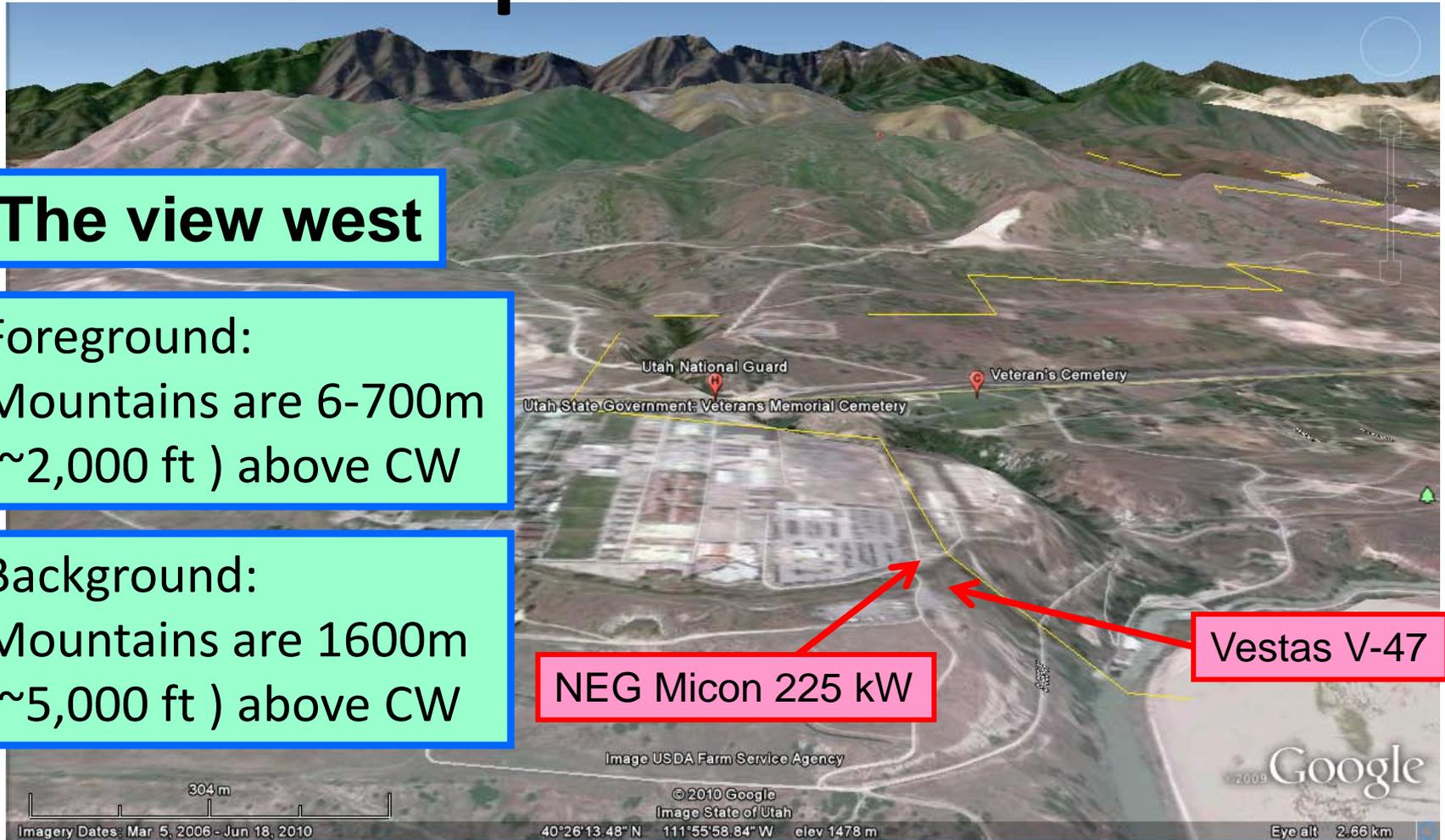


Topography (cont.) - The “Impediment” to Wind

The view west

Foreground:
Mountains are 6-700m
(~2,000 ft) above CW

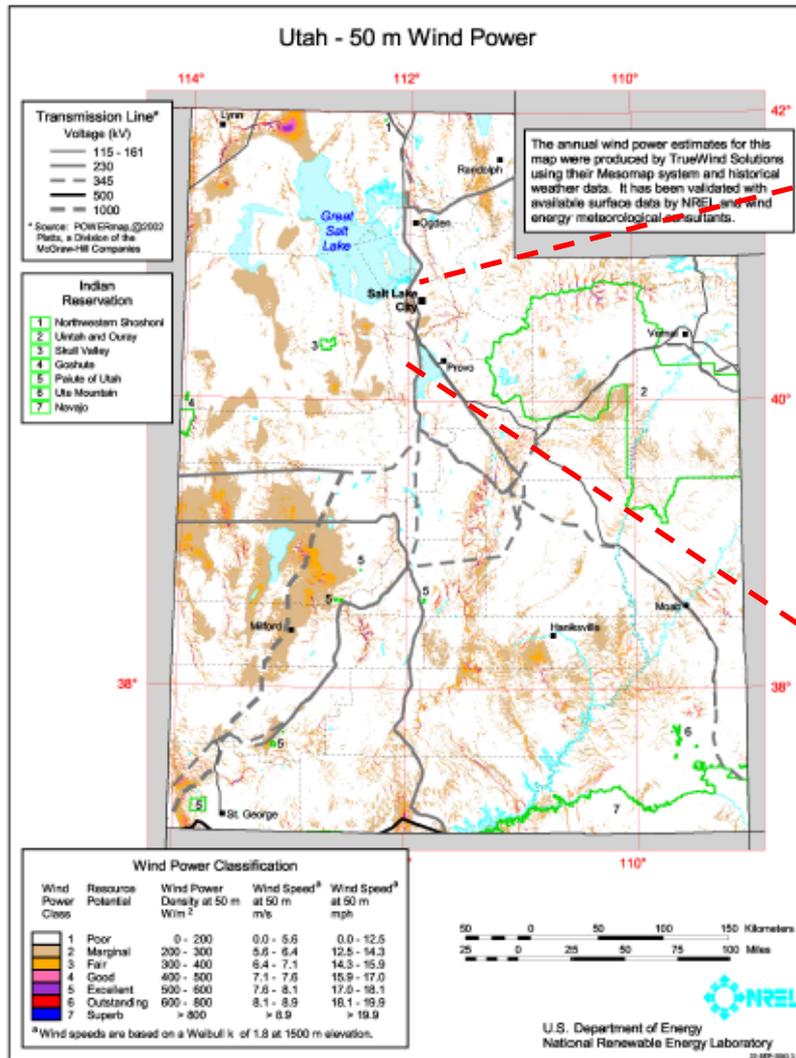
Background:
Mountains are 1600m
(~5,000 ft) above CW



Existing NEG Micon 225kW January 2004 Site Visit



Utah State Wind Map at 50m



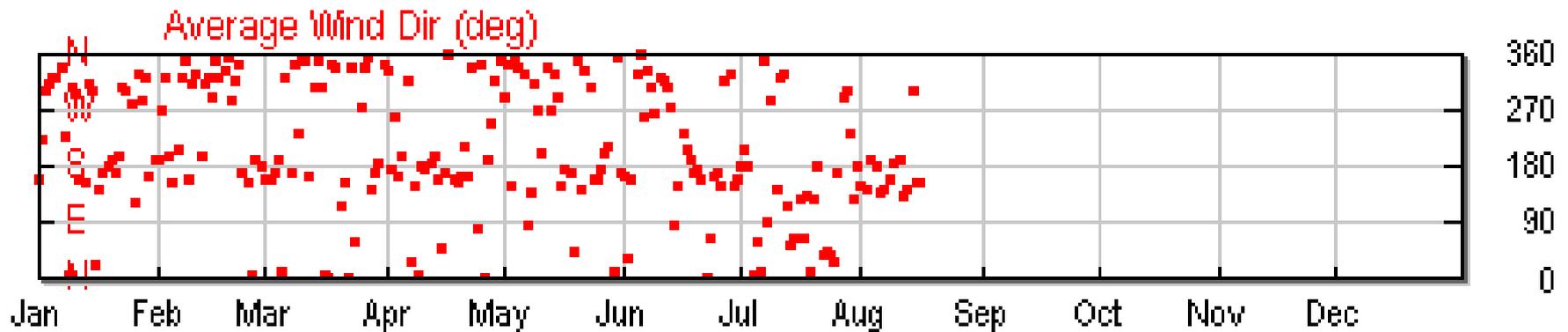
The annual wind power estimates for this map were produced by TrueWind Solutions using their Mesomap system and historical weather data. It has been validated with available surface data by NREL and wind energy meteorological consultants.



WeatherUnderground

Herriman UT

Wind Direction Data ~5 mi away



Utah State Wind Map at 80m

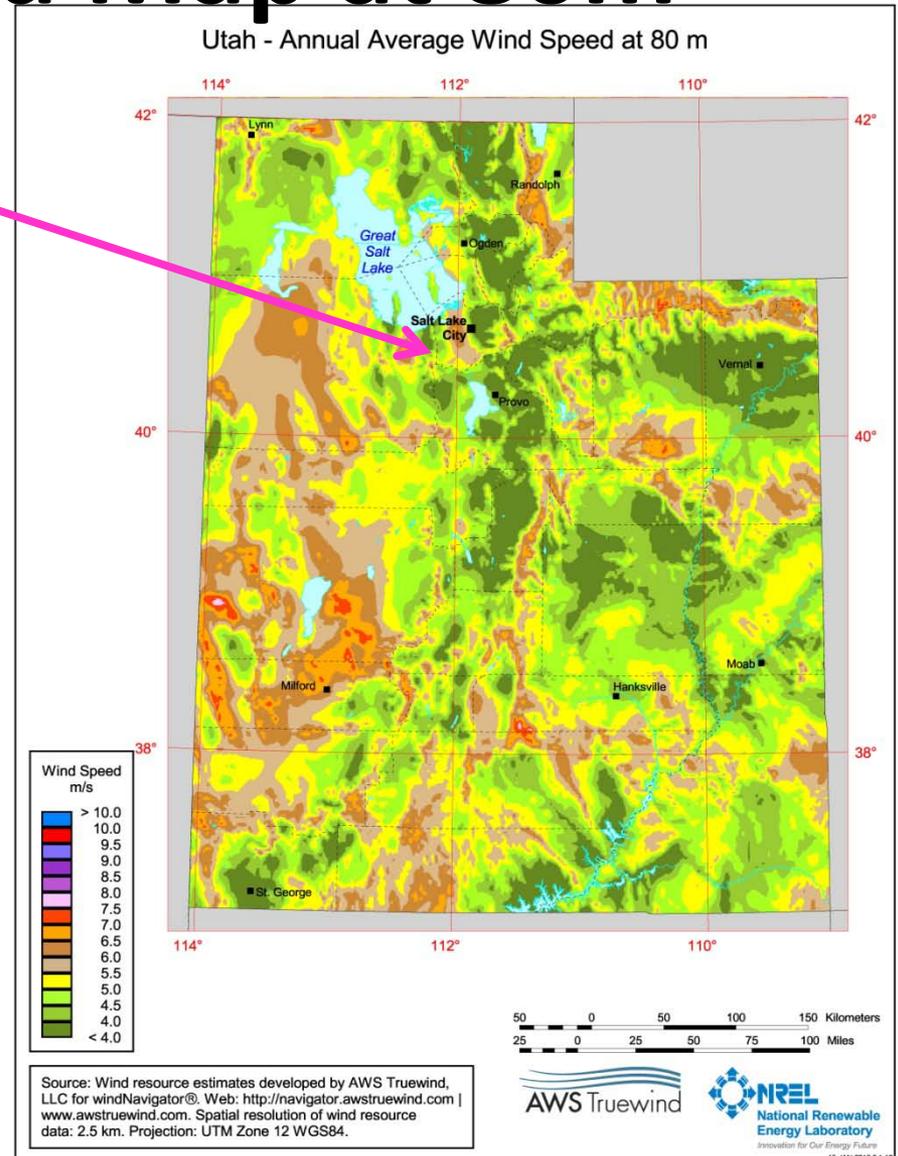
Camp Williams

Q: What does the wind map tell us?

- Not a particularly windy site.
- Orientation is important – some north-south wind corridors.

Q: What does the wind map NOT tell us?

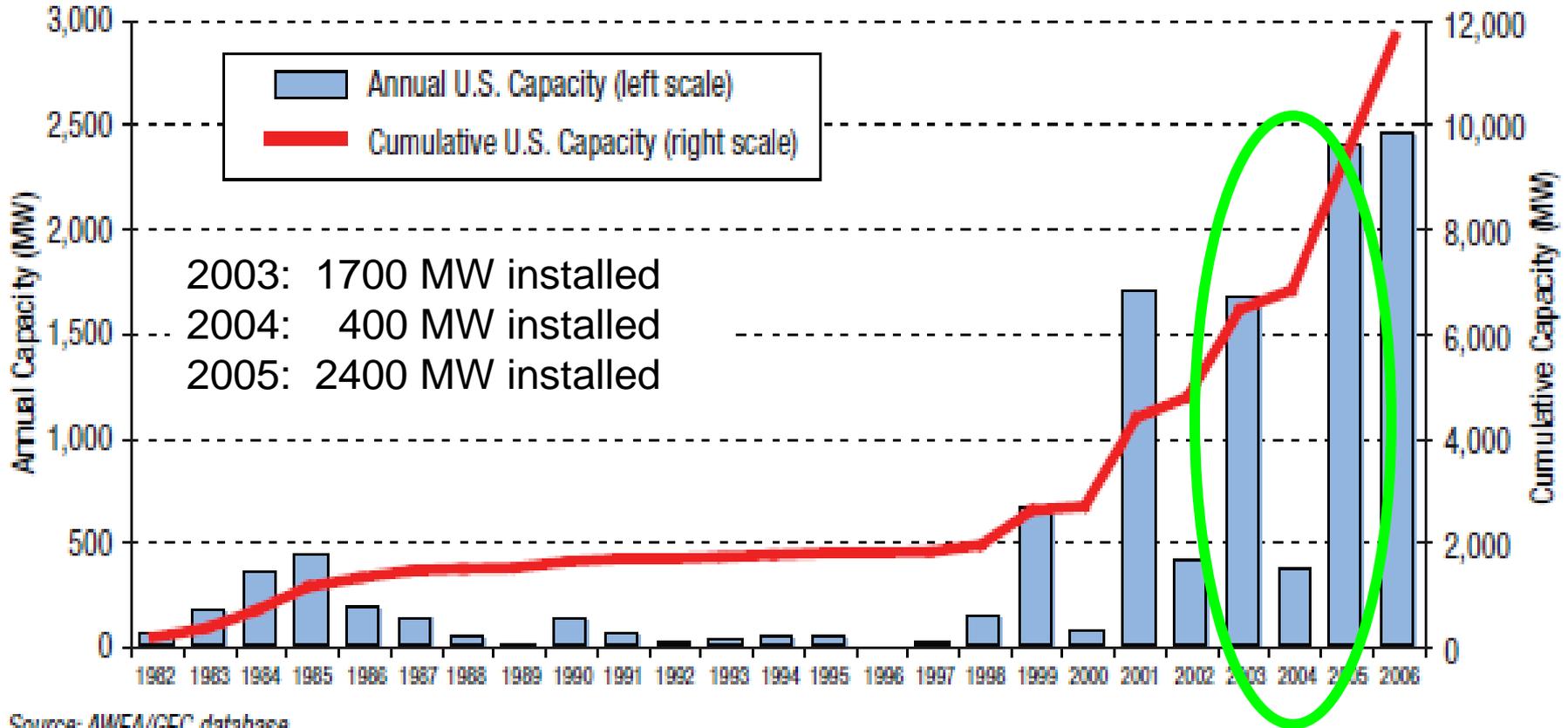
- Which direction the wind blows.
- What the wind speed frequency distribution is.



Request for Proposals (RFP)

- Was told there were reputable companies ready to do this project (while PTC was NOT in place)
- \$700K RFP – one bid – unrealistic – fell through no other bids
- Regroup – request more ECIP funds
- \$750K – no bids
- Call individual companies
- Settle price without transformer connection, underground distribution, electrical interconnection

WIND MARKET AT RFP TIME



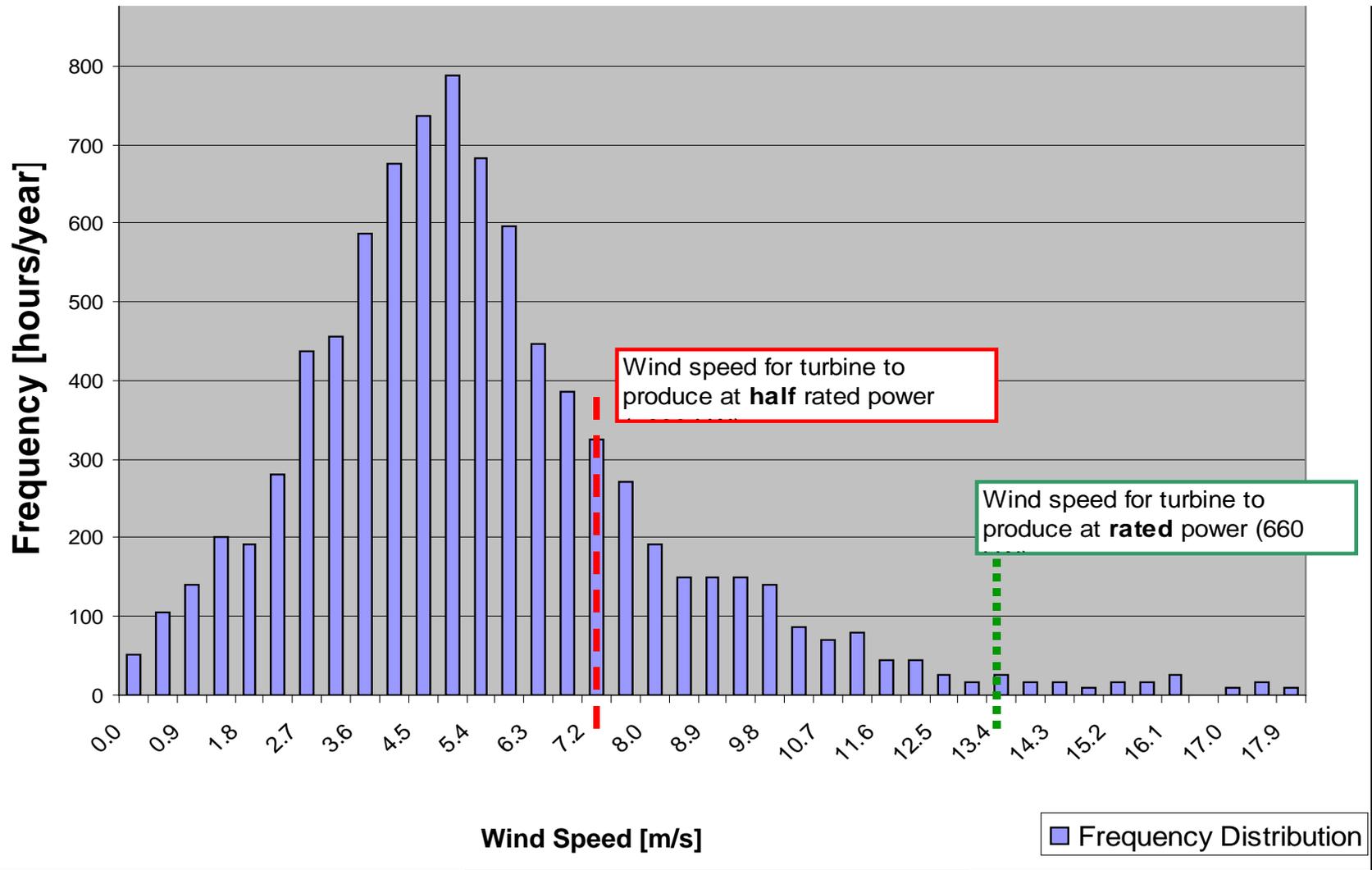
Source: AWEA/GEC database.

Manufacturer's Wind Resource Requirement

Site Conditions:

- Must have reasonable wind
- Wind cannot be too turbulent

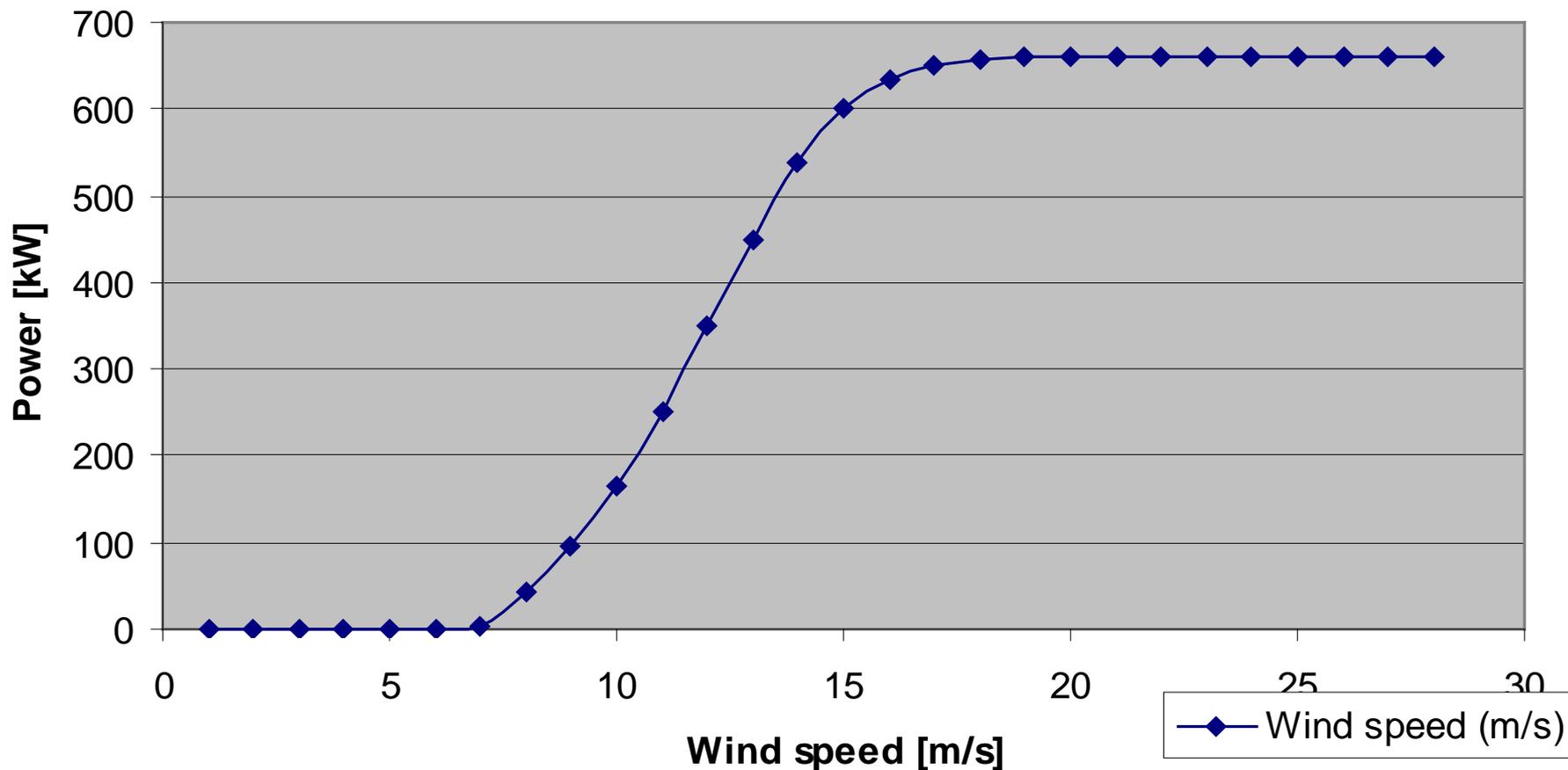
Wind Frequency Distribution



Vestas V-47 660kW Wind Turbine

Power Curve

V-47 Power Curve



NEPA

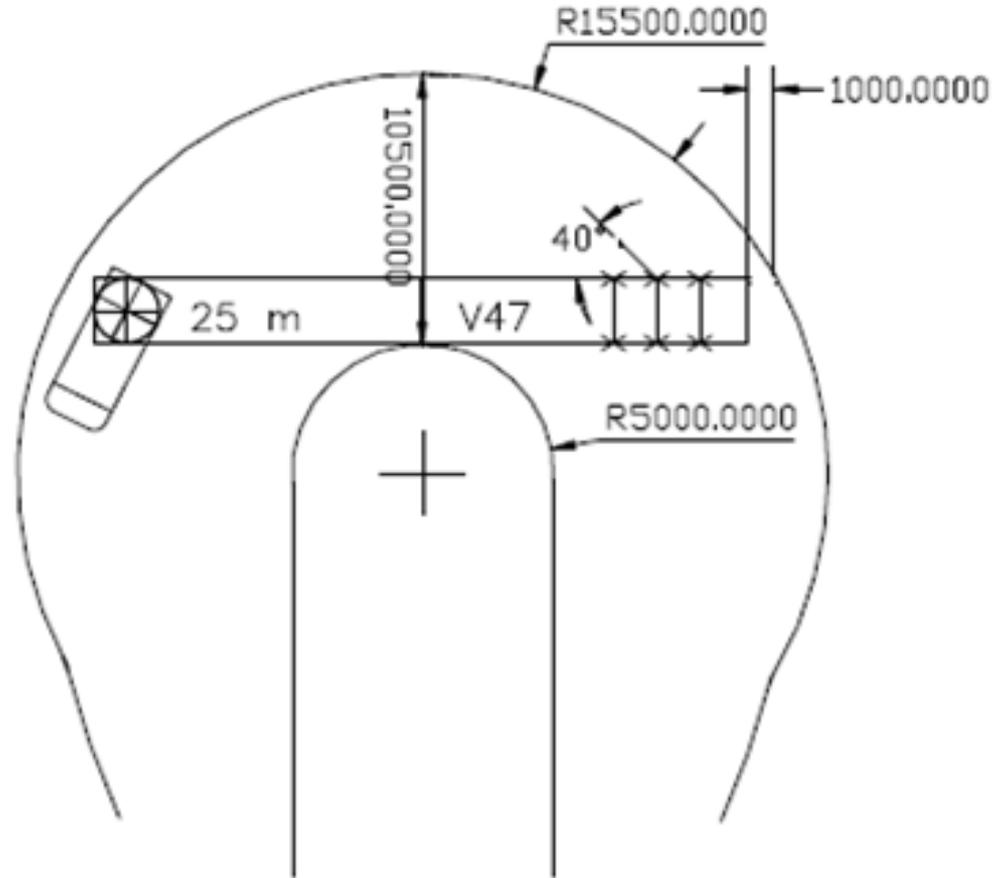
- Needed DOE Environmental approval since NREL was purchasing turbine
- Categorical Exclusion due to site analysis with 1st turbine in place

Permitting

- FAA – DoD
- Site Operations
- FERC
- Building

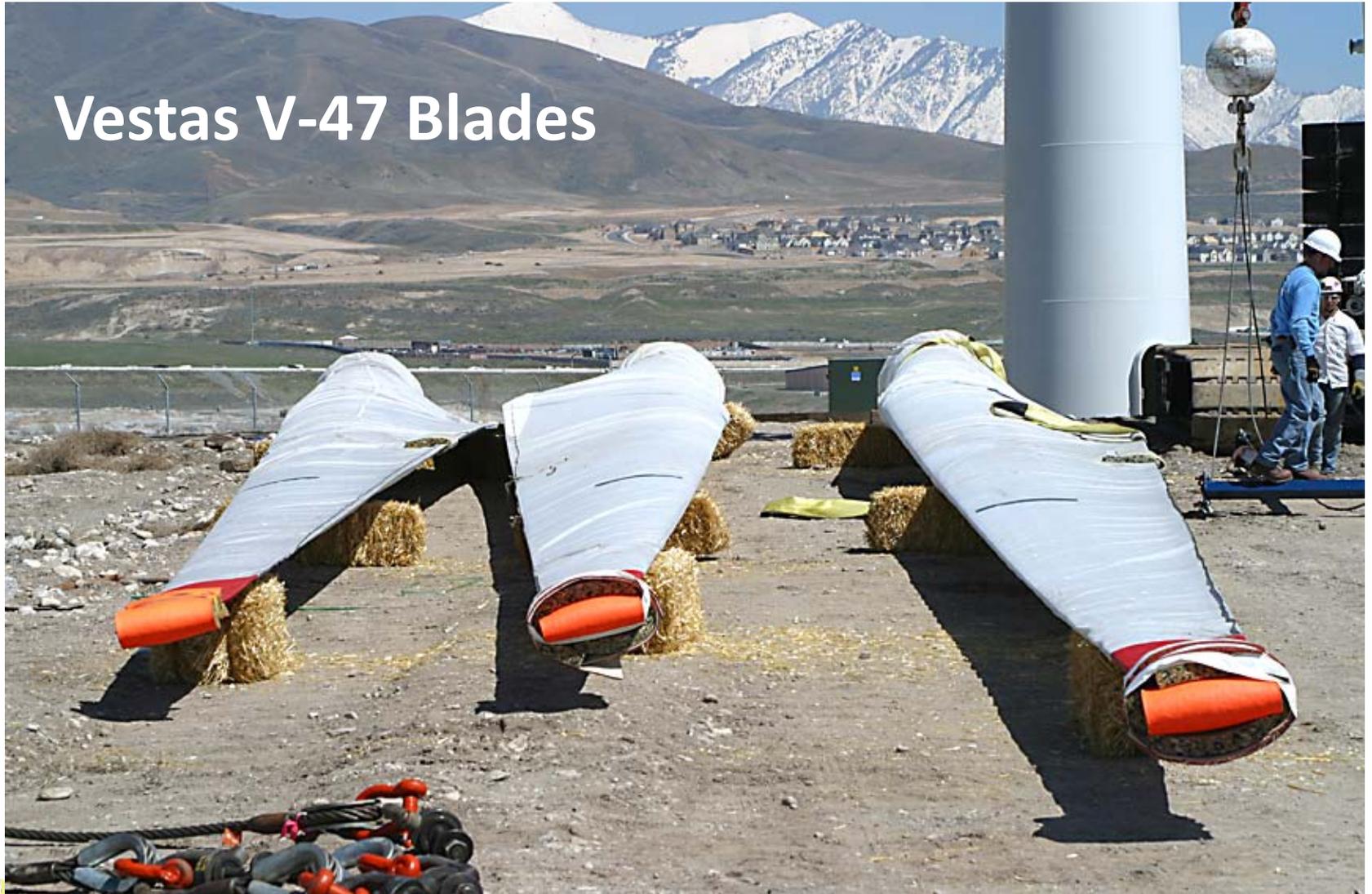
Construction/Transport – Blade Requirements

Radius required for
25m extendable
trailer with electric
/hydraulic manually
controlled turnable
rear wheels



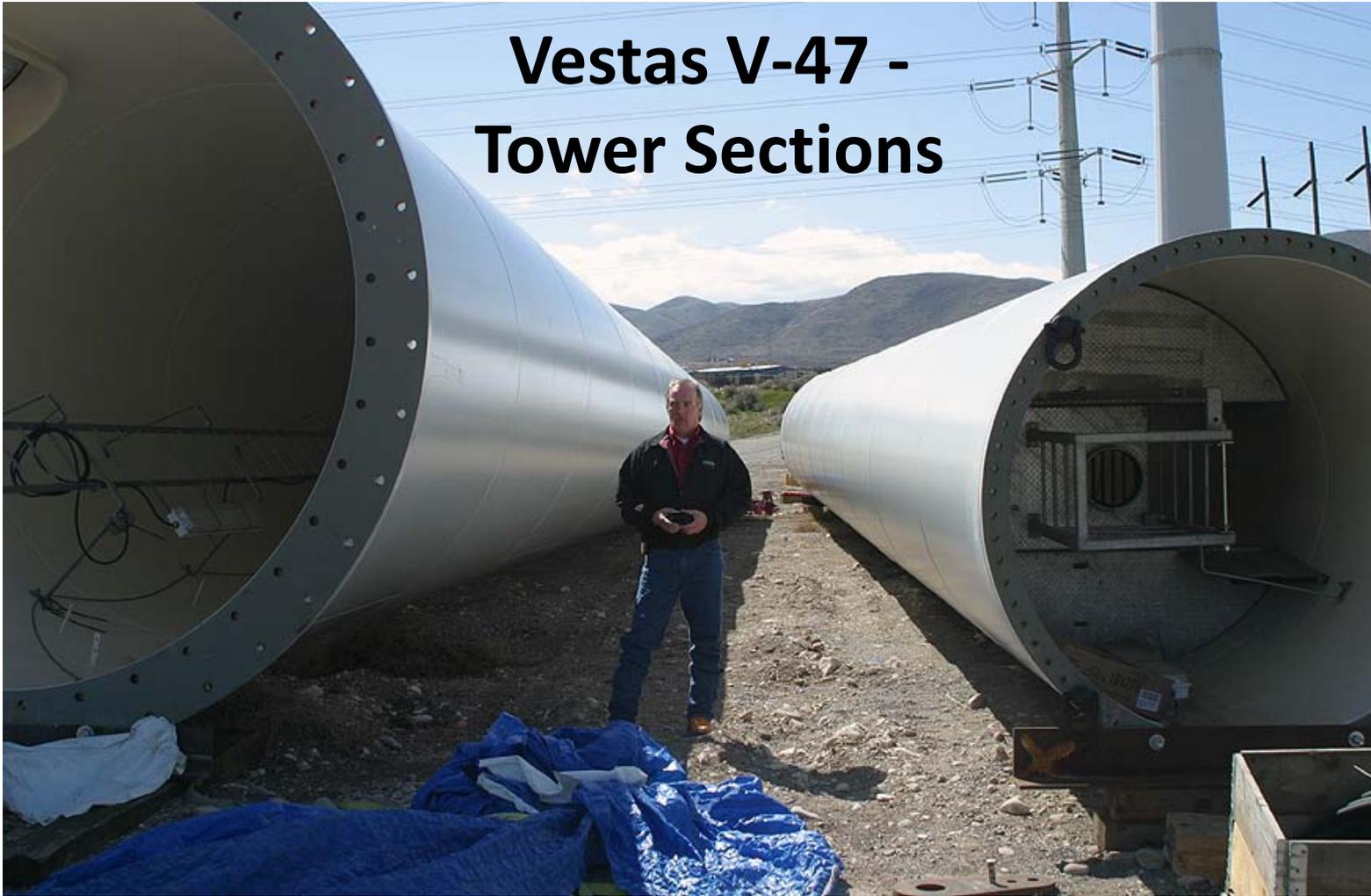
Transport , Delivery & Storage

Vestas V-47 Blades



Transport , Delivery & Storage

Vestas V-47 - Tower Sections



Erection Process - Vestas V-47

Tower construction – left
Rotor erection - below



Vestas V-47 and NEG Micon 225



Camp Williams Load Profile

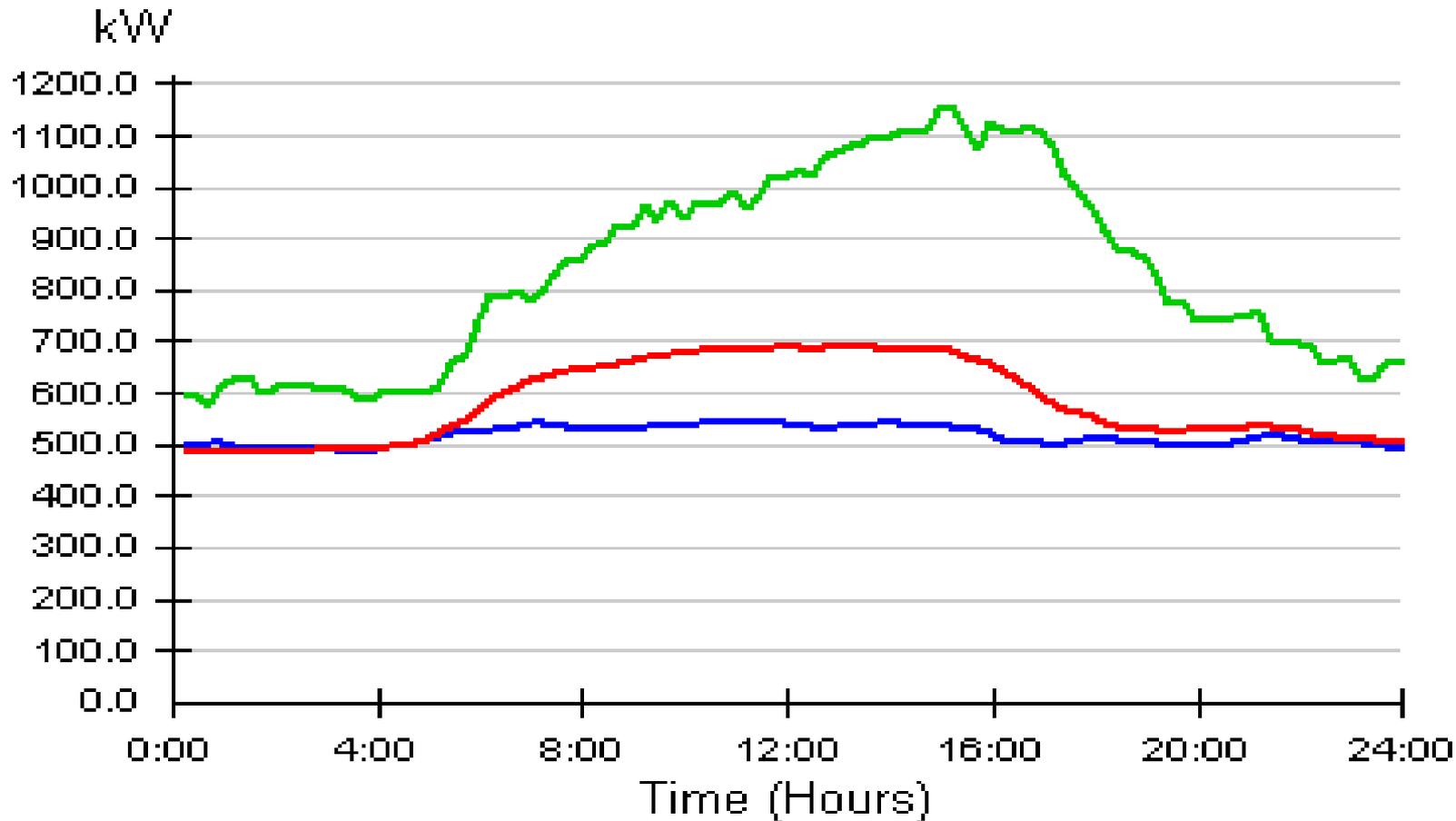
Total Energy Usage (kWh)	5,403,888
Total Weekday Energy Usage (kWh)	3,943,968
Total Weekend Energy Usage (kWh)	1,459,921
Weekday Maximum Demand (kW)	1,462
Weekend Maximum Demand (kW)	1,171
Load Factor	0.4755
Total Energy (kWh)	5,403,888
Maximum Demand (kW)	1,462
Maximum Demand Time	7/13/2004 13:15

% of annual energy growth 9.4%

prorated through Nov 19

Selected Date Range: Thursday, January 01, 2004
through Friday, November 19, 2004

Camp Williams Typical Daily Load Profile



Hours / Year Producing at Half Rated Power

Wind speed	Vestas V-47	NEG Micon 225kW	2 turbines combined	Frequency	Cumulative frequency
	Power curve data	Power curve data	Power curve data		
(m/s)	(kW)	(kW)	(kW)	[freq hours]	[freq %]
0	0	0	0	158	1.8%
1	0	0	0	342	5.8%
2	0	0	0	473	11.2%
3	0	0	0	894	21.5%
4	3	3	6	1996	44.5%
5	44	16	60	1471	61.5%
6	97	29	125	1042	73.5%
7	166	51	217	710	81.7%
8	252	72	324	613	88.8%
9	350	99	449	298	92.2%
10	450	125	575	228	94.8%
11	538	158	696	149	96.6%
12	600	190	790	114	97.9%
13	635	204	839	44	98.4%
14	651	217	868	35	98.8%
15	657	221	878	26	99.1%
16	659	225	884	44	99.6%
17	660	225	885	26	99.9%
18	660	225	885	9	100.0%
19	660	225	885	0	100.0%
20	660	225	885	0	100.0%
21	660	225	885	0	100.0%
22	660	225	885	0	100.0%
23	660	225	885	0	100.0%
24	660	225	885	0	100.0%
25	660	225	885	0	100.0%
				8670	100.0%

7.8% of year turbines produce more than 440 kW

681 hrs/yr

5.1% of year load is less than 500 kW

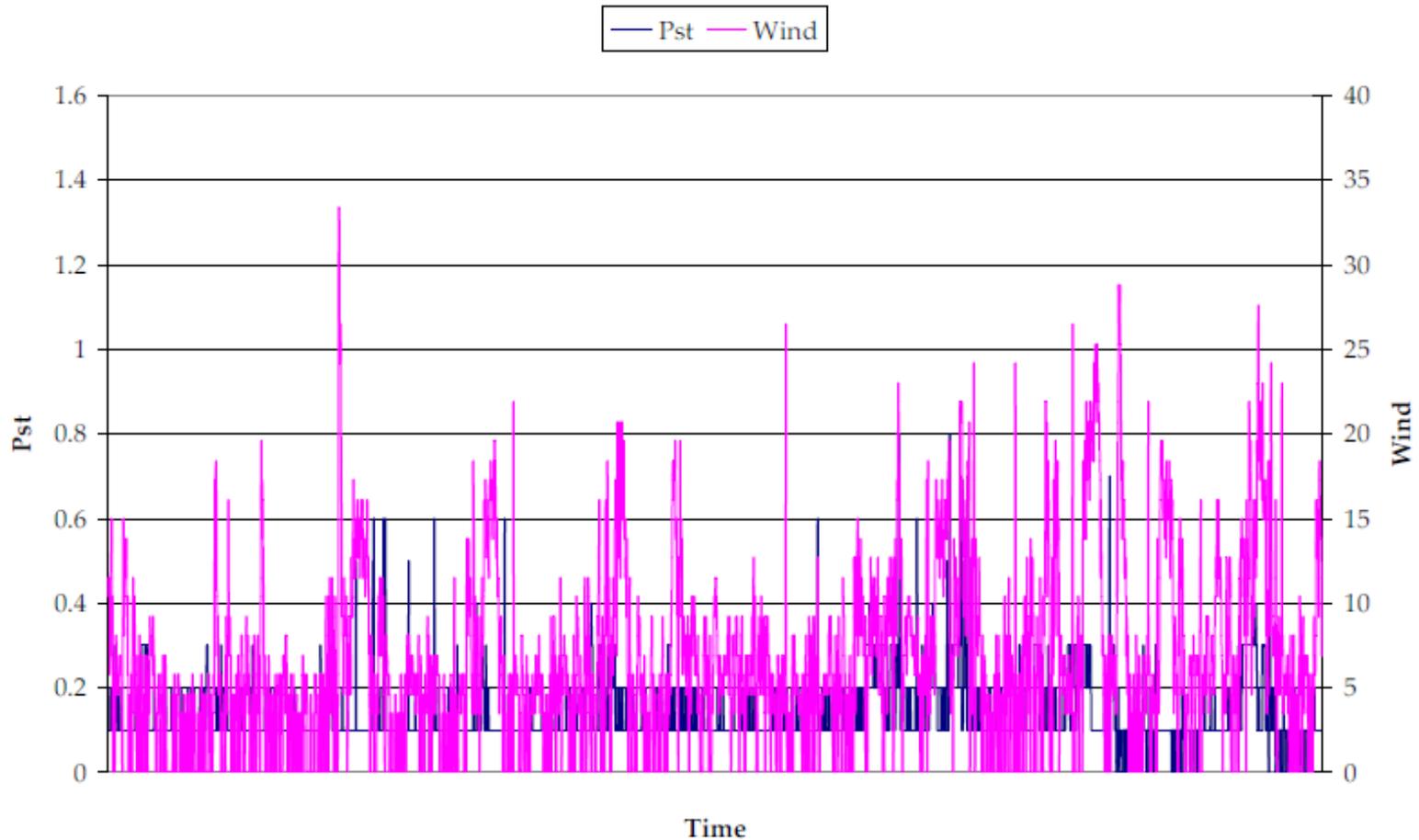
producing at 1/2 rated power or less

Utility Interconnection

- Utah Power & Light - bought by Pacific Corps
 - bought by Scottish Power
- UP&L were partial sponsors of first turbine
- Scottish Power was opposed to the interconnection
- Two informal meetings between PUC member, utility and Camp Williams
- On again, off again for ~12 months
- “Secret Weapon” really helped

Voltage Flicker Analysis

Camp Williams Pst and Provo AP AWOS Wind Speed



No correlation between low voltage events and wind turbine flicker

Camp Williams Wind Turbine Project Details

Description	Unit	Quantity	
Camp Williams			
Average Weekday CW Load	kW	600-810	
Peak Load	kW	1,400	
Minimum Load	kW	400	
Annual Energy Consumed	kWh/yr	4,500,000	
Drop in US \$ vs. Danish Krona	%	7.54%	
Wind Turbines			
Turbine Manufacturer/Model		NEC Micon 225	Vestas V-47
Rated Power	kW	225	660
Rotor Diameter	m	29.8	47
Tower Height	m	30	50
Annual Energy Generated	kWh/yr	227,000	~770,000
% of CW Annual Load	%	5%	~17%

Camp Williams Wind Turbine Project Details

Funding Sources		NEC Micon 225	Vestas V-47
Nat Guard Bureau Readiness Center		\$250K	
Utah State Energy Office		\$39K	
Nat Guard Bureau & Army Corps of Eng			\$752K
Utah State Energy Office (DOE FEMP sourced)			\$50K
NREL FEMP (internal cost)			\$30K
Wind Powering America (internal cost)			\$5K
Key Players			
Tri-Axis Engineering		General engineering	
Olsen Beale		Foundation	
Utah Power & Light		Interconnection	
Tom Wind		Wind engineering consultant	
Annual Emissions Reduction			
CO2	tons/yr	924	~1991
NOX	lbs/yr	5,565	~11437
SOX	lbs/yr	5,962	~11814
Commissioned	Yr	May, 2000	July, 2005
Total Cost	1000 \$	\$289K	\$802K
Simple Payback	Yrs	12	16

First National Guard Site with Two Wind Turbines !

**Vestas V-47
660 kW**

**NEC Micon
225 kW**



Lessons Learned

**Expect it to take 1-2 years longer than you expect
(we did it in 18 months – extraordinary – still many complained it was “so slow”)**

Work to build a team & to gain allies

- Your management
- Utility
- Environmental groups
- State Energy Office
- FEMP
- Governor & legislators

Send team members to AWEA (www.awea.org) or FEMP training

“Down” wind market has an upside

Have a “secret weapon”

SINGLE MOST IMPORTANT FACTOR FOR PROJECT SUCCESS

On the Ground

Renewable Energy
Champion

Tim Parkinson

Currently, State
Energy Manager



Carpe Ventem !

Questions ??

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