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A River of Energy Solutions

GSA Wind Project at Jackman, ME LPOE

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A River of Energy Solutions

Roman Piaskoski
Branch Chief, Energy Utilities & Environment
FMSP, GSA New England
Boston, MA

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

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

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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

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100331 NW100B Power Curve.pdf - Adobe Reader

File Edit View Document Tools Window Help

1 / 1 95.2% Find

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

Slide 10 of 21 "Copy of GovEnergy_Template" 67%

Start Jac... Se... Mic... 10... 2:54 P Friday

Wind Shear (Roughness):	0.25	—			
Wind Tower Hub Height:	37	m	Total REC Value	$	8,184
Wind Speed at Hub Height:	6.1	mps			
Form Factor, k	2.00	—	5 year contract	$	30,689
Scale Factor, A	6.92	—			
Availability:	94%		**# of households		29
Net Losses:	6%				
Time-on-Line	8197	Hours/Yr	Capacity Factor		23%
Energy	**204,590**	kWHrs/Yr/Turbine	Energy	204,590	kWh Total

Wind Speed Distribution

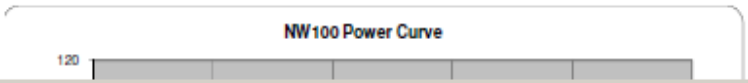
Vhub mps	Hours/Yr
1	357.0
2	670.8
3	906.7
4	1044.9
5	1082.8
6	1033.3
7	919.6
8	769.0
9	607.1
10	454.1
11	322.6
12	217.9
13	140.3
14	86.1
15	50.4
16	28.2
17	15.1
18	7.7
19	3.8
20	1.8
21	0.8
22	0.3
23	0.1
24	0.1
25	0.0

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
2	630.5	-356
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	16530
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



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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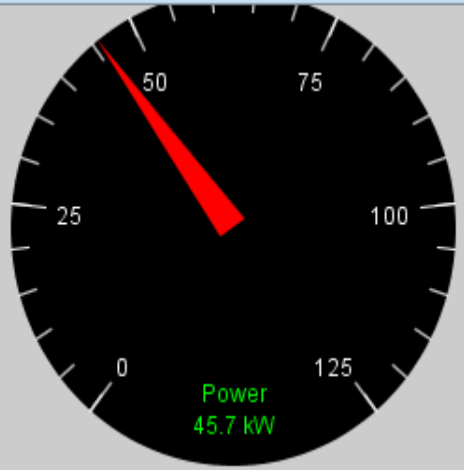
WTG1 Overview | WTG2 Overview | Trends



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

SmartView HMI 3.2.0 2011-07-05 17:57:22.0 Data OK

Done | Internet | 100%

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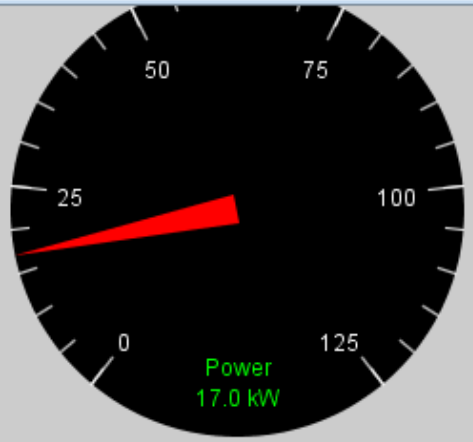
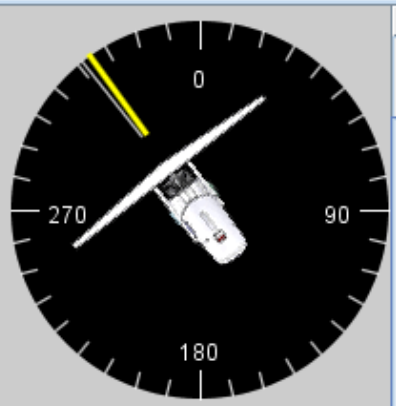
WTG1 Overview | WTG2 Overview | Trends





Rotor Speed	58.4	RPM	1 min. Wind Speed	8.3	m/s	Total Energy Produced	37286 kWh
			10 min. Wind Speed	8.8	m/s	Time Available	1989 Hr

Yaw Position	321.8
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

SmartView HMI 3.2.0 2011-07-05 17:59:49.0 Data OK

Done | Internet | 100%

Start | 2:00 PM

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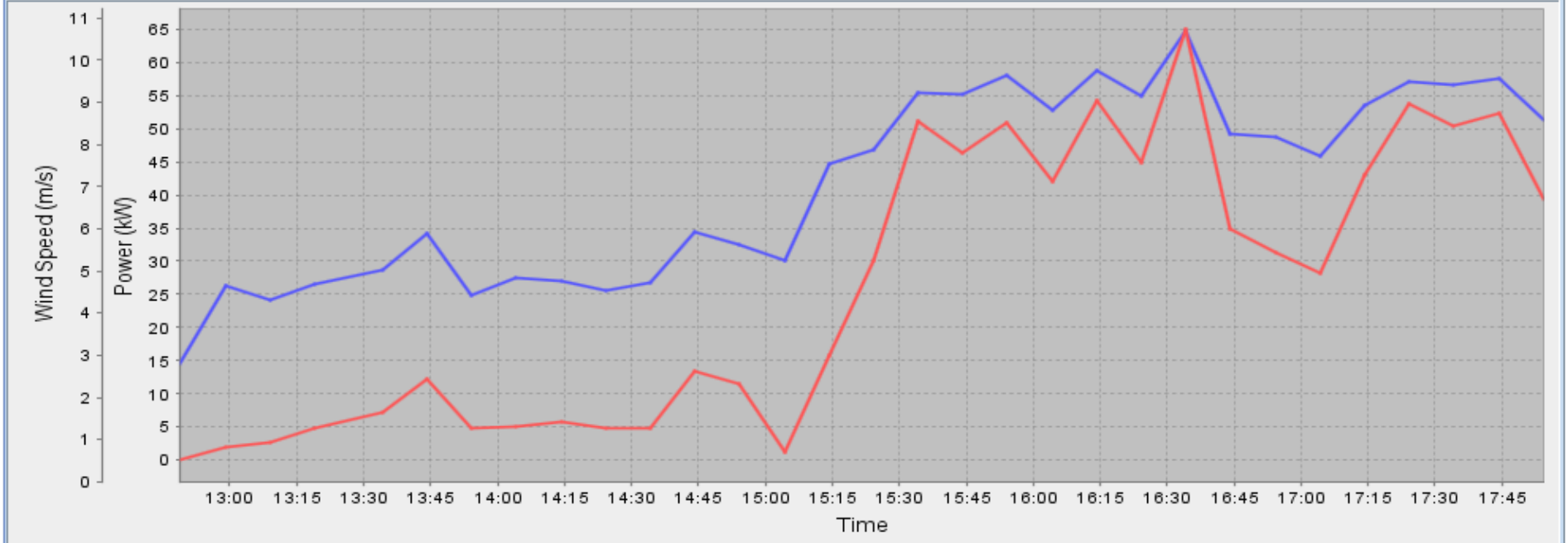
WTG1 Overview | WTG2 Overview | Trends

Configure | Chart: One Day | or from: 2011-06-04 13:57:13 | to: 2011-07-05 13:57:13 | < | > | Refresh | Export CSV



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

SmartView HMI 3.2.0 Data OK

Done | Internet | 100%

Start | 2:01 PM

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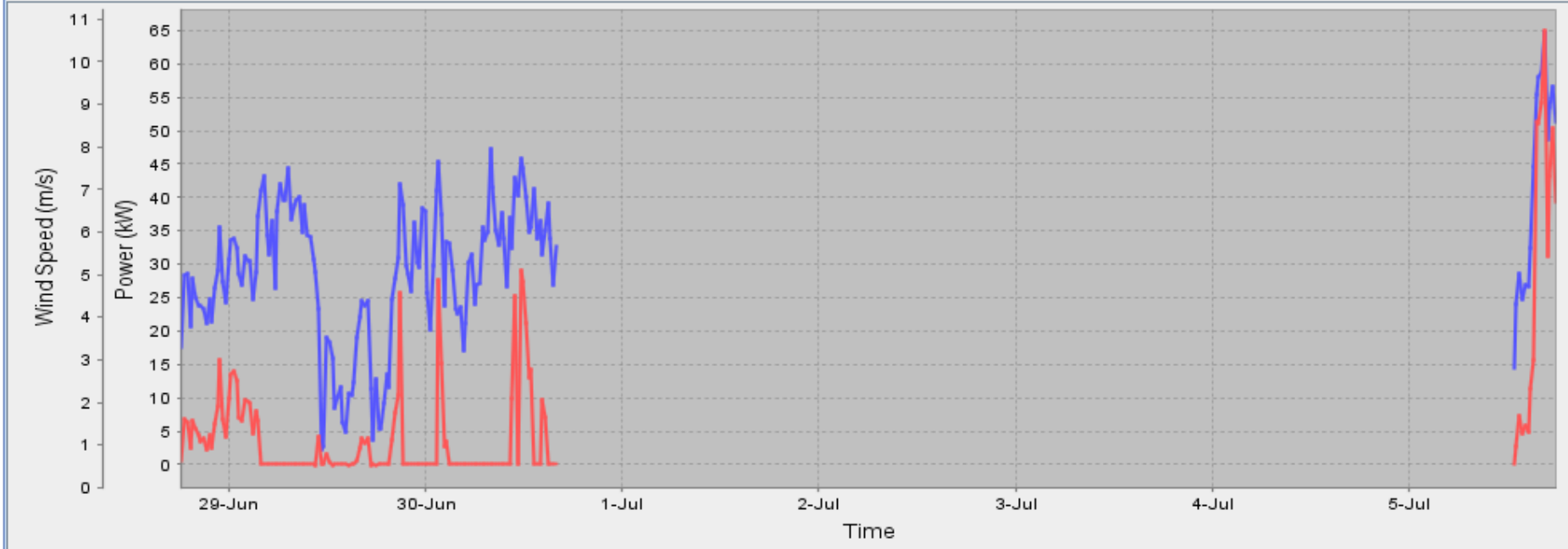
WTG1 Overview | WTG2 Overview | Trends

Configure | Chart: One Week | or from: 2011-06-04 13:57:13 | to: 2011-07-05 13:57:13 | < | > | Refresh | Export CSV



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

SmartView HMI 3.2.0 Data OK

Internet | 100%

Start | 2:02 PM Tuesday

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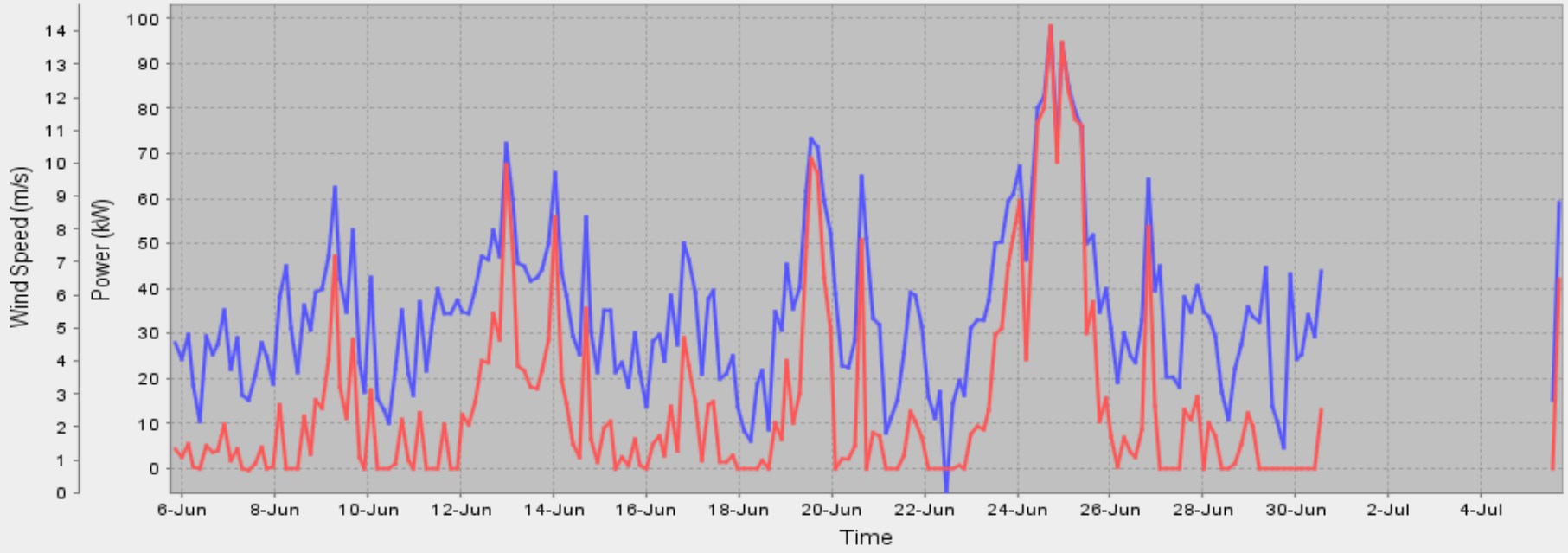
WTG1 Overview | WTG2 Overview | Trends

Configure | Chart: One Month | or from: 2011-06-04 13:57:13 | to: 2011-07-05 13:57:13 | < | > | Refresh | Export CSV



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

SmartView HMI 3.2.0 Data OK

Done | Internet | 100%

Start | 2:04 PM Tuesday

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WTG1 Overview | WTG2 Overview | Trends

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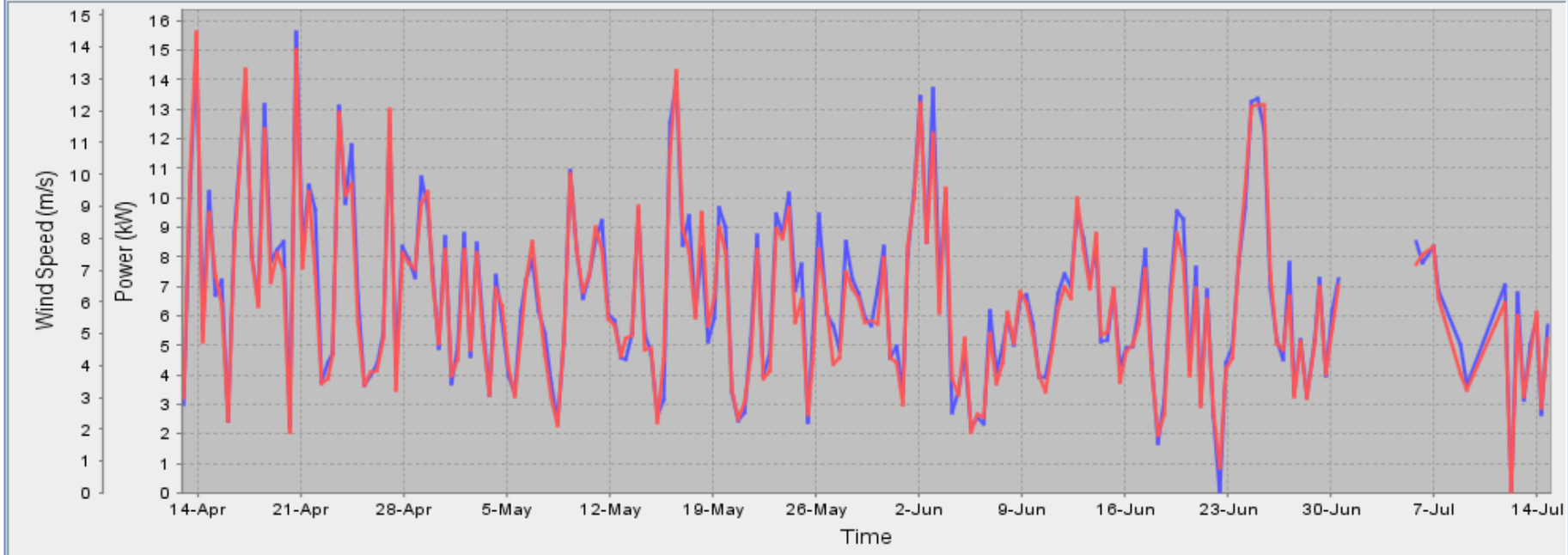

Series Name	Axis	Cursor (0)	Minimum	Maximum	Average
WTG2_R_WindSpeed_mps	Power (kW)	0	0.001	15.619	6.444
WTG1_R_WindSpeed_mps	Wind Speed (m/s)	0	0.001	14.476	6.148

SmartView HMI 3.2.0 Data OK

Done | Internet | 75%

Start | 5:58 PM Thursday

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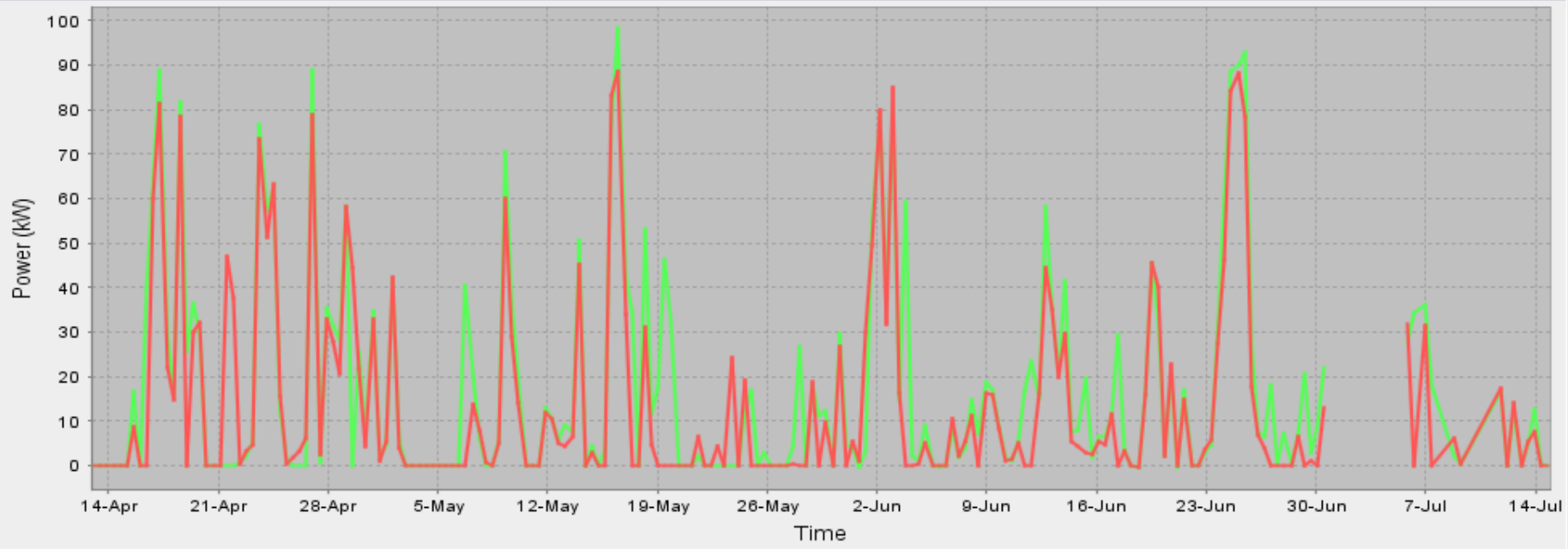
WTG1 Overview | WTG2 Overview | Trends

Configure | Chart: Custom | or from: 2011-04-12 22:27:46 | to: 2011-07-14 22:17:46 | < | > | Refresh | Export CSV



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

Done | Internet | 75%

Start | 6:19 PM Thursday

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 (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.