



Advancing Wind Power in Illinois Conference 2011

# **Craig Pals**

Tick Tock Energy

**Small Wind “How To”**

**Breakout Session**

Friday, July 22, 2011, 11:15 AM

# Small Wind Case Studies

## Comparing Performance of Two 10 kW Bergey Wind Turbines in Central Illinois



Illinois Wind Working Group  
Advancing Windpower in Illinois Conference 2011

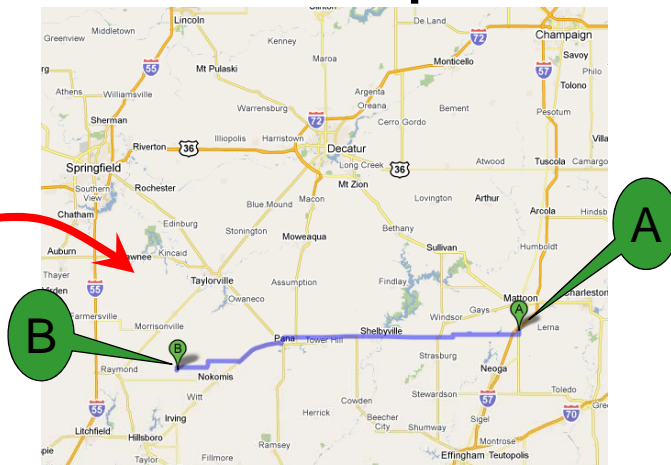
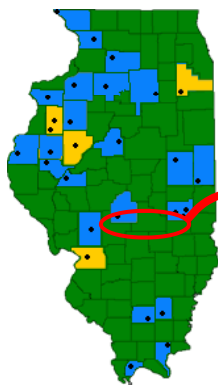
By:  
Craig Pals, P.E., CEM, GBE  
Tick Tock Energy, Inc.  
[www.ticktockenergy.com](http://www.ticktockenergy.com)

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Two Sites – 60 miles apart



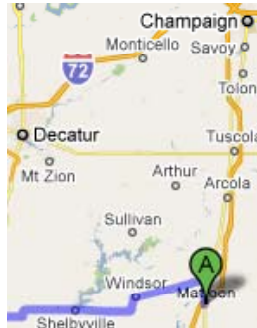
IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.





## Site A: Lake Land College, Mattoon, IL



50 miles South of  
Champaign, IL

© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11



## Site A: **Startup on 1/13/11**



### WIND Turbine:

- 10 kW (AC) Bergey
- **90-foot (27.4M) monopole tower**
- APRS World power monitoring

### SOLAR Array:

- 1.344 kW (DC) Solar PV
- Enphase microinverters & data monitoring

© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11





## Site A:

# 7,000 kWh's in first 6 Months

PowerSyncII Inverter	
Data Date:	2011-07-11 21:08:12 (CST) Report received 0 seconds ago.
Status:	RUNNING
Power:	114 watts
Energy:	10 kWh over last 24 hours 6,985 kWh on inverter
AC:	211 VAC @ 60 Hz
DC:	40 VDC @ 5 amps

5 months 29 days of Operation

Total Wind Turbine kWh's in Year #1

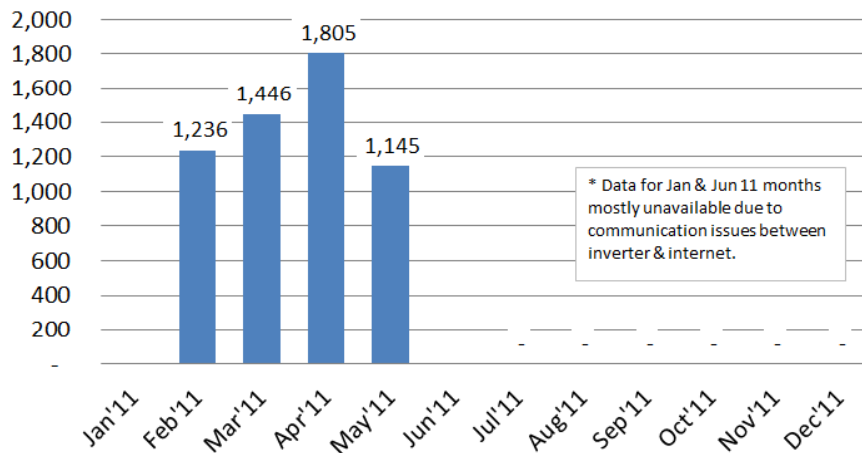
IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Site A: Lake Land College

### 10 kW Bergey Wind Turbine kWh Production by Month



\* Data for Jan & Jun 11 months mostly unavailable due to communication issues between inverter & internet.

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.

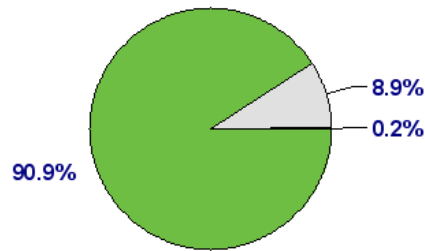




# Site A: Availability for first 6 Months



## Availability Percentages



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



# Site B: Schweizer Farms, Inc., Nokomis, IL



42 miles SE  
of Springfield, IL



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.





## Site B: Startup on 5/19/10



### WIND Turbine:

- 10 kW (AC) Bergey
- **120-foot (37M) SSV tower**
- APRS World power monitoring

### SOLAR Array:

- 2.35 kW (DC) Solar PV
- Enphase microinverters & data monitoring system

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Site B: 19,609 kWh's in First Year

PowerSyncII Inverter	
<b>Data Date:</b>	2011-05-20 21:05:17 (CDT) Report received 8 seconds ago.
<b>Status:</b>	RUNNING
<b>Power:</b>	4,991 watts 
<b>Energy:</b>	45 kWh over last 24 hours 19,609 kWh on inverter
<b>AC:</b>	246 VAC @ 60 Hz
<b>DC:</b>	135 VDC @ 36 amps

1-Year Anniversary Date

Total Wind Turbine kWh's in Year #1

IWWG Conference, Chicago, IL 7/22/11

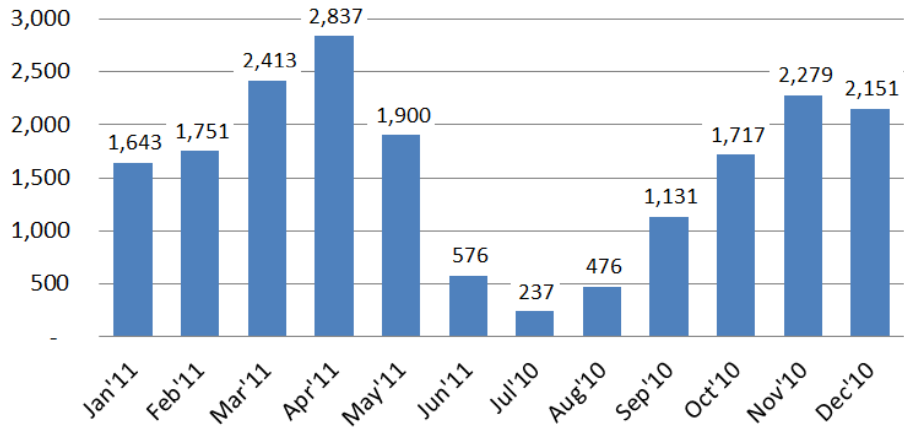
© Copyright 2011 Tick Tock Energy, Inc.





### Site B: Schweizer Farms, Inc.

#### 10 kW Bergey Wind Turbine kWh Production by Month



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.

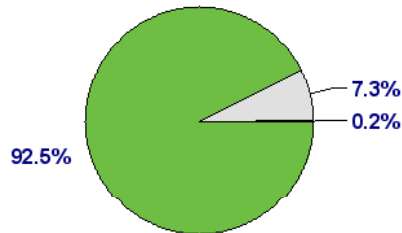


### Site B:

#### Availability for first 13 ½ Months



#### Availability Percentages



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



# Comparing the Two Sites



IWWG Conference, Chicago, IL 7/22/11

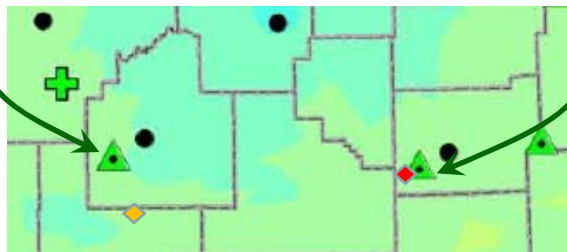
© Copyright 2011 Tick Tock Energy, Inc.



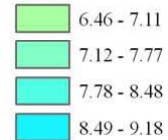
## Average Wind Speed at 80M (262 feet) 2007

Bear Creek Township MET Tower (4/05 to 3/06)

Lake Land College MET Tower (4/08 to 3/09) & Site A



### Speed in M/S



- ▲ Illinois Wind Sites
- NWS Sites
- ◆ Site A
- ◆ Site B

Source:  
[www.illinoiswind.org](http://www.illinoiswind.org)

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.

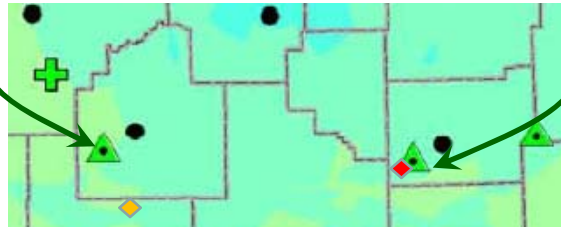




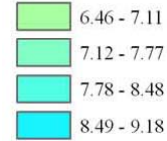
# Average Wind Speed at 80M (262 feet) 2006

Bear Creek Township MET Tower (4/05 to 3/06)

Lake Land College MET Tower (4/08 to 3/09) & Site A



## Speed in M/S



- ▲ Illinois Wind Sites
- NWS Sites
- ◆ Site A
- ◆ Site B

Source:

[www.illinoiswind.org](http://www.illinoiswind.org)

IWWG Conference, Chicago, IL 7/22/11

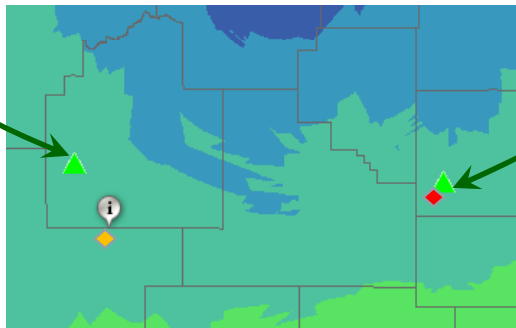
© Copyright 2011 Tick Tock Energy, Inc.



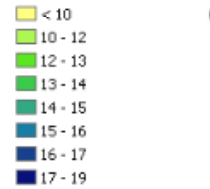
# Average Wind Speed at 50M (164 feet)

Bear Creek Township MET Tower (4/05 to 3/06)

Lake Land College MET Tower (4/08 to 3/09) & Site A



## All Yrs 50M Wind Speed MPH VALUE



- ◆ Site A
- ◆ Site B

Source: Wind Energy Site Selection Tool

[www.illinoiswind.org](http://www.illinoiswind.org)

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Bear Creek Station Data (Christian Co.) at 30M and 40M

Data Month	30 Meter		40 Meter	
	avg mph	avg M/s	avg mph	avg M/s
1/06	13.2	5.9	14.2	6.3
2/06	11.6	5.2	12.5	5.6
3/06	11.5	5.1	12.3	5.5
4/05	12.5	5.6	13.5	6.0
5	10.5	4.7	11.4	5.1
6	8.6	3.8	9.6	4.3
7	7.7	3.4	8.5	3.8
8	7.1	3.2	7.9	3.5
9	8.3	3.7	9.3	4.2
10	9.5	4.2	10.3	4.6
11	13.2	5.9	14.3	6.4
12/05	10.5	4.7	11.5	5.1
	10.4	4.6	11.3	5.0

Estimated annual average wind speed at 120-feet is 11 mph

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Lake Land College Data (Coles Co.) at 30M and 40M

Data Month	30 Meter		40 Meter	
	avg mph	avg M/s	avg mph	avg M/s
1/07	14.2	6.3	15	6.7
2/07	14.6	6.5	15.4	6.9
3/07	14.3	6.4	15.4	6.9
4/07	15.1	6.7	15.9	7.1
5/07	11.5	5.1	12.2	5.5
6/06	8.4	3.7	9.2	4.1
7/06	9.5	4.2	10.5	4.7
8/06	8	3.6	9	4.0
9/06	10.4	4.6	11.4	5.1
10/06	13.6	6.0	14.6	6.5
11/06	13.7	6.1	14.7	6.6
12/06	14.8	6.6	15.7	7.0
	12.3	5.5	13.3	5.9

Estimated annual average wind speed at 120-feet is 13 mph

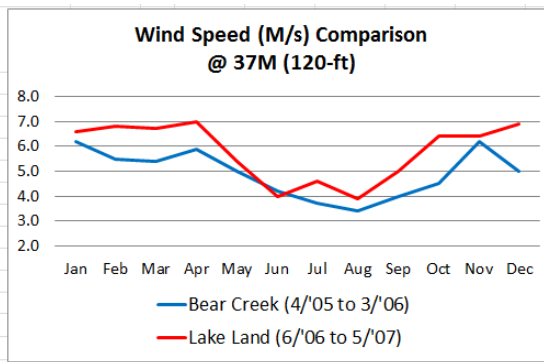
IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Wind Speed On Average is ~18% Higher at Lake Land Site

	Bear Creek (4/'05 to 3/'06)	Lake Land (6/'06 to 5/'07)	Difference
Jan	6.2	6.6	6%
Feb	5.5	6.8	24%
Mar	5.4	6.7	24%
Apr	5.9	7.0	19%
May	5.0	5.4	8%
Jun	4.2	4.0	-5%
Jul	3.7	4.6	24%
Aug	3.4	3.9	15%
Sep	4.0	5.0	25%
Oct	4.5	6.4	42%
Nov	6.2	6.4	3%
Dec	5.0	6.9	38%
Average =	4.9	5.8	18%



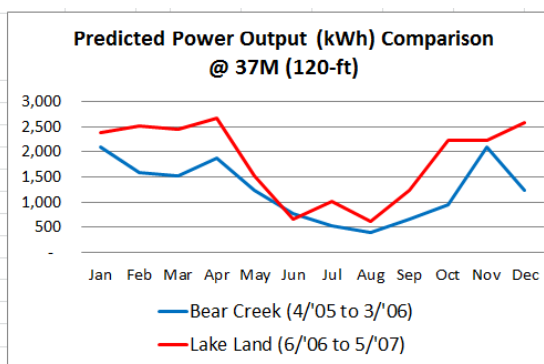
IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## PREDICTED Power Output On Average is 48% Higher at Lake Land Site

	Bear Creek (4/'05 to 3/'06)	Lake Land (6/'06 to 5/'07)	Difference
Jan	2,085	2,372	14%
Feb	1,590	2,517	58%
Mar	1,520	2,444	61%
Apr	1,870	2,662	42%
May	1,240	1,518	22%
Jun	780	665	-15%
Jul	532	1,009	90%
Aug	399	620	55%
Sep	665	1,238	86%
Oct	952	2,227	134%
Nov	2,085	2,227	7%
Dec	1,240	2,589	109%
TOTAL =	14,958	22,087	48%

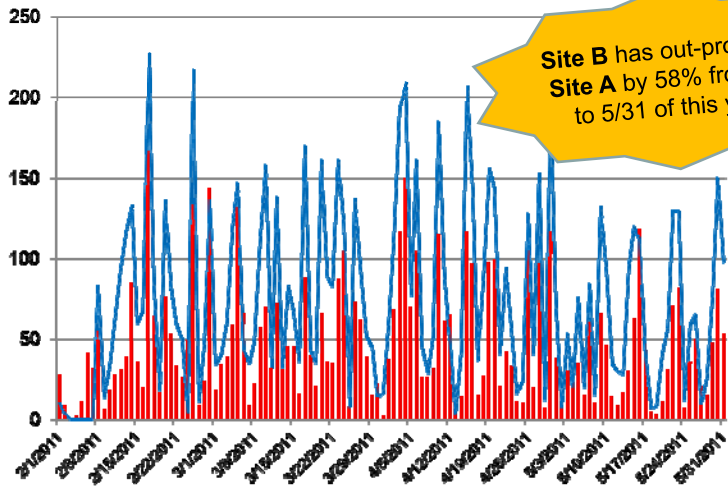


IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## 2011 – Daily kWh ACTUAL Production: Schweitzer Farm Site w/ 120-Ft Tower vs. Lake Land w/ 90-Ft Tower



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Wind Power Dependent on Tower Height

Performance of 10 kW Bergey at Schweitzer Farm, Nokomis, IL

Tower Ht. Ft.	Avg Annual Wind Speed (M/s) @ Hub Ht.	Predicted kWh/year	ACTUAL kWh/year
80	4.4	8,143	
100	4.6	11,315	
<b>120</b>	<b>4.9</b>	<b>14,958</b>	<b>19,609</b>
140	5.2	16,033	

*Comment: Wind at site over past 12 months also probably stronger than the 2005-2006 Bear Creek Met tower data used in model.*

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



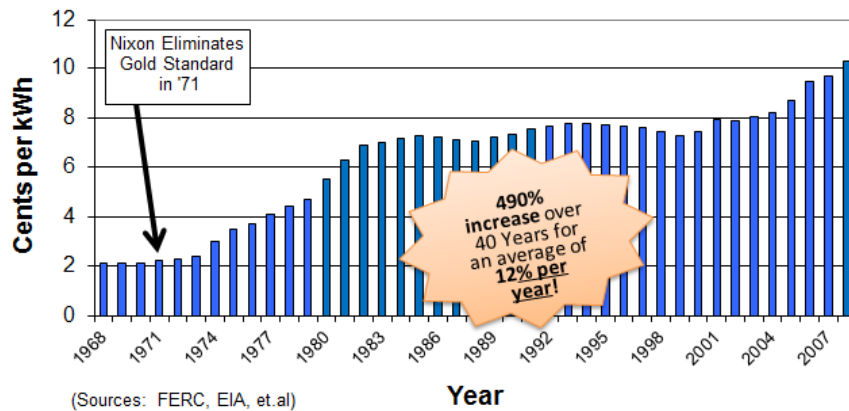


IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## 40-Year Average Price of Electricity 1968 to 2008 (commercial Sector)

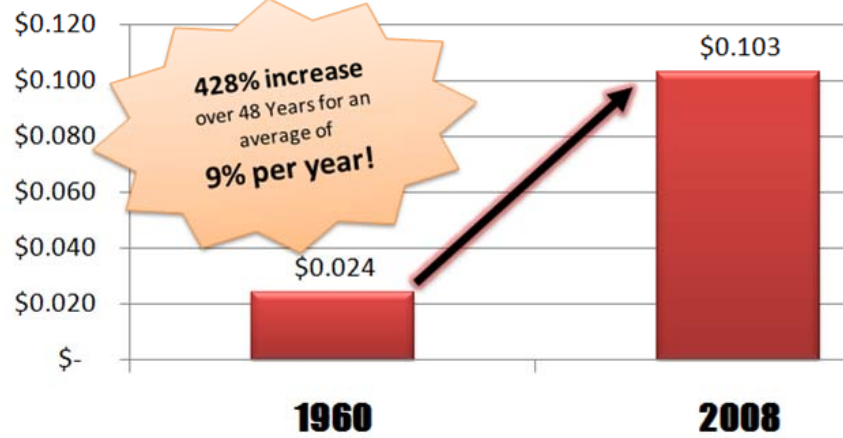


IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Electricity INFLATION for past 48 Years



© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11



## U.S. Monetary Policy is Driven by the Printing Press



© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11



NOVEMBER 5, 2010

## Central Bank Treads Into Once-Taboo Realm

By JON HILSEN RATH

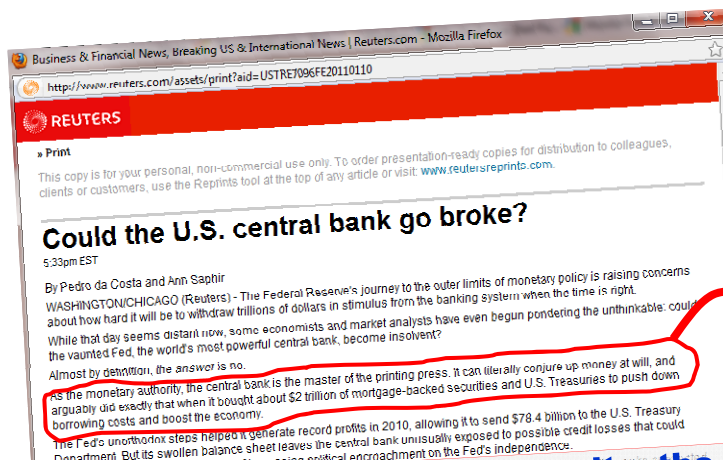
The Federal Reserve will print money to buy nearly as much U.S. Treasury debt in the next eight months as the U.S. government will issue.

The Fed's decision this week to buy \$600 billion more of U.S. Treasury debt is setting off a debate about the risks of a central bank entwining its policies so tightly with the government's

**The Federal Reserve will print money....**

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



**(1/10/11) As the monetary authority, the central bank (Federal Reserve) is the master of the printing press. It can literally conjure up money at will.....**

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



# FIAT Currency (is not Money)



Money  
(Tangible)



Fiat Currency  
(easily created and manipulated)

© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11



# INFLATION = Hidden Tax



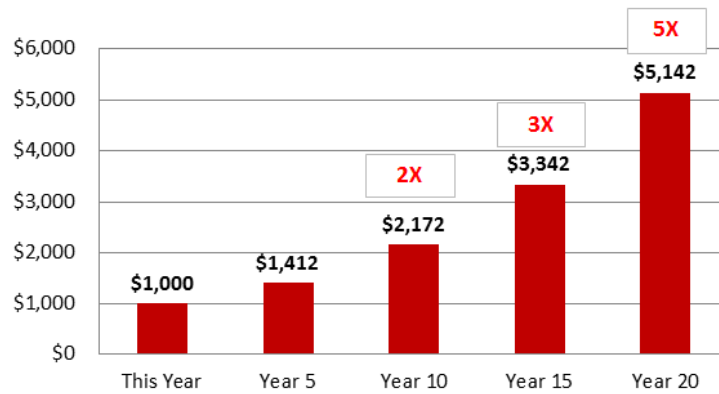
© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11





## \$1,000 per year Electric Bill Over Next 20 Years with 9% Annual Inflation

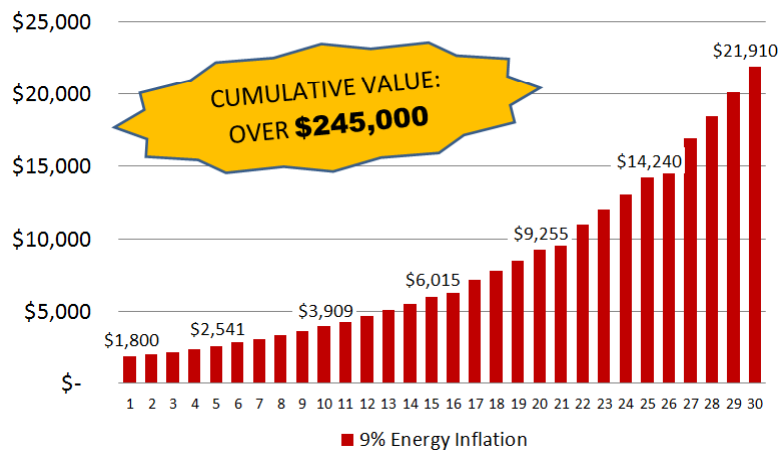


IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Value of 18,000 kWh/yr of Wind Power at 9% Energy Inflation



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



# Concluding Remarks



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



# Reliability is #1



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Think: TALL Towers!



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Tools for Energy & Economic Freedom



IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



**Thank YOU!**

**Questions or Assistance?**

**www.ticktockenergy.com**

**craig@ticktockenergy.com**  
**866-949-7770**

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



**FOR MORE INFO:**

**Wind Turbine Performance Data Monitoring Sites:**

**Site A: Lake Land College, Wind Turbine Data:**

[http://data.aprsworld.com/data/ps2/current.php?station\\_id=A2719](http://data.aprsworld.com/data/ps2/current.php?station_id=A2719)

**Site B: Schweizer Farms, Inc., Wind Turbine Data:**

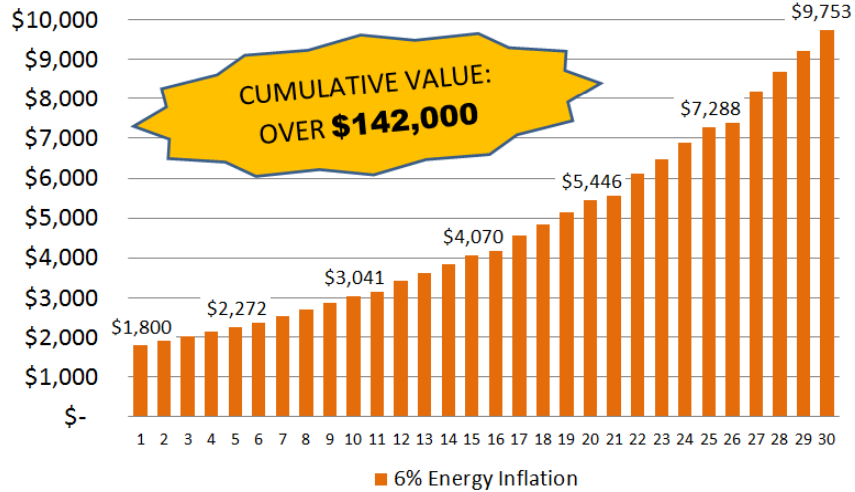
[http://data.aprsworld.com/data/ps2/current.php?station\\_id=A2271](http://data.aprsworld.com/data/ps2/current.php?station_id=A2271)

IWWG Conference, Chicago, IL 7/22/11

© Copyright 2011 Tick Tock Energy, Inc.



## Value of 18,000 kWh/yr of Wind Power at 6% Energy Inflation



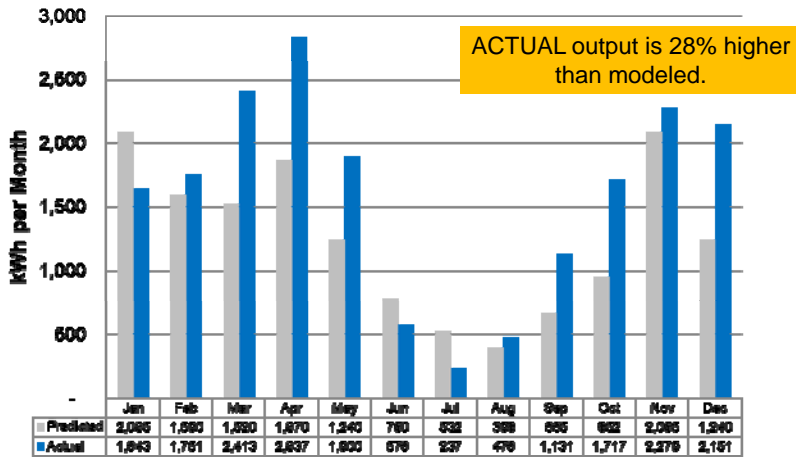
© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11



## Schweitzer Farm Site (120-ft tower):

### Actual vs Predicted Power Output



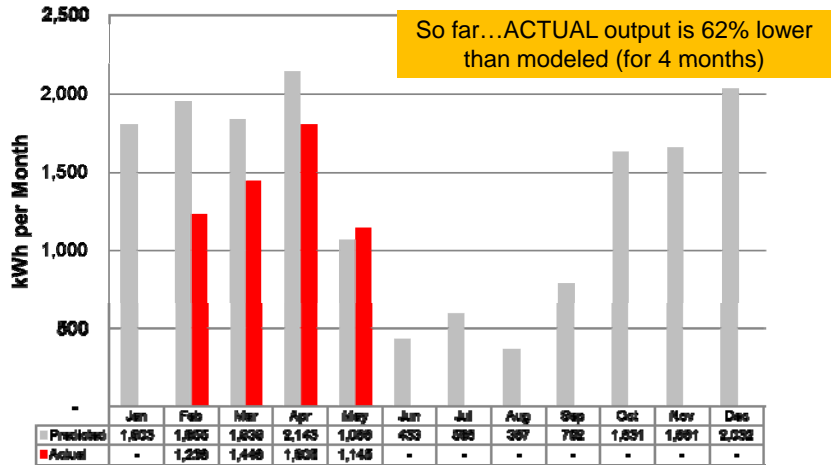
© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11



# Lake Land Site (90-ft tower):

## Actual vs Predicted Power Output



© Copyright 2011 Tick Tock Energy, Inc.

IWWG Conference, Chicago, IL 7/22/11

