FACTORS TO CONSIDER IN SMALL WIND PROJECTS

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Michigan Agr-Energy 2007

March 13, 2007

Lansing, Michigan

Primary Factors For Consideration

- Objectives: Philosophy, politics, economics
- Connected or disconnected, net or back-up
- Energy Loads: Electricity, heat, self-supply
- Siting: Location, permitting, wind resources
- Understanding wind energy basics
- Understanding the wind machines
- Understanding your neighbors
- Installation, operation and maintenance

“Our farmers will be the oil sheiks of tomorrow.”

Dr. Hermann Scheer, Member of German Parliament and economist.

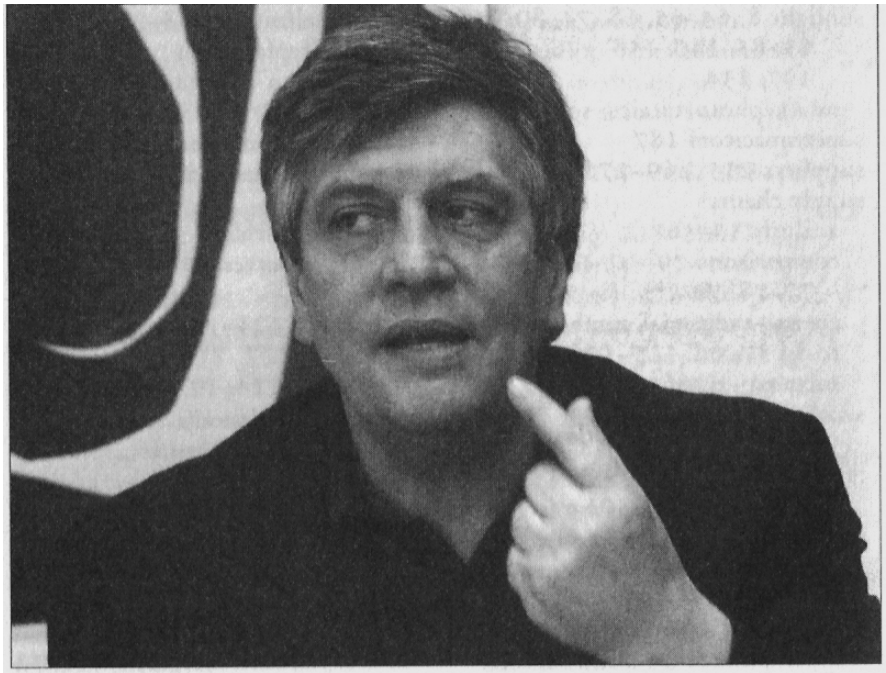
“The farmers will become combined food, energy and raw material producers, and they will be ecologically integrated. Ruralisation will lead to new forms of settlements and revitalization of the primary economy with increased local employment and less commuting.”

Publications:

The Solar Manifesto

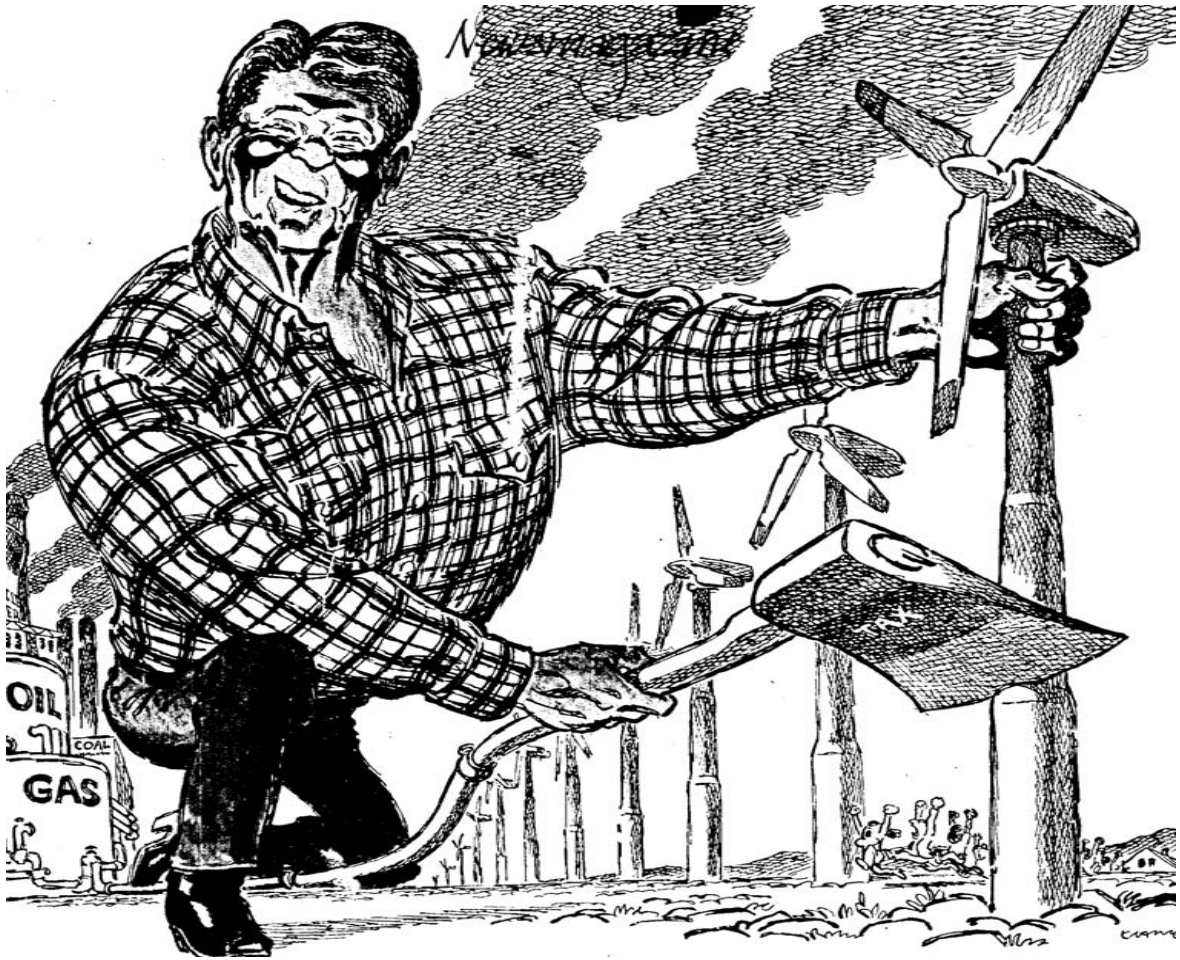
The Solar Economy, &

Energy Autonomy.



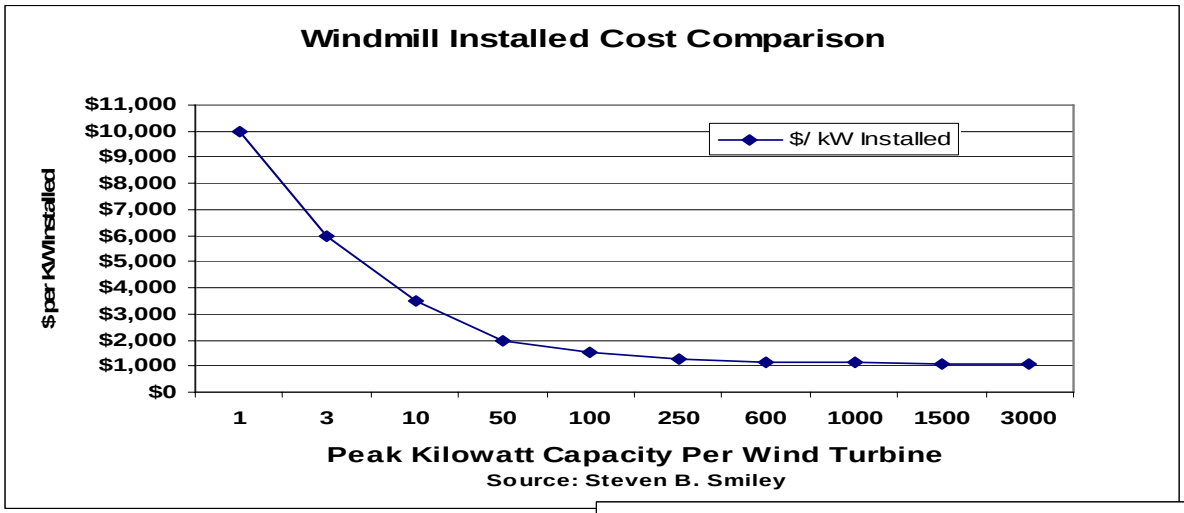
DR. HERMANN SCHEER is a Member of Parliament for the German Government, the *Deutscher Bundestag*. In addition, he is President of EUROSOLAR, the European Association for Renewable Energies, and General Chairman of the World Council for Renewable Energy. He has been awarded several prizes in recognition of his work and achievements, receiving the Alternative Nobel Prize in 1999, the World Solar Prize in 1998 and the World Prize for BioEnergy in 2000.

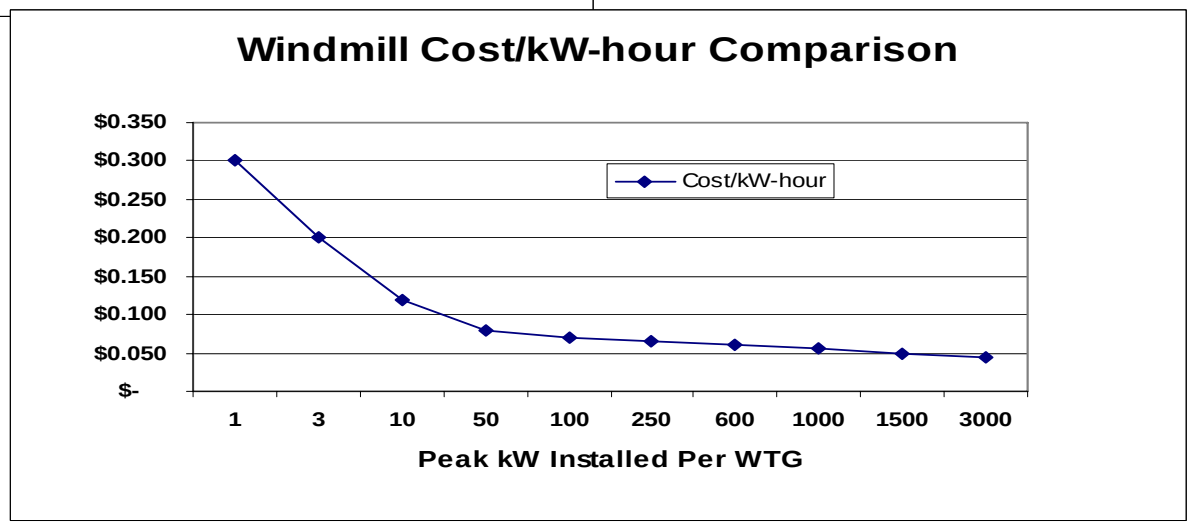
All energy prices & choices are based on politics and policy!!



Senator Carl Levin, Dr. Hermann Scheer, Subhendu Guha, Pres. United Solar and James Epolito, CEO MEDC: Making Policy

Wind Power: Cheapest and cleanest energy on the market at the right scale.





What is “Small?”
65 kW Laker H.S.

More Small Windmill Examples

Small Windmills (electric) for the Small Farm

- **1 to 20 kW Peak Capacity**
- **$5,000 to $50,000 installed cost**
- **100 kW-hrs/mo to 4,000 kW-hrs/mo.**
- **50 to 100 ft. tower depending on site**

Energy Loads: Daily, Seasonal, Peak, Average, Heat, etc.

Wind Energy Concepts

Air density

Wind velocity

Wind Power

Swept Area

Tip speed ratio

Turbulence

Height variations

Wind frequency distribution

Windmill power curve

********** Putting it all together **********

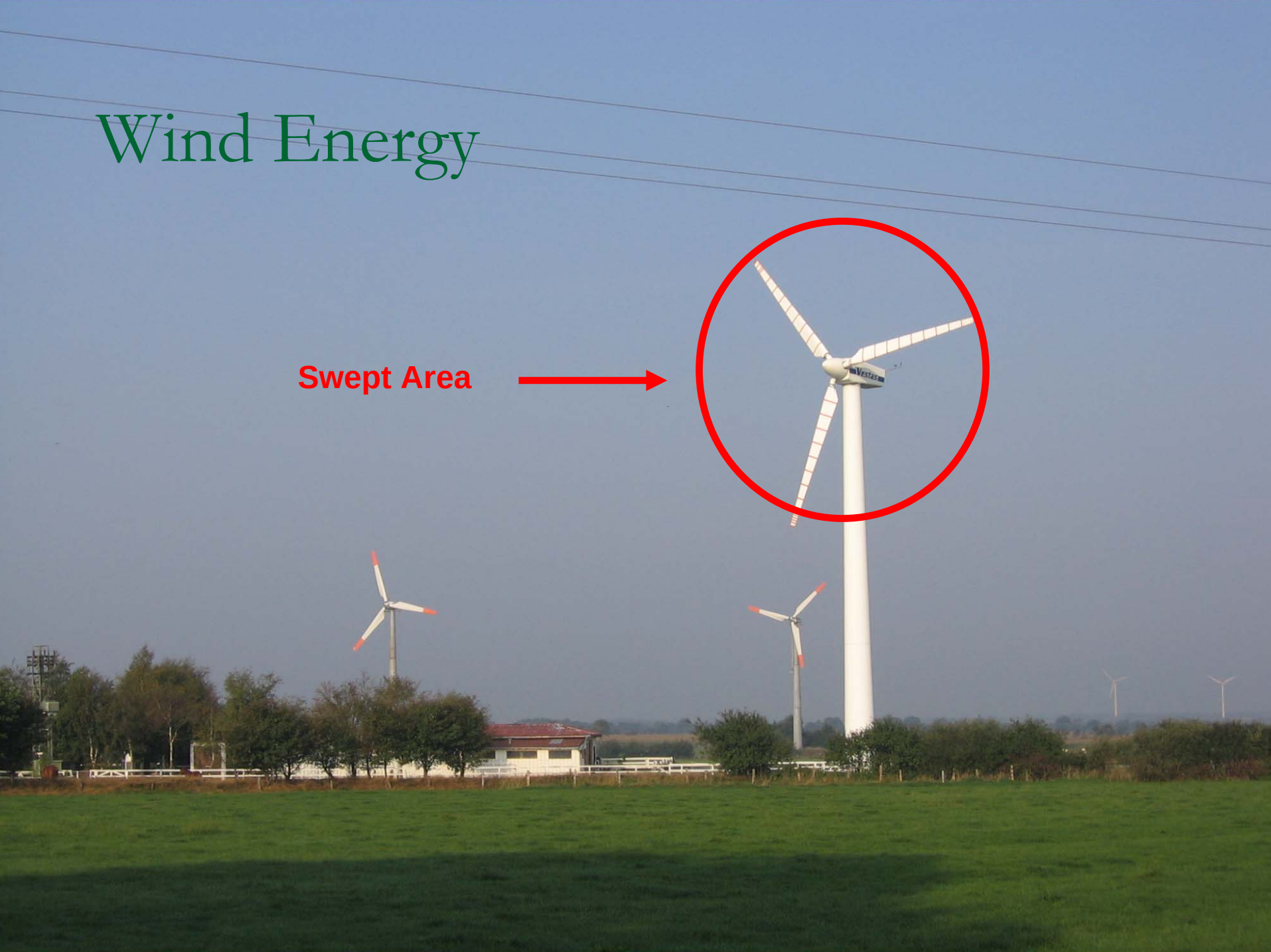
The Power in the Wind

The air density (weight), velocity (speed) and swept area of a windmill determines how much energy can be captured. Simply put:

Power = air density x velocity (cubed) x swept area

While the weight (density) only varies slightly (+/- 10%) with temperature, air pressure, elevation, etc, the wind velocity changes the power available by a cubic factor (v^3). The swept area will change significantly with the windmill blade length and so a blade twice as long provides 4 times the energy.

Wind Energy

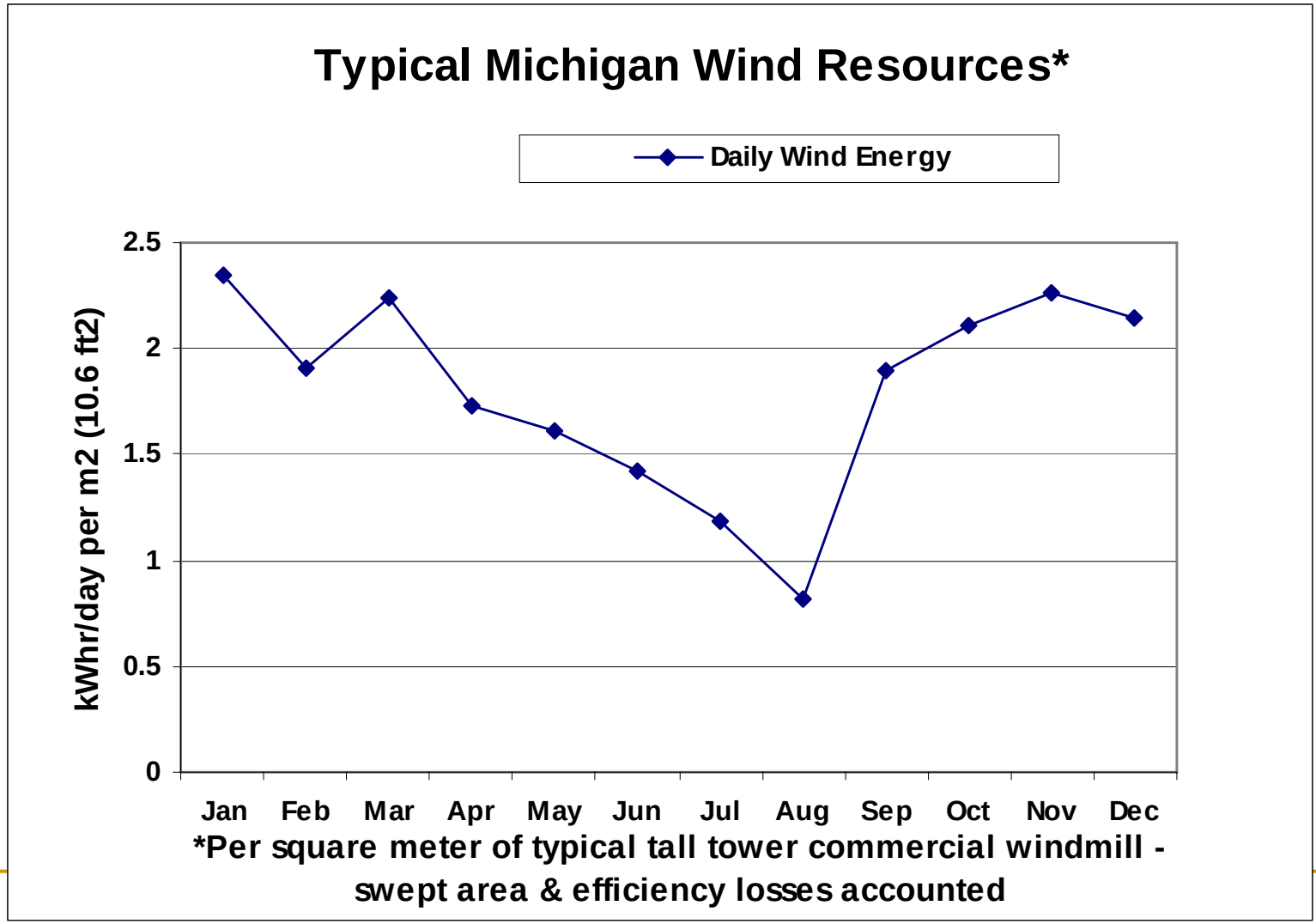


Swept Area of a Windmill

Area = Πr^2 (Where π = 3.14 and r = radius or blade length)

If you double the radius ("r") you get 4 times the area! You do the math!

Daily Average Wind Resources



Power In The Wind, Cont.

Q. At what wind speed do we get the most power?

Velocity (MPH)	Power (V^3) V x V x V	Wind % Hrs/Yr	Relative Power	% Annual Power
5	**125**	10.00%	13	0.2%
10	**1,000**	30.00%	300	5.3%
15	3,375	35.00%	**1181**	**21.0%**
20	**8,000**	10.00%	800	**14.2%**
25	15,625	5.00%	781	**13.9%**
30	**27,000**	3.00%	810	**14.4%**
35	42,875	2.00%	858	**15.3%**
40	**64,000**	0.50%	320	5.7%
45	91,125	0.30%	273	4.9%
50	125,000	0.10%	125	2.2%
55	**166,375**	0.05%	83	1.5%
60	216,000	0.02%	43	0.8%
65	274,625	0.01%	27	0.5%
70	343,000	0.00%	0	0.0%
80	512,000	0.00%	0	0.0%
90	729,000	0.00%	0	0.0%
100	**1,000,000**	0.00%	0	0.0%

Whisper 500

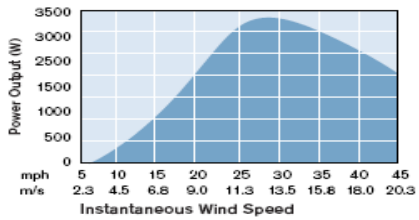
Technical Specifications

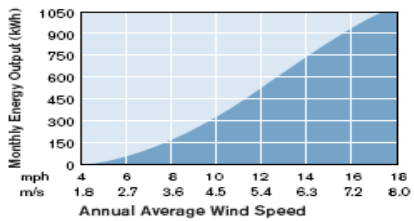
Rotor Diameter	15 feet (4.5 m)
Weight	155 lbs (70 kg)
Shipping Dimensions (box 1: body)	body: 36 x 25 x 32" (914 x 635 x 812 mm) 295 lbs. (133.8 kg)
Shipping Dimensions (box 2: body)	blades: 88 x 12 x 6" (2235 x 305 x 152 mm) 38 lbs. (17.2 kg)
Mount	5" schedule 40 pipe (12.7 cm)
Start-Up Wind Speed	7.5 mph (3.4 m/s)
Voltage	24, 32, 48 VDC (high voltage model available)
Rated Power	3000 watts at 24 mph (10.5 m/s)
Peak Power	3200 watts @ 27 mph (12 m/s)
Turbine Controller	EZ - Wire Wind & Solar hybrid controller (included)
Body	Welded steel; powder coated protection
Blades	(2) Carbon reinforced fiberglass
Overspeed Protection	Side furling
Kilowatt Hours Per Month	538 kWh/mo @12 mph (5.4 m/s)
Survival Wind Speed	120 mph (55 m/s)
Warranty	5 Year Limited Warranty

5 YEAR WARRANTY

MADE IN THE USA

Performance Curves



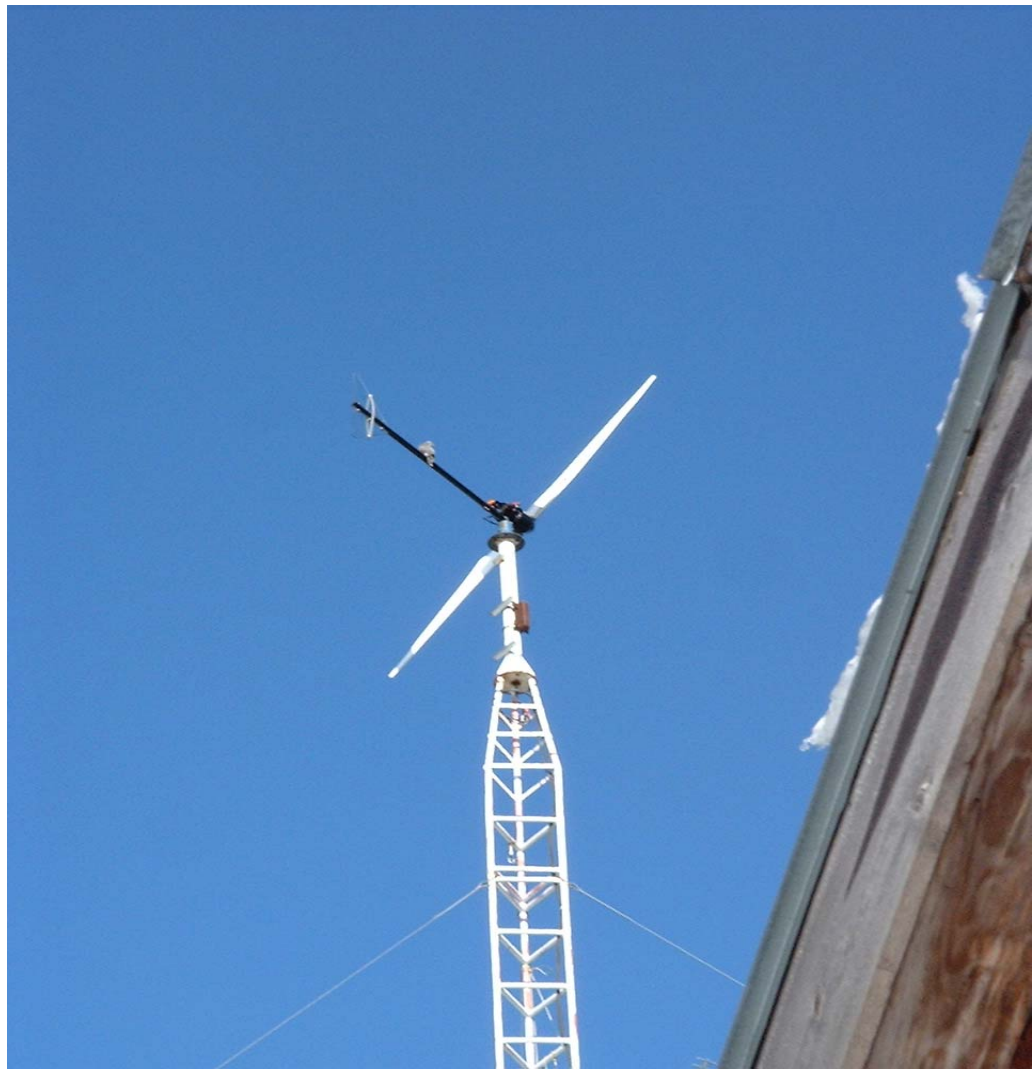


Southwest Windpower • 1801 W. Route 66 • Flagstaff, AZ 86001 • Tel 928.779.9463 • Fax 928.779.1485 • E-Mail info@windenergy.com
www.windenergy.com

Remote Small Windmill Applications: Romanian small farm 10 miles from utility grid.

The Myth of Birds and Windmills

- Avian and bat impacts are seldom seen or very low at mid-west windmills
- Almost nothing compared to cars, windows, tall radio towers with guy wires, electric utility lines, land and habitat loss from farms, cities, urban sprawl.



Windmill Permitting Issues

- Most windmill ordinances are discriminatory (in my opinion) and variances required but legal challenges are not worth the trouble for most
- Typical reasons for opposition to windmills
  - Jealously
  - Greed
  - Hate
  - Ignorance
  - “The look and sound irritates me!”

Wind Power Environmental Impacts: See no evil, hear no evil, speak no evil.

The Walton (pioneers!) Whisper 500 Permit

- No existing ordinance for WTG's
- Township applies 30 ft. height limit
- Either variance or new ordinance required
- $1,000 in fees, legal and/or permit application
- Windmill raised at 29 ft. height first
- One year debate and discussion
- New zoning ordinance approved after 14 + meetings and tower raised to 84 ft.
- Township board comments "is that all we were debating over for a year?"

Small Wind O&M

- Watch and listen
- Read the O&M Manual
- 6 Month inspections
- Clean and protect
- Good home owner insurance

Things Go Wrong: Murphy’s Law

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