

Small-Wind Energy in Northwest Arkansas

(Updated February 15, 2008)

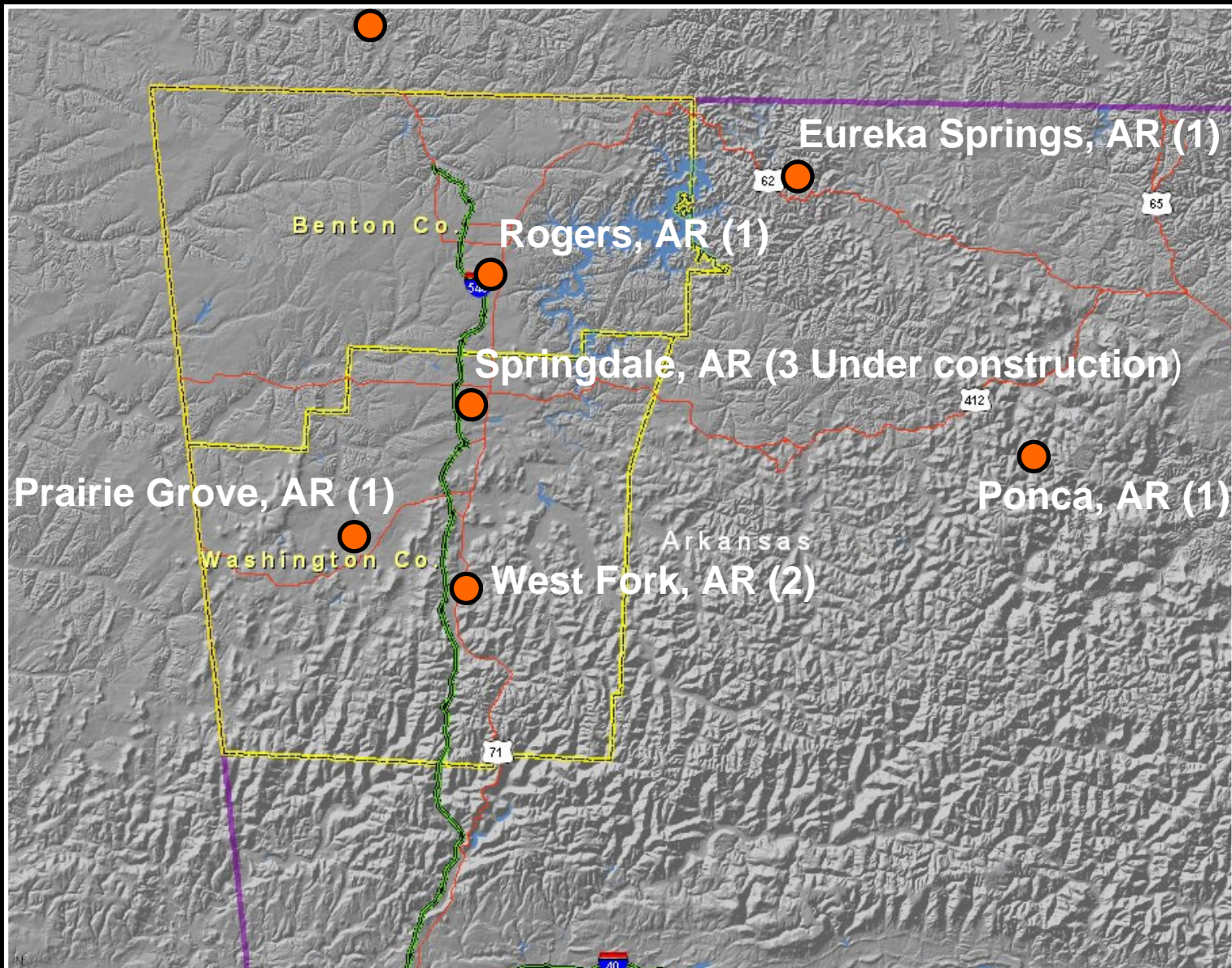
Arkansas Wind Energy Conference, University of Arkansas Fort Smith, Fort Smith, AR, January 17, 2008

Stephan Pollard, Ph.D.-Environmental Dynamics

Fayetteville, AR

Region's Small-Wind Turbines

Neosho, MO (1)



Electricity Price and Consumption: Arkansas and the U.S.

Average PRICE: 2006

Electricity Sector	Arkansas	U.S.
Residential	8.85 cents/kWh	10.40 cents/kWh
Commercial	6.96 cents/kWh	9.46 cents/kWh
Industrial	5.24 cents/kWh	6.16 cents/kWh

Average PRICE: September 2007

Electricity Sector	Arkansas	U.S.
Residential	9.02 cents/kWh	10.94 cents/kWh
Commercial	6.97 cents/kWh	9.88 cents/kWh
Industrial	5.51 cents/kWh	6.55 cents/kWh

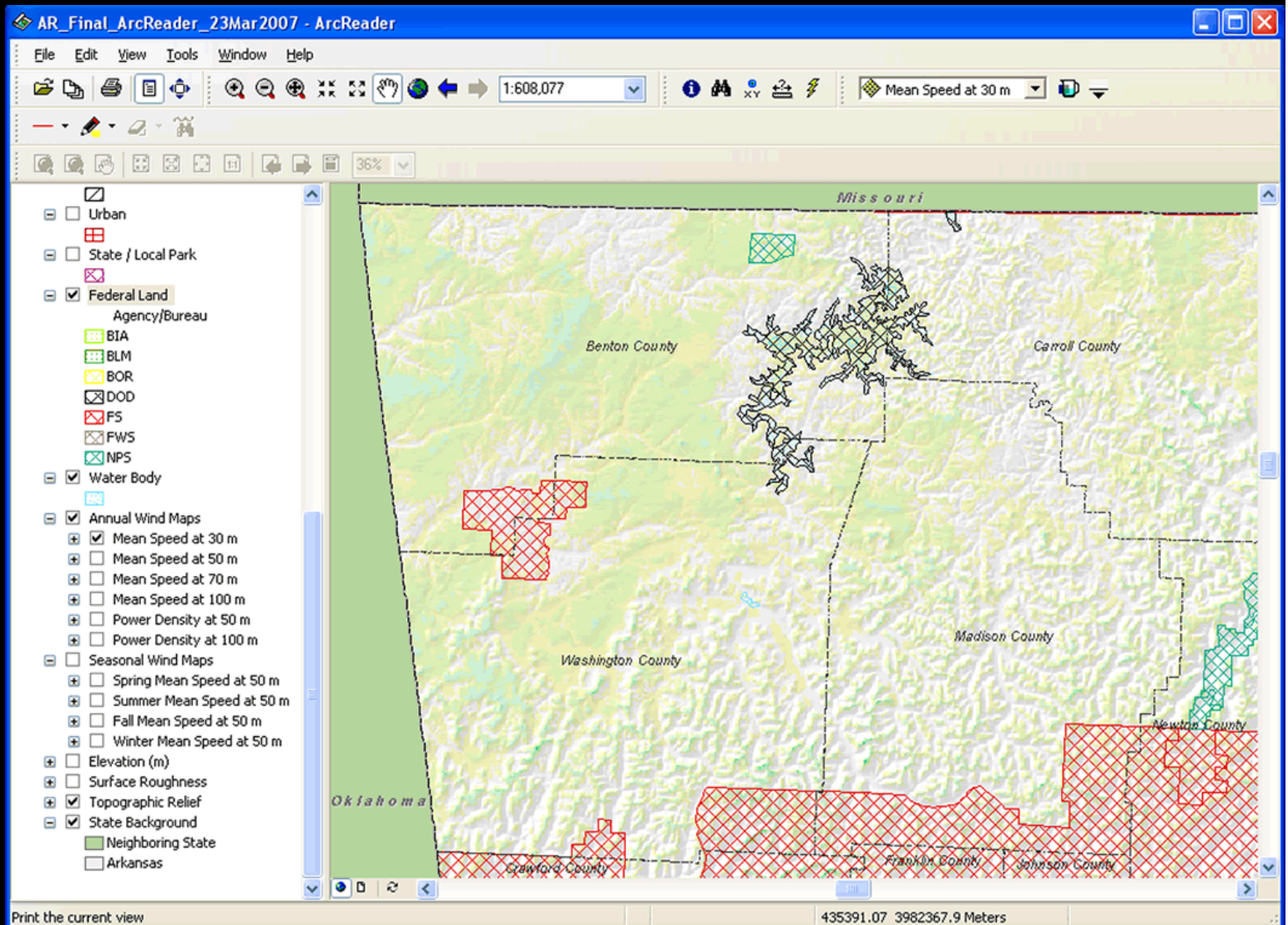
Average Monthly CONSUMPTION: 2006

Electricity Sector	Arkansas	U.S.
Residential	1,108 kWh	920 kWh

Current Wind Resource Data, NWA AR

Average Annual
Wind Speed at
30 meters height
in MPH

White: < 10.1
Yellow: 10.1 to 11.2
Light green: 11.2 to 12.3
Turquoise: 12.3 to 13.4



General Turbine Suitability

Speed @ 30 meters (mph)	Suitability for Small Turbines		Speed @ 70 meters (mph)	Suitability for Large Turbines
< 8.9	Poor		< 13.4	Poor
8.9 – 11.2	Fair		13.4 – 15.7	Fair
11.2 – 13.4	Good	70 m	15.7 – 17.9	Good
13.4 – 15.6	Very Good	100 m	17.9 – 20.1	Very Good
> 15.6	Excellent		> 20.1	Excellent

General Rule of Thumb: For small-scale consider wind energy if -

- Remote application (off-grid) with average wind speeds above 8 mph
- Grid-Intertied application with average wind speeds above 10 mph

Neosho, MO



Make:	Nordtank	Cut-in Wind Speed:	8 mph
Model:	(reconditioned) Nordtank 65	Rated Power:	65 kW @ 39 mph
Tower Height:	125 ft	Notes:	
Hub Height:	128 ft	• Owner: Crowder College	
Rotor Diameter:	54 ft	• Purpose: For Use as Teaching Tool	
Swept Area:	2,290 ft	• Installer's Est Ave Mo Prod: 5 kWh to 8 kWh	

Eureka Springs, AR

Make: Southwest Windpower
Model: AIR 403 (superseded by AIR-X)
Rotor Diameter: 46 inches
Start-up Wind Speed: 8 mph
Rated Power: 400 watts @ 28 mph
Ave Mo Prod: 38 kWh @ 12 mph



Southwest Windpower AIR 403

(Stock Photo)

Rogers, AR

Make: Southwest Windpower
Model: Skystream 3.7
Rotor Diameter: 12 ft
Swept Area: 115.7 sq ft
Cut-in Wind Speed: 8 mph
Rated Power: 1.9 kW continuous output,
2.6 kW peak

Ave Mo Prod @ 8 mph: 100 kWh
Ave Mo Prod @ 9 mph: 170 kWh
Ave Mo Prod @ 10 mph: 240 kWh
Ave Mo Prod @ 11 mph: 310 kWh
Ave Mo Prod @ 12 mph: 380 kWh
Ave Mo Prod @ 13 mph: 450 kWh

Notes:

- Owner: Wal-Mart
- AWS Truewind Ave Annual Wind Speed @ 30 m: 12 mph



Ponca, AR

Make: Bergey Windpower
Model: BWC XL-S
Rotor Diameter: 22 ft
Swept Area: 415 sq ft
Cut-in Wind Speed: 7 mph
Rated Power: 10 kW @ 31 mph

Ave Mo Prod @ 8 mph: 240 kWh
Ave Mo Prod @ 9 mph: 370 kWh
Ave Mo Prod @ 10 mph: 520 kWh
Ave Mo Prod @ 11 mph: 700 kWh
Ave Mo Prod @ 12 mph: 900 kWh
Ave Mo Prod @ 13 mph: 1130 kWh

Owner: Mike Mills
Service Start: June 2005

Notes:

- Reported average monthly production: ~ 660 kWh
- AWS Truwind's reported average annual wind speed at 30 m: 13.4 mph



Prairie Grove, AR

Make: NEG
Model:(reconditioned) Micon 108
Year: 1985
Tower Height: 75 ft
Hub Height: 78 ft
Rotor Diameter: 62 ft
Swept Area: 3154 sq ft
Cut-in Wind Speed: 8 mph
Rated Power: 108 kW @ 33 mph

Owner: Bitworks, Inc.
Service Start: October 2003
Purpose: Mostly hobby
Notes:

- Two...maybe three damaging lightning strikes
- Rough data indicates an average monthly production of ~2,400 kWh
- AWS Truewind's reported average annual wind speed at 30 m: 11.2 mph



West Fork, AR

Make: Southwest Windpower
Model: AIR 403 (superseded by AIR-X)
Rotor Diameter: 46 inches
Start-up Wind Speed: 8 mph
Rated Power: 400 watts @ 28 mph
Ave Mo Prod: 38 kWh @ 12 mph



Southwest Windpower AIR 403

(Stock Photo)

West Fork, AR

Make: Bergey Windpower
Model: XL.1
Rotor Diameter: 8.2 ft
Swept Area: 53 sq ft
Cut-in Wind Speed: 6.7 mph
Rated Power: 1 kW @ 24.6 mph

Ave Mo Prod @ 8 mph: 55 kWh
Ave Mo Prod @ 9 mph: 85 kWh
Ave Mo Prod @ 10 mph: 138 kWh
Ave Mo Prod @ 11 mph: 150 kWh
Ave Mo Prod @ 12 mph: 188 kWh
Ave Mo Prod @ 13 mph: 220 kWh



(Stock Photo)

Small-Wind Considerations at St. Thomas

1. Wind Resource – How much is there?
2. Electrical Output – How much can be expected?
3. Economics (Are we going to come out ahead?) and Incentives
4. Current Technology
5. Grid Interconnection – Net Metering and the Local Electricity Provider
6. Siting Considerations and Barriers
 1. Physical
 2. FAA regulations
 3. Insurance
 4. Noise
 5. Zoning and Home Owner Association covenants
 6. Wildlife interactions – birds and bats (three endangered species: Indiana, Ozark big-eared, and gray)
 7. Shadow flicker
 8. Property value and taxes
 9. Anti-wind groups
7. Installation – DIY vs hiring a contractor
8. Operation, Performance, Maintenance, and Safety



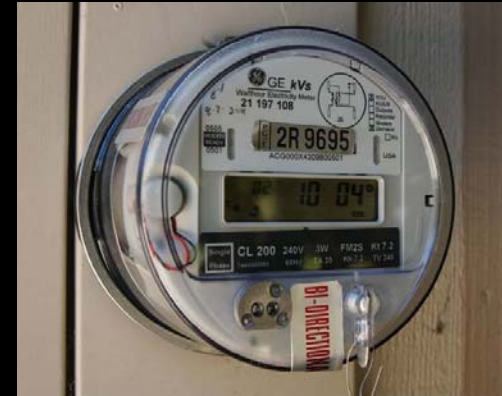
Arkansas's Net Metering Law (Act 1781)

Eligible Renewable/Other Technologies:

- Wind
- Solar Thermal Electric
- Photovoltaics
- Biomass (chicken poop and rice hulls included)
- Hydroelectric
- Geothermal Electric
- Fuel Cells
- Microturbines using renewable fuels

Applicable Sectors:

- Residential, Commercial, and Industrial
- General Public / Consumer
- Nonprofit
- Schools
- Local Government
- State Government
- Federal Government
- Agricultural
- Institutional



Limit on System Size:

- 25-kW for residential
- 300-kW for commercial

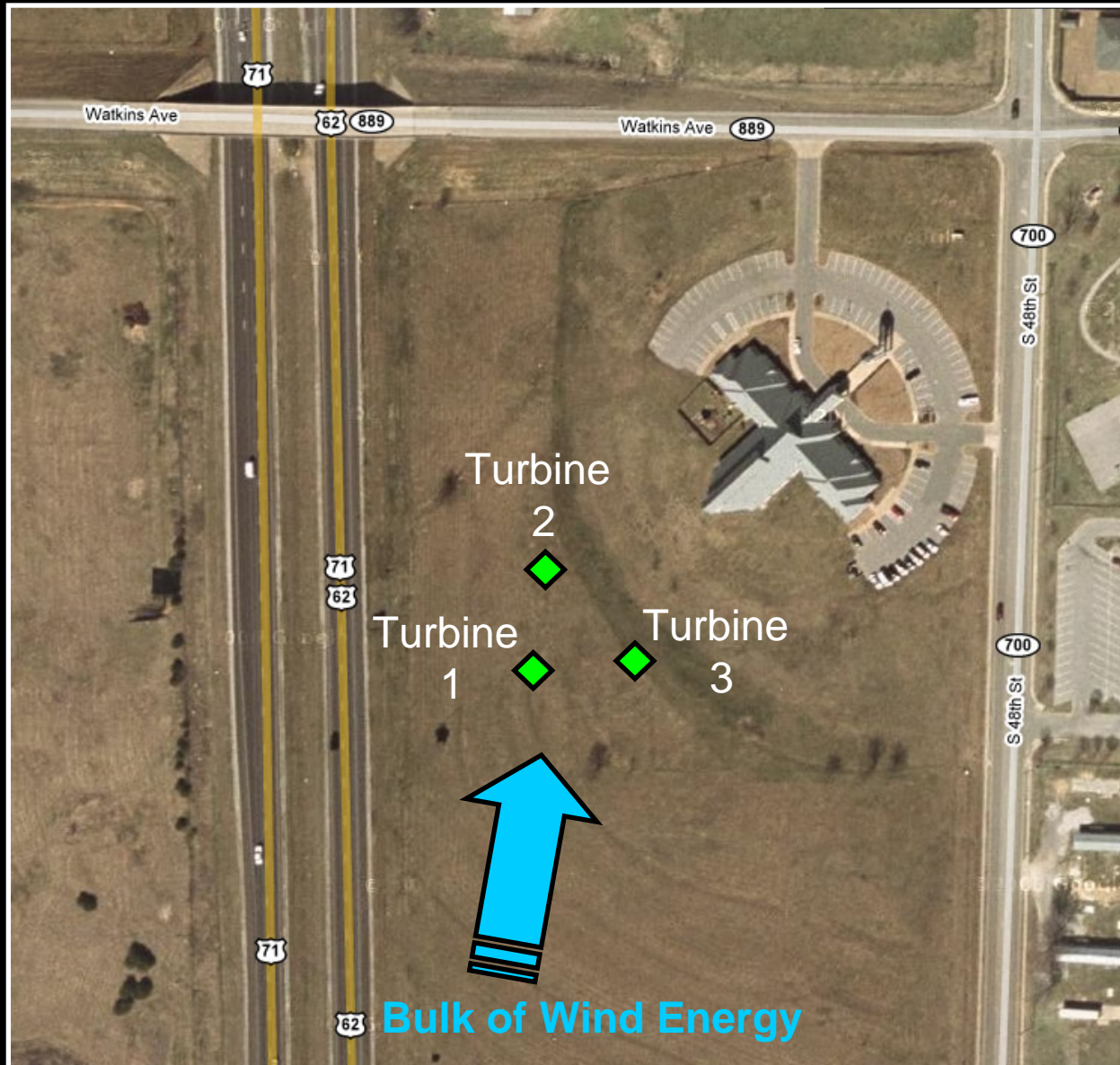
Treatment of Net Excess:

- Credited at retail rate to customer's next bill;
- Granted to utility at end of 12-month billing cycle

Ownership of any REC Created:

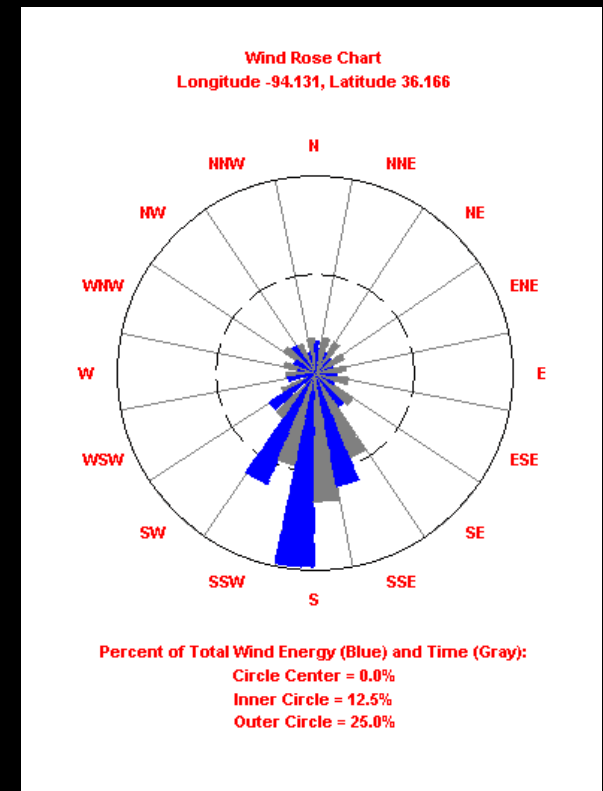
- Property of net metering customer

Springdale, AR



Mean Annual Wind Speed
11.4 mph @ 30 meters

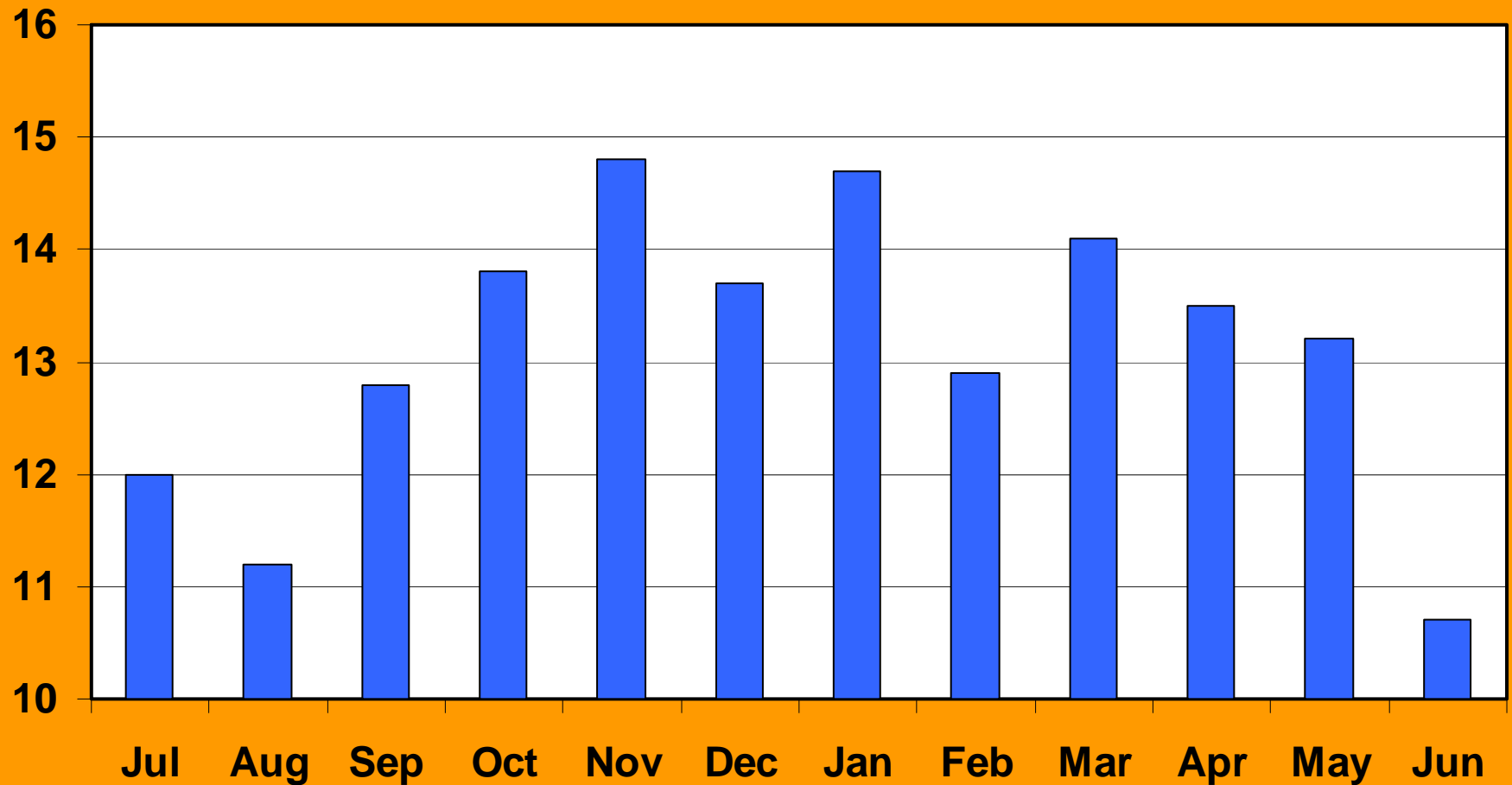
Suitability for Small Turbines
FAIR to GOOD @ 30 meters



St. Thomas Episcopal Church, Springdale, AR

Ave Wind
Speed
in MPH

St. Thomas' Windier Months



Wind-Turbine Information Resources

Home Power Magazine

- Dec 2007 / Jan 2008 Wind Power: 24 Top Turbines
- Jun 2007 / Jul 2007 2007 Wind Turbine Buyer's Guide

Book

Wind Power: Renewable Energy for Home, Farm, and Business
by Paul Gipe

Presentation by

Stephan Pollard, Ph.D.-Environmental Dynamics

Sustainability Incubation and Strategies
Environmental Program Management

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Appendix: Big-Wind Considerations

1. Wind Resource – How much is there and verification
2. Meteorological tower installation
3. Electrical Output – How much can be expected?
4. Economics (Are we going to come out ahead?) and Incentives
5. Current Technology – Turbines and towers
6. Transmission Requirements and Grid Interconnection Protocol
7. Siting Considerations and Barriers
 1. Physical
 2. Institutional
 1. Policies – Federal
 1. Bureau of Land Management and Guidance on Processing Right-of-Way Applications on Public Lands
 2. Department of Defense and Homeland Security relevant policies
 3. U.S. Fish and Wild Life Service
 4. National Telecommunications and Information Administration
 5. Others
 2. Policies – State
 3. Regulations – Federal
 1. Federal Aviation Administration
 2. Others
 4. Regulations - State
 1. Public Service Commission and Environmental Impact Statements
 2. Arkansas Game and Fish Commission and Environmental Impact Statements
 3. Others
 3. Wildlife interactions – birds and bats birds and bats (three endangered species in the region: Indiana, Ozark big-eared, and gray)
 4. Noise
 5. Shadow flicker
 6. Property value concerns
 7. Anti-wind groups
8. Installation – site access and construction
9. Operation, Performance, Maintenance, and Safety