

**WASCO COUNTY ENERGY ORDINANCE UPDATE
NON-COMMERCIAL ENERGY USES
SCALE OF WIND & SOLAR DEVELOPMENT**

- A. Average Residential Energy Consumption: Locally, an average residence consumes 1,333 kilowatt-hours per month or 16,000 kilowatt-hours per year. The trend has shown an annual increase in consumption.

-Watt - A unit of measure for the rate of energy conversion. Equal to 1 joule of energy per second.

-Kilowatt - A measure of power for electrical current (1,000 watts)

-Kilowatt-hour - A measure of energy equal to the use of one kilowatt (1,000 watts) in one hour. One kilowatt-hour equals the amount of electricity needed to burn a 100 watt light bulb for 10 hours.

-Megawatt - A measure of power for electrical current (1,000,000 watts)

- B. Photovoltaic/Solar Energy Production

The following information was largely obtained from Solar Buzz and provides some context for the size of solar systems associated with residences.

<http://www.solarbuzz.com/Consumer/fastfacts.htm>

1. A 1 kilowatt Solar System (about 10-12 solar modules):

- Requires about 100 square feet of installation area;
- Generates around 1,600 kilowatt hours per year in a sunny climate and about 750 kilowatt hours per year in a cloudy climate; and
- Costs about \$7,000 to install before any rebate programs.

2. Residential Energy Needs - Based on the numbers above, at maximum solar capacity and before any rebates, a solar system that would meet all of the energy needs of an average house would require approximately 1,000 square feet of installation area and cost \$70,000.

Area		Production		Cost
Square Footage	Acreage	Kilowatt-Hours/Year	Households	
100	.002	1,600	.1	\$7,000
500	.01	8,000	.5	\$35,000
1,000	.02	16,000	1	\$70,000
1,500	.03	24,000	1.5	\$105,000
2,000	.04	32,000	2	\$140,000
2,500	.05	40,000	2.5	\$175,000
5,000	.11	80,000	5	\$350,000

10,000	.23	160,000	10	\$700,000
20,000	.45	320,000	20	\$1,400,000
30,000	.68	480,000	30	\$2,100,000
40,000	.91	640,000	40	\$2,800,000
43,560	1	696,960	43.5	\$3,049,200

C. Wind Production

The following information should help put into context the size requirements associated with different towers as well as the limitations on height of towers based on setback requirements.

1. Development Square Footage Requirements

- Septic Drainfield = 7,000 square feet
- House Foot Print = 3,500 square feet
- Well = 100 square feet (estimated)
- Driveway 25' long X 12' wide = 500 square feet
- Total = 11,100 square feet

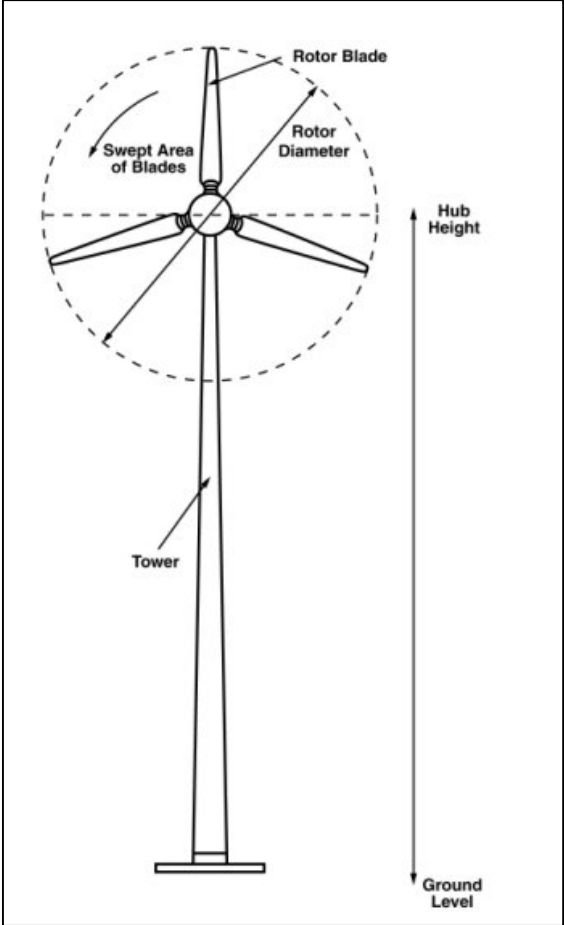
2. Property Dimension & Square Footage Comparisons: Included are the full dimensions and square footage by acres and dimensions of different property sizes.

Property Size	Property Dimensions	Available Dimensions	Property Square Footage	Available Square Footage
½ Acre	147' x 147'	103' X 103'	21,780	10,680
1 Acre	209' x 209'	180' X 180'	43,560	32,460
2 Acres	295' X 295'	275 X 275	87,120	76,020
5 Acres	466' X 466'	454' X 454'	217,800	206,700
10 Acres	660' X 660'	651' X 651'	435,600	424,500
80 Acres	1,866' X 1,866'	1,863' X 1,863'	3,484,800	3,473,700
160 Acres	2,640' X 2,640'	2,637' X 2,637'	6,969,600	6,958,500

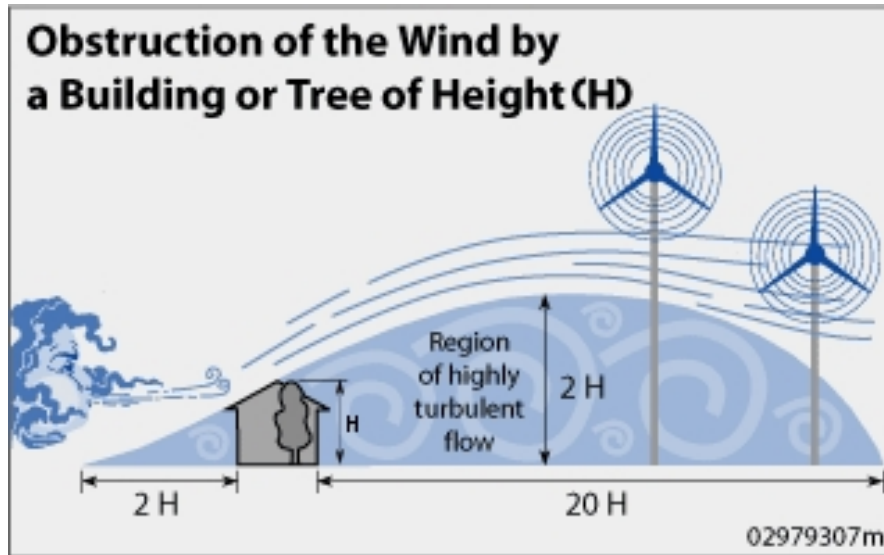
3. Wind Production Variables

There are three primary variables regarding the amount of energy production from a wind turbine.

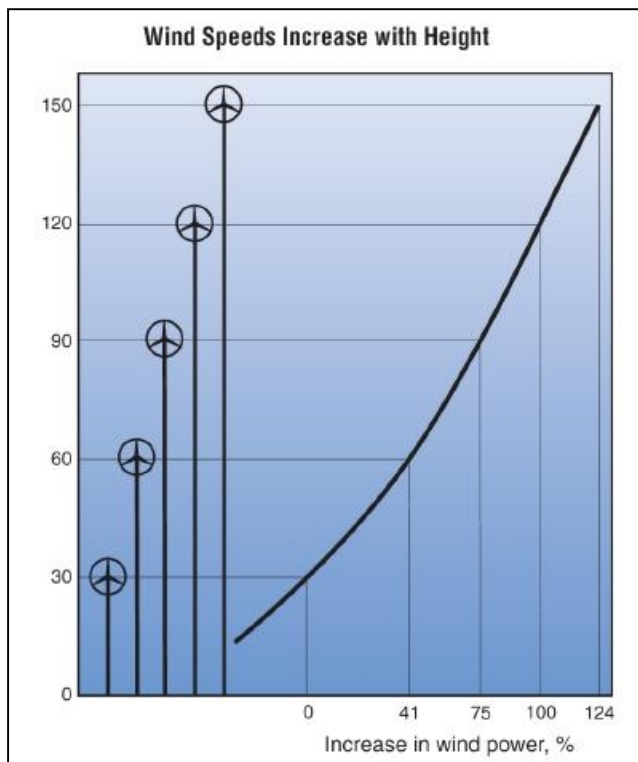
- a. Rotor Diameter/Wind Swept Area – The longer the blades the greater the rotor diameter and the more efficient the wind can be converted to energy.



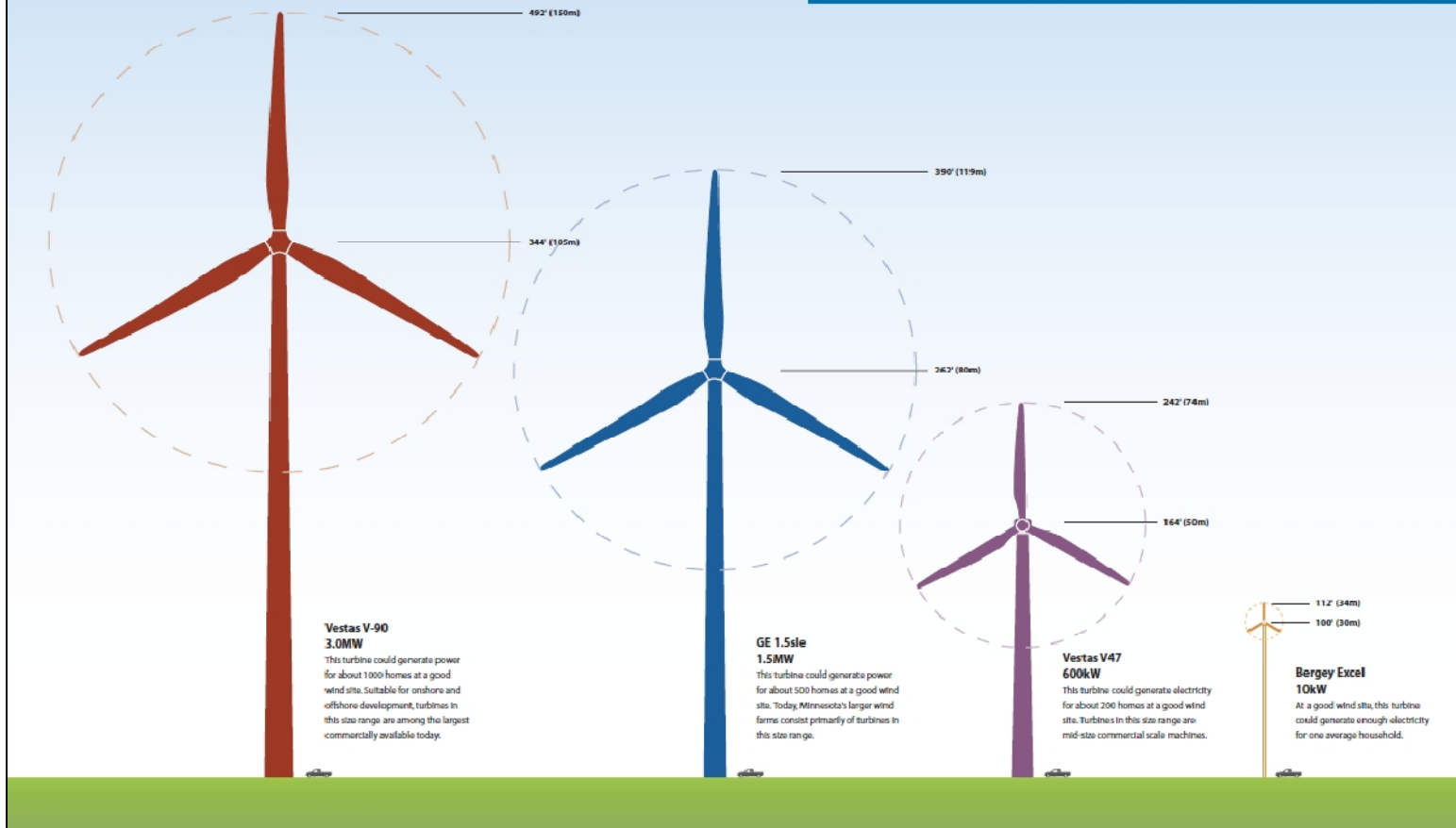
- b. Height – Placing the whole rotor above any obstacle generates more consistent and less obstructed or turbulent wind. The rule used by experienced wind installers is to place the whole rotor at least 30 feet above any obstacle (usually trees) within 500 feet of the tower or the prevailing tree line, whichever is higher.



- c. Wind Speed – The greater and more consistent the wind speed the better.



THE SCALE OF WIND POWER



1. 3 MW – 492' Tall – 1,000 Home Capacity
2. 1.5 MW – 390' Tall – 500 Home Capacity
3. 600 KW – 242' Tall – 200 Home Capacity
4. 10 KW – 112' Tall – 1 Home Capacity

4. Wind Tower Examples

- a. Horizontal Axis Turbines: The following are actual wind turbines available for purchase.

http://www.ecobusinesslinks.com/small_wind_turbines_small_wind_generators_gallery.htm

Energy output is based on 12mph average monthly wind speed. Tower heights would range from 30 feet to 120 depending on the location.

Rotor Diameter: 3.8 Feet

Kilowatt-hours/month: 38

Percent of Monthly Household Needs: 2.8%



Rotor Diameter: 7 feet

Kilowatt-hours/month: 103

Percent of Monthly Household Needs: 7.7%



Rotor Diameter: 8.2 feet
Kilowatt-hours/month: 195
Percent of Monthly Household Needs: 14.6%



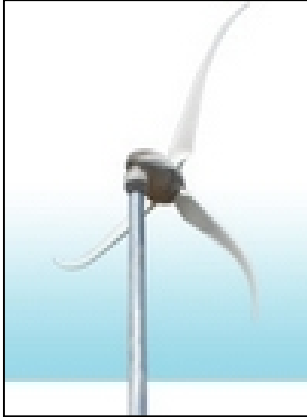
Rotor Diameter: 8.9 feet
Kilowatt-hours/month: 228
Percent of Monthly Household Needs: 17.1%



Rotor Diameter: 10.5 feet
Kilowatt-hours/month: 260
Percent of Monthly Household Needs: 19.5%



Rotor Diameter: 12 feet
Kilowatt-hours/month: 400
Percent of Monthly Household Needs: 30%



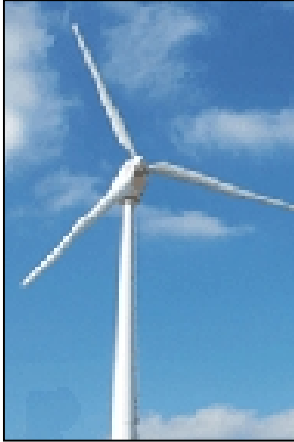
Rotor Diameter: 15 feet
Kilowatt-hours/month: 538
Percent of Monthly Household Needs: 40%



Rotor Diameter: 23 feet
Kilowatt-hours/month: 1,500
Percent of Monthly Household Needs: 112%



Rotor Diameter: 32.8 feet
Kilowatt-hours/month: 4,246
Percent of Monthly Household Needs: 318%



b. Vertical Axis Turbines:





c. Turbines Accessory to Other Uses

Horizontal Axis Turbine on Electrical Line & Street or Parking Lot light



Vertical Axis Turbines on Street or Parking Lot Light



d. Turbines Mounted on Buildings

Vertical Axis Turbines



Horizontal Axis Wind Turbine

