



Small Wind Energy Systems

Wind energy helps reduce U.S. dependence on fossil fuels and your dependence on increasingly expensive electricity from utilities. Wind provides a nonpolluting, cost-effective, renewable energy source. A wind turbine requires an initial investment, but is financially competitive with grid power as you reduce or avoid utility costs.

Small wind turbines are a proven technology with a track record of over 30 years. Upwards of 150,000 turbines account for more than one billion operational hours worldwide. American companies are the wind energy market and technology leaders. Growing demand for small wind systems could cut costs by more than half over the next decade. Small wind turbine generation capacity usually ranges from 1 to 75 kW.

Can Small Wind Work for You?

Following are some of the factors to consider before purchasing wind energy equipment:

Wind resources. Strong and consistent winds will maximize energy generation. Wind conditions almost anywhere in Pennsylvania will support a small wind system; power generation only requires a 9-mph average wind speed. Check wind speeds in Pennsylvania using www.pawindmap.org, then consider an on-site assessment. In general, a more exposed property has better wind potential. Trees and buildings increase “roughness,” adding to tower height requirements.

Permitting. Wind towers typically rise 80-120 feet to catch the best wind. Check local zoning ordinances for height and set-back restrictions before investing in a small wind energy system. A 1-acre property can accommodate most turbines.

Financing. The price you pay for electricity, the cost per kilowatt hour and your total monthly bill, dictate how long it will take to recover your investment in a wind turbine. Larger electricity users will have a shorter payback period, 10-15 years versus 15-25 years for smaller users, because generation costs decline as you increase turbine size and therefore production and use. This makes wind turbines a better investment for consumers with the highest monthly energy bills, especially people paying more than \$100 after energy efficiency improvements. Off-the-grid locations can forgo high utility connection fees by installing a stand-alone small wind or wind-solar hybrid system with a battery, making wind an even better investment.

Benefits. A small wind energy system can easily reduce your electricity bill by 50 to 90 percent. Connecting turbines to the power grid can enable wind producers to sell excess electricity back to the local utility. Over its 20 to 40 year life, a small wind turbine can offset approximately 1.2 tons of smog-related air pollutants and 200 tons of global warming causing carbon dioxide from power plants. Your turbine will ease demand on the power grid and insulate you from rising electricity prices.

Net Metering

In Pennsylvania, wind energy producers can exchange their excess generation for grid electricity in a net metering arrangement. When the wind is blowing, any extra power flows back into the grid, turning the electric meter backwards (or a second meter forwards). The utility trades this electricity for the grid power you use when the wind is slack. All renewable energy systems up to 50 kW and many up to 5 MW qualify. Net metering policy in Pennsylvania only guarantees the producing customer retail value for offset energy costs, providing economic incentive for wind power only to meet the generator's use.

Two other features of a utility's rate structure also influence the benefits of small wind: graduated rate schedules (especially for commercial rates) that give lower rates to larger users and higher supplemental rates for power producers.



Choosing and Financing a Small Wind Turbine

Turbine Options

The upfront cost of a turbine, tower, and inverter ranges from \$3,000 to over \$30,000. Depending on wind resources, local restrictions, utility rates, and your electricity use, wind turbine manufacturers will offer several options including:

- A low cost 1.5 kW wind turbine can produce 300 kWh of electricity per month. This will meet the needs of a small home with low energy use, but will not meet peak seasonal demand. Initial cost is \$3,000 to \$5,000.
- A \$10,000 investment will allow year round grid independence given strong winds. To generate the same amount of power -- most homes use 700 to 1,000 kWh per month -- in most of Pennsylvania, however, initial cost can exceed \$20,000, dictating a longer payback.
- A slightly larger 10 kW turbine will generate close to 1000 kWh per month. Cost can exceed \$40,000, but the system will pay for itself in 18 years given a local electricity rate of 13 cent/kWh (close to the average in the Philadelphia area).
- A solar-wind hybrid energy system is another option. It can provide a more reliable source of electricity because the sun tends to shine stronger when the wind is slack and vice versa. Battery storage provides more consistent output from a wind turbine. Costs vary, as hybrid systems can be tailored to meet site conditions and customer needs.

Financing the Purchase

Several financing tools and a variety of incentives are available to help finance your small wind energy system. Loans structured for other equipment purchases and even mortgages refinanced to include a wind turbine can work. The monthly savings on your electricity bill can cover the majority of your payments on a loan taken out for the wind turbine purchase.

Net metering remains the best incentive for small wind in Pennsylvania, providing producers with full retail value for their wind energy. Throughout the 20-40 year turbine lifetime, your investment in small wind should pay an 8-25 percent after-tax rate of return.* As electricity prices rise, you will earn even more. Continuing insurance and maintenance costs should be minimal, usually no more than \$150 per year for a 10 kW, \$30,000 turbine.

Additional Small Wind Resources

- ▶ For a near-complete resource on small wind, visit the American Wind Energy Association (AWEA) Web site. Take a look at the [slide show](#), [tool box](#), and [expert advice](#) pages for information on siting, permitting, interconnection, manufacturers, economics, and case studies. www.awea.org/smallwind.
- ▶ Get answers to your technical questions at The Danish Wind Industry Association's guided tour site, www.windpower.org/en/tour.htm.
- ▶ Assess your Pennsylvania wind resource at www.pawindmap.org.

For more information, visit www.depweb.state.pa.us, keyword: OETD.

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* www.awea.org, Small Wind Slide Show "Factors Affecting Payback"