



Steps in the Small Wind Series

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E³A: Small Wind Energy Applications for the Home, Farm, or Ranch

Operation and Maintenance



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Credit: Ed Kennell

If you are considering the purchase of a small wind system, you should know that small wind systems require at least annual maintenance. Maintenance needs increase with the number of moving parts on the turbine, higher average wind speed, and/or turbulence. This factsheet provides an overview of operation and maintenance considerations, but you will need information specific to your wind system in order to complete actual maintenance. Your owner's manual should provide most of the information you need to maintain your system properly.

Proper Installation: The First Step in System Maintenance

Careful assembly of parts and high-quality installation will help to prevent many maintenance issues. Proper installation of a system includes appropriate bolt torque, especially when installing the blades, rotor, and tower. Electrical wiring practices should include wire gauge sizing, proper grounding and crimping, and ensuring wiring meets electrical code standards. Lubrication should be completed to the manufacturer's specifications. Other factors may include the sequence of assembly and installation, proper initial tower installation or setup of guy wire tensions, and appropriate pouring of the foundation.

Budgeting for Maintenance

The amount of maintenance (and money) your system will require will vary by the turbine, site, wind speed and turbulence and by your access to parts and services. Here are a few things to consider:

- Most of the moving parts are mounted on the tower. You will need to climb the tower or install a tilt-up tower that will allow you to lay the tower down to perform maintenance. Even with a lift or bucket truck, you will likely need to climb the tower to perform all required maintenance. If you are not willing to climb the tower, you will have to hire someone to perform maintenance. Consider costs of climbing gear and/or service expenses when developing your budget.
- Some references suggest budgeting \$0.01 to \$0.02 per kilowatt-hour of electricity produced. Others recommend one to three percent of the total installed cost be budgeted annually. Determine the appropriate amount for your system by learning about the components that will require regular replacement, understanding their costs. Then you can set aside enough annually to afford replacement.
- Access to parts and service can be a consideration. Budget for shipping expenses on parts or mileage for service calls.
- Maintenance gear should also be included in your budget. In addition to some owner's manuals, *Home Power Magazine* has several articles that address the types of gear you may need. Your installer may be willing to help you understand what you will need to maintain your small wind turbine.
- Look closely at warranties. How long will the manufacturers of turbines, towers, foundations, and other parts warranty their products? What is in the



Courtesy of DOE/NREL, Credit: Warren Gretz

fine print? Does the warranty include shipping new parts, cost of repair, or technical services? It is not typical for all costs to be covered by a manufacturer. However, reputable manufacturers are more likely to offer better warranties because they have a track-record of proper function, are confident in the construction and operation of their systems, and want to ensure that their customers are satisfied. You should review the timetable for replacement, repair, or service when reviewing warranty information from the manufacturer. This information may help to choose the best system for your application. A good warranty may save thousands in repair bills.

- Budgeting for reduced electrical production should also be included in your maintenance budget. Repair that requires parts to be ordered, shipped and installed will prevent your system from operating for several days or weeks.

Servicing Work

Consider the work that will need to be done on your small wind turbine. Ask the question, “If not you, then who?” This question is important for two primary reasons: 1) Even people who are technically competent to perform maintenance may need to sub-contract the work. If you become ill or injured, who will maintain your system? Are you willing to spend time maintaining the system? It is easy to defer maintenance because you are busy, the weather is cold, or you would rather spend your free time doing other activities. You may find that hiring service work makes more sense. 2) It may take some time to locate a qualified technician in your area. In some cases, installers are willing to provide maintenance services on a fee-basis and some turbines come with service contracts. Depending on your area, however, access to qualified technicians may vary. If technicians will have to travel to reach your site, you will need to consider mileage expenses as part of your budget.

Components to Inspect

A great source of information for the type of maintenance recommended for your turbine is the owner’s manual. Most manufacturers provide an overview of the maintenance requirements and recommendations for part replacement. The following information is not a thorough maintenance guide. It intends only to give you an overview of the components of the turbine you will need to inspect:

- **Power Room** — Inspect all electrical components and wires. This will include everything from circuit breakers to the inverter. Your inspection will involve checking for ground faults, tightness of connections, corrosion, or conducting electrical tests recommended by the turbine manufacturer. You will also have battery inspections if batteries are part of your system configuration.



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**Note – Batteries will require inspection and monitoring more frequently than annually. Check with your installer on battery maintenance requirements.*

- **Foundations and Towers** — The requirements for tower maintenance vary according to the type of tower. In general, you will need to inspect the foundation to ensure that the tower is straight and plumb. You will also need to check for rust, compromised welds, or other pieces of the tower base that are broken or missing. On guyed-towers, you will need to look for slack or wear in the wires. Corrosion (often indicated by rust), unusual movement, and wear on all points of connection are considerations when performing maintenance. You will also need to check the brakes and grounding of the tower.
- **Tower Mechanics** — Checking for loose or missing bolts, nuts, and lock nuts. The wiring down the tower as well as any tower-mounted data equipment will need inspection.
- **Wind Generator** — All moving parts and points of connection require inspection. Loose hardware, rust, grease or oil stains (in atypical locations), and black powder are indications of wear that you should address. Inspect turbine tower mounting and blade mounting integrity. Components involved with passive control or furling, depending on the type of system, also require inspection.
- **Blades** — In addition to checking the points of connection at the rotor, check the blades for cracks, nicks, pits, and damage to the leading edge.

Safety

Safety should be a primary concern and never discounted or overlooked when performing any turbine maintenance. Be aware of the safety recommendations for your system. Safety concerns include falls, electrocution, and multiple pinch points. Maintenance may include manipulating heavy objects with winches and lifts, which generates thousands of pounds of force. Remember that much of the maintenance work will be performed well above the ground. Maintenance work performed on the tower will require climbing equipment and careful attention to detail. The wind speed will increase and the temperature will

likely be cooler as you reach the top of the tower.

There are steps that you can take to mitigate hazards. You can ensure electrical disconnects are in place and functional to protect you from back-feed. Check for functioning rotor brakes. Pay attention to the location of overhead electrical lines and trees. Wearing protective eyewear, gloves, hardhat, clothing, and safety equipment can help to protect you while you work. Be informed, and preferably trained, on wind turbine maintenance and safety.

In short, you should consider the need to maintain a small wind system before purchase.

Like automobiles, those that are well cared for can provide years of service. Those that are not well maintained will show the lack of care through loss of energy production, catastrophic system failures and shortened life expectancy. Be sure to have frank discussions regarding maintenance with your installer to ensure you accurately understand the maintenance requirements of your system before you commit to a small wind turbine.



Courtesy of DOE/NREL.
Credit: Jerry Bianchi

Notes

References

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