

## →☰ Going On- or Off-Grid

### ⚠ Crucial Stuff: Ability to go On-Grid

If you need to connect your turbine to the grid, are you allowed and able to?

It is not always possible to connect an electricity-generating renewable energy system to the national electricity grid or the isolated grid in your area. If you want to connect, you need to ensure grid interconnection and net metering are allowed by your utility. Call your local utility to find out more.



There are many advantages and disadvantages of connecting to the grid. To find out which is more practical for you, compare the on- and off-grid options:

- **Description**
- **Comparison**
- **The Good & Bad**
  
- **Description of On- and Off-Grid Small Wind Energy Systems**

If your facility happens to be on or near an existing electricity grid, you will have to decide whether or not you want your small wind turbine to be connected to the grid. Below is a comparison of on- and off-grid applications - this will give you an idea of the typical applications for each system. After this, you can look at the practicality of option, as well as the pros and cons.

#### **On-Grid Applications:**

- The wind turbine and the load it serves (e.g. a house) are not connected to a large, external electricity distribution or transmission grid. This can be a national grid or one that supplies an isolated community, mining complex, or other large load.
- The house or other load typically receives its electricity from the wind turbine when wind is available and from the grid when supplemental/backup power is needed.
- Small wind turbines above 30 kW commonly use induction generators that produce grid-compatible AC electricity and can be connected to the grid directly, without inverters

#### **Off-Grid Applications:**

- The wind turbine and the load it serves (e.g. a house) are not connected to a larger electrical network.
- Since wind is usually an intermittent energy resource, off-grid systems are typically installed with some form of energy storage device (usually a bank of lead-acid batteries) that stores excess wind-generated electricity and supplies it to the load (e.g. house) when there is insufficient wind. Battery systems can supply reserve power when energy demand exceeds that delivered by the wind turbine, such as during calm spells.
- DC electricity from turbines can be used directly for battery

(although other power conditioning equipment such as step-up transformers may be required). Such turbines usually need to be connected to the grid in order to operate, since the generator relies on the grid for field excitation and frequency synchronization.

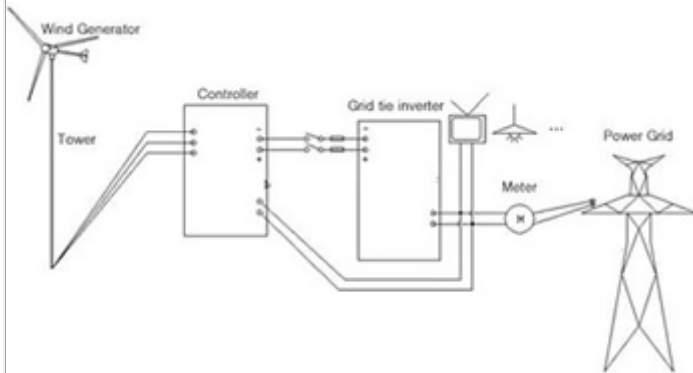
- To connect a renewable energy system to the grid, you must adhere to interconnection guidelines and a net metering agreement.

### ● Comparison

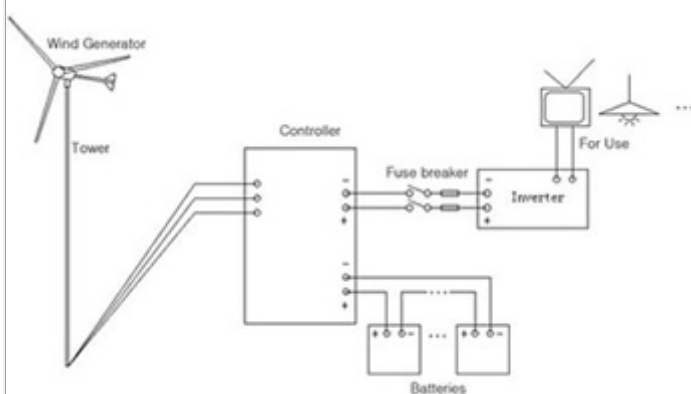
Below is a comparison of on- and off-grid small wind systems configurations, applications and practicality so you can determine which is more suitable for your needs.

#### Typical Configuration

Typical on-grid small wind turbine configuration with a permanent magnet alternator and synchronous inverter:



Typical off-grid small wind turbine configuration with battery storage but without supplemental or backup energy systems:



### ● On-Grid

### ● Off-Grid

### ● Applications

A small wind system can be used on-grid (for a cottage, home, farm, or business) or off-grid (for a boat, RV, cottage, home, farm, business, remote community, or remote station):

- For on-grid, small wind can help supplement your grid electricity and reduce your dependency on the local electrical utility.
- For off-grid, small wind can help provide electricity to remote locations for both seasonal and year-round use.
- For isolated grids (not connected to the national electrical grid), small wind can help reduce the use of diesel generators, thereby saving fuel costs and reducing pollution.

### ● Practical if

<ul style="list-style-type: none"> <li>You have an average annual wind speed of at least 3 m/s at your site</li> <li>The utility's requirements for connecting your system to its grid are not prohibitively expensive</li> </ul>	<ul style="list-style-type: none"> <li>You have an average annual wind speed of at least 3 m/s at your site</li> <li>A grid connection is not available or can only be made through an expensive extension. The cost of running a power line to a remote site to connect with the utility grid can be prohibitive (up to \$30,000 per kilometer), depending on terrain.</li> <li>You would like to gain energy independence from the grid</li> </ul>
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- The Good & Bad**

There are many advantages and disadvantages associated with being on the grid. Below is a comparison of the pros and cons of both on-grid and off-grid applications - you should consider these as you decide which is most suitable for your needs.

<b>On-Grid</b>	<b>Off-Grid</b>
<b>Advantages</b>	
<ul style="list-style-type: none"> <li>Allows renewable energy generators to use the "grid as storage" for excess generation, thereby reducing the need for expensive battery storage systems and improving the payback period for the investment.</li> <li>Eliminates the need for an expensive second meter, thereby reducing the installation costs.</li> <li>Reduced or eliminated environmental impact from the disposal of lead-acid batteries, the burning of fossil fuels for backup generators and potential spills of generator fuel.</li> </ul>	<ul style="list-style-type: none"> <li>Systems are easy to set up</li> </ul>
<b>Disadvantages</b>	
<ul style="list-style-type: none"> <li>Grid connection is not permitted everywhere in Canada</li> <li>Process to obtain approval for interconnection from the utility company can be lengthy and complicated, and requires careful planning</li> <li>For DC output turbines, connection to the grid requires an inverter capable of producing "grid-ready" AC electricity. While such inverters are commonly available for photovoltaic systems, most of these models can only be used with wind turbines if they are tied to a battery bank that acts as an energy buffer. A number of leading manufacturers of small wind turbines are in the process of developing 'battery-less inverters' that avoid the extra cost of battery banks. Note, for battery-less inverters, the requirement by many utilities for inverter compliance with the UL 1741 standard (in USA for example) limits the amount of time some small wind systems can spend storing energy in the grid. Be informed of recent inverter developments (consult an expert, if necessary) before deciding to go with a battery-less inverter for on-grid application.</li> </ul>	<ul style="list-style-type: none"> <li>Cost of batteries</li> <li>Maintenance of batteries</li> <li>Back-up system costs (for hybrid systems)</li> <li>Higher level of skill, knowledge, and discipline required for managing electrical load according to what your generation system(s) can provide</li> </ul>