On & Off...Grid

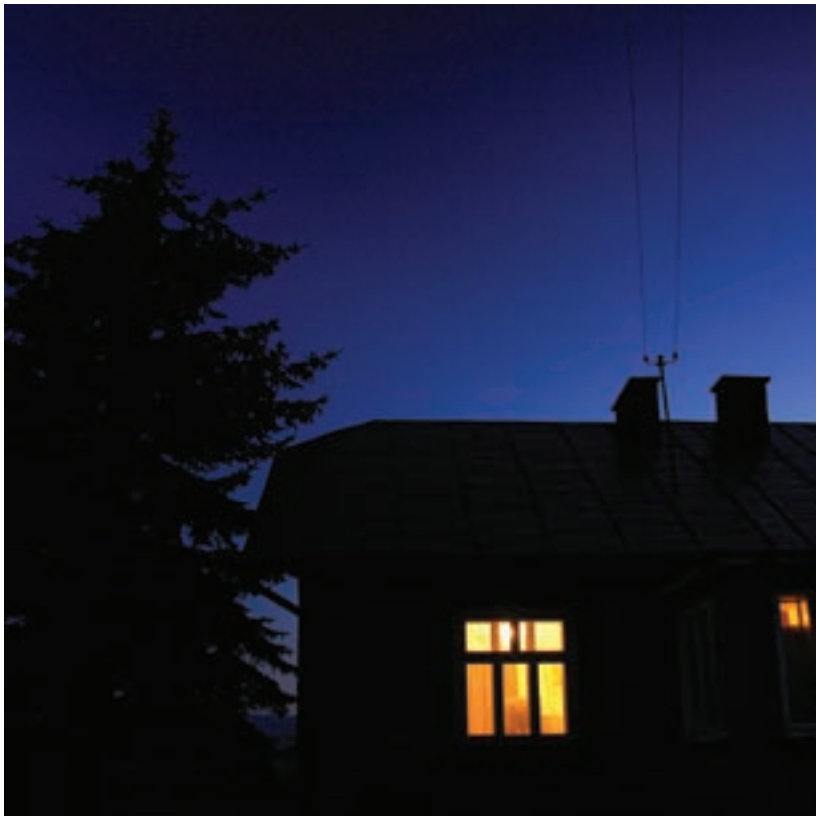
The Utility Network

by Ian Woofenden

Derivation: From gridiron, *from Middle English* gridire *or* griddle, *and indicating something consisting of or covered with a network.*

In 1880, Thomas Edison electrified a string of streetlamps on Broadway in New York City—one of the first steps toward our modern utility grid. Gradually, companies selling electricity to homes and businesses in the United States strung wires to connect their generating plants to their customers. This evolved into our present-day electricity grid, which connects about 140 million customers with about 17,000 generating plants in the Continental states, using millions of miles of cable. This network is an incredibly useful tool that makes good use of energy resources to feed the varying load demand.

Gradually over the last 40 years, renewable energy technology for homes and businesses has hit the mainstream. This has led to two general types of renewable energy systems, with variations in each.



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ON-GRID systems come in a few different flavors. One major distinction is between battery-based systems and batteryless systems.

Battery-based on-grid systems include energy storage to power critical loads during grid outages. They require a battery bank sized to handle the loads needing backup and for the number of hours or days of outage protection desired.

These systems can be configured to sell surplus energy back to the grid, crediting the user's account. Or they can be similar to off-grid systems, not selling back any energy, but using the grid to charge batteries or run loads directly when there isn't enough renewable energy. We don't have standardized terminology to distinguish these two types of on-grid systems from each other. Calling them "utility-interactive" and "utility-supported" might be appropriate.

In the case of utility-interactive systems, the inverter (an electronic device that converts DC electricity to AC electricity) is programmed to synchronize with the grid and send to it any electricity the home or business isn't using at the moment, "spinning the meter backward." This excess energy is used to offset utility energy consumed when the customer is using more than their home system produces. The inverter also maintains the batteries at a set voltage, shunting excess energy generated to the grid. Utility-supported systems aren't configured to send excess electricity to the grid, but to use the grid for backup and battery charging when necessary.

Batteryless grid-tied systems have no batteries for storage, offering no utility outage protection. When the grid fails, these systems are designed to automatically shut down. When the grid is operational, any renewable energy that isn't being used at a given time is sent back to the utility to offset energy used from the grid. Batteryless systems are simpler, less expensive, and more efficient, but they provide no backup. No single inverter on the market today will let you choose between batteryless and battery-based grid-tie at the flip of a switch—you must make this decision up front.

OFF-GRID renewable energy systems run independently of the utility grid, using batteries to store and deliver energy. Many people live and work beyond the reach of utility lines, and the cost of line extension can be very high (in my area, more than $20 a foot). Others have a desire to cut the cord and be off grid even though the utility lines are near. This is an impractical choice in my opinion, but may be more attractive if the utility does not allow you to sell your surplus electricity, or if they have unreasonable charges or requirements for connection. But off-grid systems cannot use the grid as a "battery," so once the batteries are filled, any surplus energy they generate is wasted. These systems also must supply 100 percent of the electricity needed, which usually means having a backup, fossil-fueled generator (a dirty and expensive source of electricity), unless you have sufficient renewable resources at your site.

Off-grid homes are a good microcosmic example of the responsibilities and challenges of gradually making the grid more and more sustainable. We either live within the capacities of our renewably powered systems and deal with the vagaries of the wind, sun, and water; or we wrestle with ways to wean ourselves from depending on fossil fuels (with its costs and impacts) for backup energy. Off-gridders also must take on all the responsibilities that the rest of the population pays a utility to handle—financing, R&D, design, installation, maintenance, troubleshooting, operation, and replacement. As years go by, we try to invest in more renewable capacity, and learn to use it wisely. This long-term investment gives us cleaner, more reliable energy.

With the perspective and experience of more than 25 years living off grid, I encourage you to view the grid as a useful tool, and use it to your advantage when it comes to installing an RE system. But whether you cook your waffles off-grid or on, I hope you too will move toward using more and more *renewable* energy.

Ian Woofenden (ian.woofenden@homepower.com) lives off grid in Washington's San Juan Islands, using sun, wind, and a bit of propane to make electricity and hot water for his family. In addition to his work with *Home Power*, he organizes workshops for SEI, consults, and teaches.