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Alternative ENERGY

On or off the grid, advancements in wind, geothermal and solar technologies are delivering a bevy of options for homeowners. **BY CHRIS WOOD**

It is the golden rule of real estate: Location is everything. Two hiking buddies looking to settle down into their first cabins, chose different ridges in Lehigh Gap, Pennsylvania. It seemed perfect: reasonable land prices, direct access to the Appalachian Trail and, courtesy of Blue Mountain, a natural geography and altitude suitable for erecting wind turbines to supply primary energy needs.

Or so they thought. “Two friends, same mountain,” recalls Gerald Rowan, a visiting professor in art and architecture at Lehigh University and the author of “Compact Cabins,” a book on energy-efficient, smaller-square-footage homes. “One guy put up his turbine and has more energy than he needs, and the other guy two ridges over had to take down his tower because there wasn’t any wind. It speaks directly to the concept of appropriate technology when it comes to residential energy systems.”

Indeed, as homeowners continue to embrace sustainable energy systems — for energy efficiency and cost savings as much as for green credibility — experts are advising careful consideration of cost, climate and, most important, locale when it comes to selecting and installing an alternative energy system. Wind, solar, geothermal and hybrid systems combing two or more sustainable energy components all have pros and cons, as well as cost and installation issues to consider. The good

news is that all of these energy technologies have proven out in home applications. They are also becoming less maintenance intensive and, courtesy of state and federal green tax credits and rebates, are increasingly affordable. Selecting one just comes down to that age-old golden rule: where you’re located.

What to Choose

When considering energy systems for your home—whether in new construction or in retrofit/remodel applications—the largest guiding decision is locale, particularly for homes that will be off the local utility grid. “If you are off the grid, you are obviously generating the entirety of your energy needs,” says Dal Loiselle, founder of Fairfield, Iowa-based sustainable homebuilder Evergreen Homes and Developments. “So you are going to need an off-the-grid system, which means solar panels or a wind system or both.”

For power generators dependant on sun and wind, climate is an obvious issue but one that is still surprisingly overlooked: Solar is not as efficient in less sunny and more northern latitudes, and wind turbines are rendered ineffective in an area that’s dead calm. Although homeowners can alleviate those issues somewhat — turbines can be erected on taller towers to catch more constant and stronger winds, and solar panels can be mounted on racks that track toward the prevailing direc-

tion of the sun — you are then talking about additional mechanics that require upfront cost and ongoing maintenance.

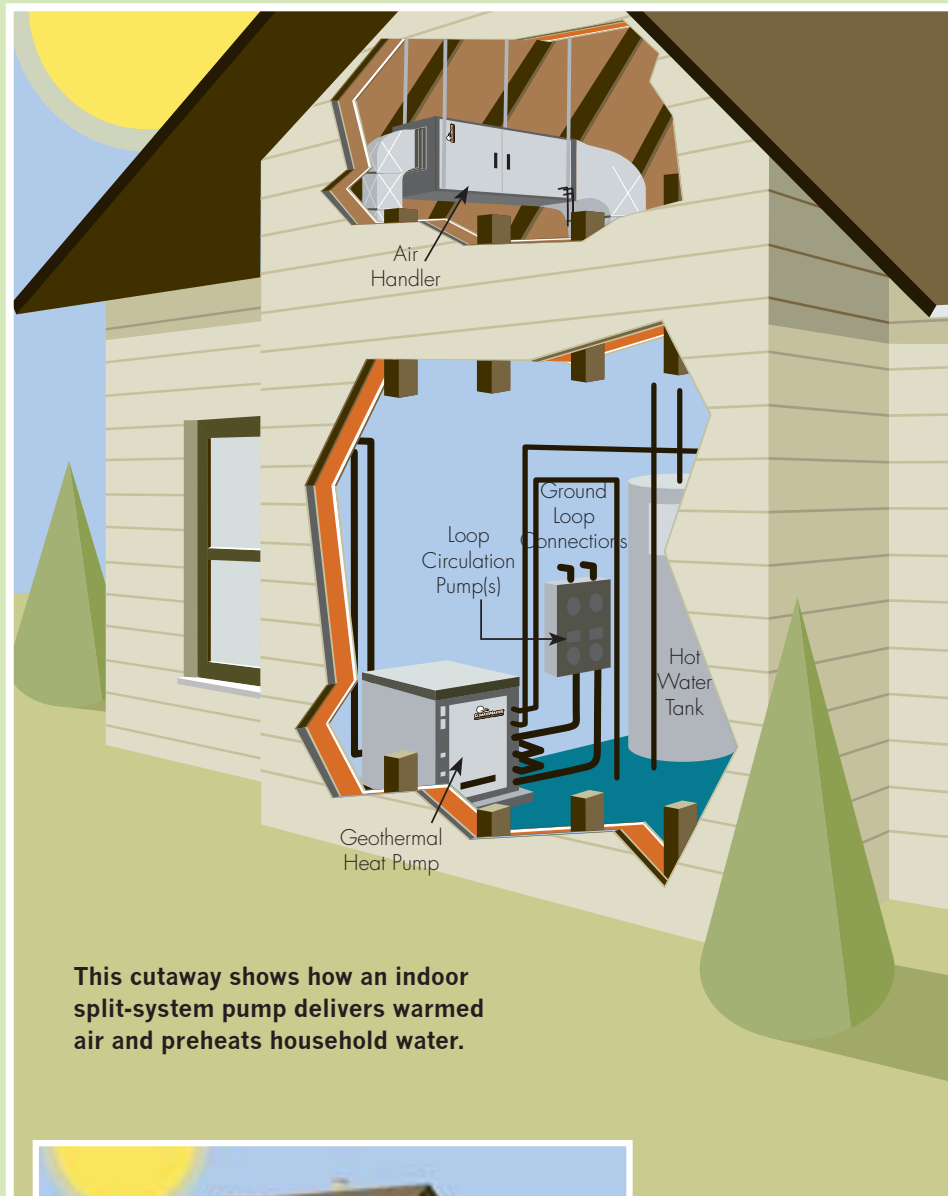
Although geothermal systems that use heat in the ground offer a comparatively uninterrupted source of power, site location can still be an issue for residential applications. Geothermal units themselves are not any more onerous to install than comparable home appliances, such as a hot-water heater, but the loops required for tapping into the Earth’s stored heat energy often require drilling anywhere from 60 to 250 feet down — an expensive prospect when you are dealing with rocky terrain or are geologically positioned above thick bedrock. “Even in a place where you’re going down just 60 feet, you are looking at \$30,000 or \$40,000 for a geo-exchange system,” says Ari Meisel, a New York City-based LEED Accredited Professional and green building consultant.

What You’ll Pay

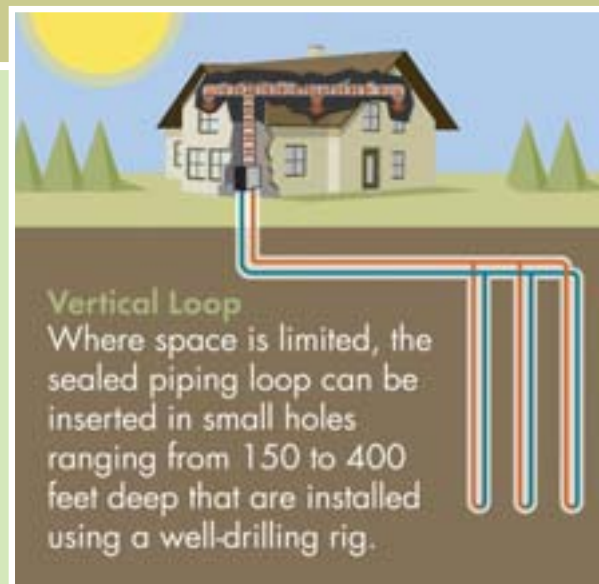
Geothermal system manufacturers such as Oklahoma City-based ClimateMaster Inc. counter that installations are typically in the thousands — rather than tens of thousands — of dollars, but with the caveat that the cost for applications vary significantly depending primarily on — you guessed it — location. “If you have the land, a horizontal loop is cheaper because you are not going as deep,

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The Lowdown on GEOTHERMAL



This cutaway shows how an indoor split-system pump delivers warmed air and preheats household water.



The drawing at left depicts a closed-loop, liquid-to-air system using vertical loops, which are deeper but not as space-consuming as horizontal pipes.

A ClimateMaster outdoor split-system heat pump (right), the building's heating and cooling plant.

A ground-source (geothermal, geo-exchange) heat pump uses the constant temperature underground as an exchange medium to regulate temperature in the house.

A few feet down, the crust's temperature is relatively constant at 45 to 58 degrees Fahrenheit, year round. Geo-exchange heat pump systems take advantage of this by circulating water or other liquids through continuous loops of plastic pipes buried in the ground (or a water source like a pond). Those are closed-loop systems; an open-loop option uses well or surface water as the exchange liquid, which is returned to the source.

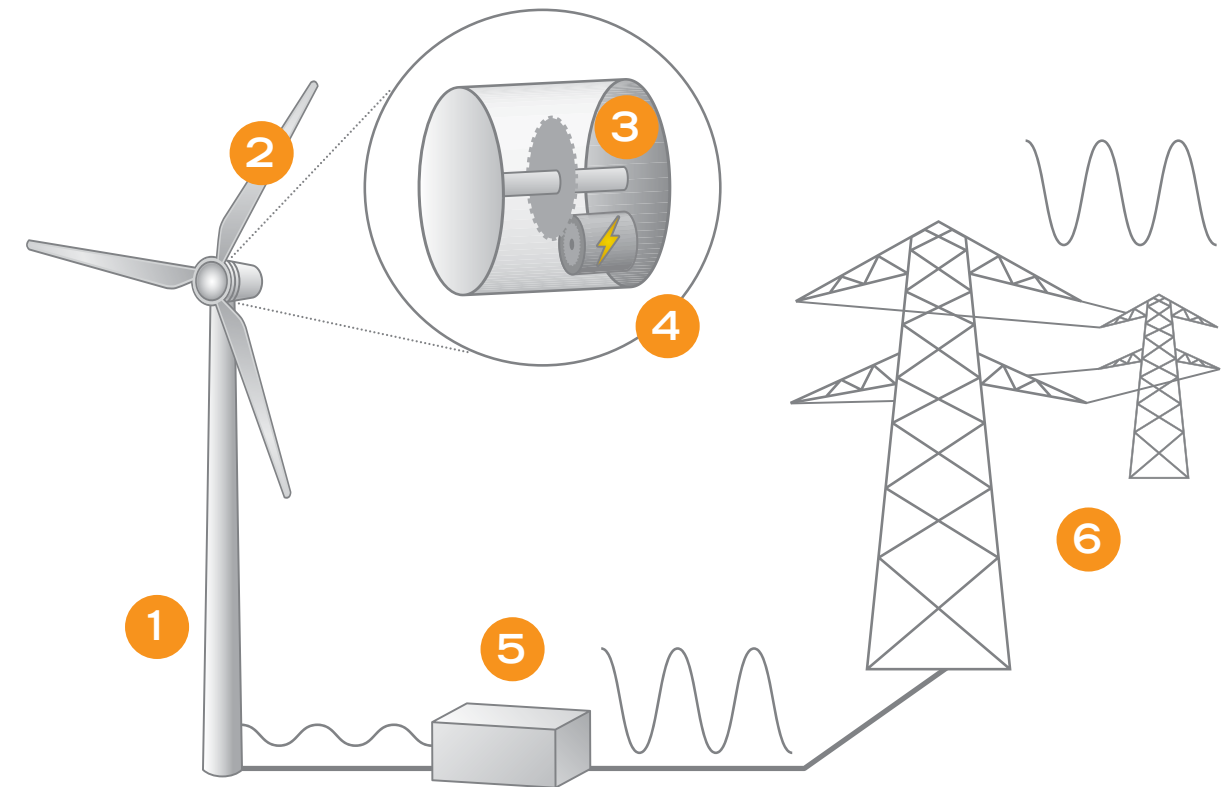
The fluid collects heat from the soil during winter and carries it through the system to a heat pump in the building, where the heat is compressed to produce more heat that warms air to 90 to 105 degrees, which is moved through the house via standard ductwork. Or it can send heated liquid through an under-floor radiant system. During summer, a reverse process occurs as circulating fluids transfer heat from the building back into the earth. The very reliable, efficient system provides pleasantly even heat and year-round humidity control, and it's much quieter than air conditioning.

Ground-source heat pumps also can be used to heat a portion of the hot water supply.



IMAGES COURTESY CLIMATEMASTER

How Does Wind Energy Work?



1. The wind blows on the blades and makes them turn.
2. The blades turn a shaft inside the nacelle (the box at the top of the turbine).
3. The shaft goes into a gearbox which increases the rotation speed.
4. The generator uses magnetic fields to convert the rotational energy into electrical energy. These are similar to those found in normal power stations.
5. The power goes to a transformer, which converts the electricity.
6. As winds increase, turbine output increases and the amount of power purchased from the utility decreases. When wind produces more power than the house needs, the extra electricity is sold to the utility.

whereas it can be much more expensive to drill 150 feet down," says ClimateMaster marketing and communication manager Evie Seibert.

Likewise, upfront costs for wind and solar installations can vary depending on the size and kilowatt hour (kwh) power-generating capacity, as well as the relative seclusion of your home. Wind power typically clocks in right around \$10,000 for entry-level turbines and \$40,000 or more for the larger-kwh, high-tower-mounted units, while solar in general runs between \$15,000 to \$40,000. Those costs can be offset by green tax rebates and homeowners can also opt to lease systems or go smaller to save on their initial investment. "Current tax incentives are creating a buzz across the sustainable energy industry," says Seibert, who adds that homeowners can check out the Database of State Incentives for Renewables & Efficiency (dsireusa.org) to determine what incentives are available in their area. "There is a rise

in awareness of energy and environmental consciousness, and clean energy is a great alternative to burning fossil fuels, but the main thing powering the growth in the market is the tax incentives. Everyone is looking to save a buck."

Homeowners who want to look before they leap into what can be fairly expensive systems can go small when it comes to wind and solar. "We are pretty excited where small wind is going," says Nick Blitterswyk, CEO of New York City-based Urban Green Energy, an advocate of wind power. "The American Wind Energy Association is projecting thirtyfold growth in the small wind market, mostly because it is a pretty robust and cheap technology to use. One-kilowatt, roof-mounted, vertical-access turbines are \$6,500 and can accommodate winds up to 110 miles per hour—although if you are off the grid, you'll likely need a 4-kilowatt turbine."



Upfront costs may be higher, but the long-term savings from efficient alternative energy systems can be a big improvement over standard hookups. For example, although this home is nearly 6,000 square feet, it incurs a monthly bill of only \$50, thanks to solar power.

What You'll Get

Still, there's little getting around the fact that sustainable energy systems involve significant upfront costs. "All of the energy systems are fine for some, but they're not for everyone," says Ted Krause, owner of Wild River Log Homes in North Branch, Minnesota. "It often doesn't make financial sense for someone who won't use the home all year." That trend, again, could depend on location. "You'll find more solar- and wind-connected homes than anything else," counters Loiselle. "A lot of people build homes, and they want to be out in the wilderness somewhere. And to do that, they need to have an off-the-grid system."

Home-energy experts say that proper building design and construction are the first steps to getting a shorter payback on solar, geothermal and wind systems. Energy costs can be

severely mitigated by reductions in square footage, but regardless of size, a drafty home is going to make or break the return on investment on anything that generates homeowner heat and power. "To make any system affordable, you have to tighten your house envelope," Loiselle says. "The less energy you need, the more affordable it is going to be."

With variations, a homeowner should expect to have a system pay for itself roughly over two decades, and if you're off the grid, the payback becomes immeasurable. "A lot of people like that," says Loiselle. "Once they get off the grid, they have more of a sense of being within their environment: It's a sunny day, and wow, all of a sudden there is lots of power. They have more of a sense of the connectedness to the nature that is supplying their needs."

To that end, Rowan suggests homeowners consider local alternatives to power and heat that aren't typically factored into the sustainability footprint. "If you are in eastern Pennsylvania, you are surrounded by forest, and one of the most efficient and cost-effective ways to get energy is by burning wood, which is also a renewable energy source," says Rowan. "But no matter what energy system you apply, you need to consider the amount of convenience that you want. If you are willing to cut and haul wood and build a fire every time you want heat, that becomes very practical. But there are people who want simply to drive up to their home, walk in, turn the thermostat up and have heat. There is a certain cost to the environment and to the purse strings that you will pay for that convenience." **EEH**

MOUNTAIN LOG HOMES OF COLORADO/BEATON PHOTOGRAPHY PHOTO

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