

Wary of Waning Power Supplies, Eco-Minded Architects Build a Better Box

By Katherine Salant
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Dennis Meadows has long argued that the world's resources are limited and its environment stressed.

In the 1972 bestseller "Limits to Growth," he was part of a team that concluded that the world would exceed its resource base in the first half of the 21st century. In subsequent updates, they have said that the world's growing population has already outstripped its resources and that we are now collectively consuming our planetary seed corn.

Meadows is beginning plans for a major renovation of his house in [New Hampshire](#). High on his list is the need for a backup power source.

This is not a priority for most people planning a new house or a major renovation. Despite having endured power losses caused by weather or man-made grid glitches, most people regard outages as random and uncommon.

Meadows, though, said he thinks power losses will occur more frequently as the sources of the fossil fuels that power our grid become less reliable.

Within 10 to 20 years, he predicted, prices for electricity and home heating could be four times what they are today because of fuel scarcity. Or you could flip the switch and nothing would happen because the local utility's fuel source is in a foreign country that has become an unreliable supplier.

Other reasons for the scarcity could be of our own doing. Although our thirst for electricity grows undiminished, many states no longer allow new construction of coal-generating plants.

Renewable energy sources including solar and wind will eventually be important producers of our electricity, but the transition will not be seamless, Meadows said.

So what kind of backup system is appropriate?

Although high-tech gizmos can be enticing, homeowners should first seek to reduce energy loads. That way there's less to replace during a power loss, said David Foley, a [Maine](#)-based architect who is working with Meadows.

In Maine and New Hampshire, where the winter temperatures can reach 15 degrees below zero, the best way to cut heating energy is to "build a better box" with materials that are readily available, Foley said. Homeowners in his area can cut their heating requirements in a new house by at least 50 percent by doubling the amount of insulation that would

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normally be used, installing windows with three panes and conscientiously plugging air leaks.

The only observable difference is the exterior walls, which can be as thick as 12 inches.

In a renovation, these modifications can often be retrofitted. Either way, the house will be so airtight that mechanical ventilation must be added. However, heating equipment can be much smaller.

Even more insulation can reduce heating requirements to the point that the heat given off by the building's occupants, appliances and lighting, plus the passive solar heat streaming in through south-facing windows, is sufficient for the entire house. This approach, called the passive house, was pioneered in [Germany](#) in 1990. About 9,000 such buildings have been built in [Europe](#).

The first passive house in the United States was built in [Urbana, Ill.](#), in 2003 by Katrin Klingenberg, an architect and a professor at the [University of Illinois](#). She said she can heat her 1,200-square-foot house with 10 100-watt light bulbs.

To accomplish this in Urbana, where the temperature can fall below zero during the winter and rise above 100 during the summer, her walls are 16 inches thick, the insulation in her attic is 16 inches thick, the windows have three panes, and the underside of her concrete floor slab is insulated to a depth of 14 inches. (There is no basement.) Her house is 90 percent more energy-efficient than a conventionally built house in Urbana.

In [Florida](#), which has a relatively benign climate, a passive house would be far easier to build, said Danny Parker, a senior research building scientist at the Florida Solar Energy Center in Cocoa.

In Florida, unlike in the Midwest and the Northeast, you save energy with a building that keeps the heat outside. The change in wall thickness from adding insulation would be barely noticeable -- it's about 1 1/2 inch. White roof tiles and white siding would reflect heat from the house.

Other modifications include dual-paned windows with an energy-efficient coating, a three-foot overhang to shade the walls below, added tightness to prevent hot, humid air from leaking in, and carefully sealed air-conditioning ducts that are within the cooled space. These steps would reduce energy needs by 72 percent compared with a conventional house. Tile floors would reduce cooling needs even further.

This strategy is so effective that a house that incorporates them would be cooler without air conditioning than a conventionally built house with the air conditioning running, Parker said.

Once you've reduced the energy loads, what about the backup system?

The most cost-effective choice is a gas or propane generator, even though it uses fossil fuels, all three building experts said. Foley, the Maine architect, sizes one to provide enough power for "comfortable camping" -- heat, well pump, ventilation, refrigerator and a few lights.

To get this level of power using alternative energy -- a sun-powered photovoltaic system and batteries that provide power at night -- is prohibitively costly unless the house is quite small, he said.

In Florida, a photovoltaic system and batteries would be more feasible because "comfortable camping" there requires less energy than it does in Maine, Parker said.

For more information on the Passive House, see <http://www.e-colab.org> and <http://www.passivehouse.us>.

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