Taking a Building 'Offline'—Your Options

"Off the grid"—a phrase that, at one time, was used to communicate a rugged, rural way of life…without the dependability of electrical service on which modern business depends.

Today, however, a growing number of commercial building owners are investigating a range of independent power technologies—including solar photovoltaics, wind, and microturbines. They are examining these new options with an eye toward lower electric bills, improving electric reliability, and lowering their buildings' environmental impact.

New equipment makes it safe to maintain your utility connection, so you don't have to give up the security of utility service even if you're generating all the electricity you need on site.

Laws, leases & 'free' loans

With demand for electricity rising alongside fears of global warming, both state utility regulatory commissions and electric utilities are making it easier for commercial building owners to produce their own electricity.

Federal and state tax credits, where present, can cut initial purchase and installation costs significantly.

Additionally, with ***net metering*** rules enacted in many states, your meter actually can "run backwards" when you generate electricity in excess of your own needs—as you sell that power back to your utility.

Equipment lease arrangements, increasingly available for off-grid options (including renewables), are making building power alternatives even more palatable. They further reduce out-of-pocket expenses for those who wish to go "off the grid." Arrangements vary; owners may pay little or nothing to have the equipment installed, and then pay a guaranteed flat rate to a third party for the electricity they draw off the system.

Utilities are beginning to develop similar plans to cut owners' outlays. An example: New Jersey regulators recently approved utility PSE&G's new ***solar loan program.*** It provides 15-year loans to customers who install photovoltaic systems.

Such arrangements can be creative and enticing. For PSE&G's more ambitious customers, *there might not be a need to repay the loan in cash!* If the system's output meets certain goals, the customer repays the utility via the solar facility's production – which enables the utility to meet its renewable-energy portfolio requirements.

While the customer repays PSE&G "in kind," the end-user still enjoys the benefits of off-the-grid power.

Power-full opportunities

Determining the renewable-energy technology that's right for your building and business requires a bit of homework.

Solar photovoltaics, small wind systems, and microturbines are the three most developed approaches today. [Note that micro-hydropower—small hydro-electric dams—may be an additional possibility for owners whose buildings are sited near suitable water resources.]

Following is a brief overview of advantages and challenges these options offer.

Solar photovoltaics

Solar power is probably the most widely adaptable renewable technology on the market today. State and federal tax incentives have pushed the industry to record growth—the U.S. added more than 300 megawatts of solar-based generating capacity in 2007, according to the Solar Energy Industries Association.

Materials going into manufacture of solar equipment vary, but essentially electricity is generated via an electro-chemical interaction that occurs when sunlight hits a panel or film that's been coated with specially designed crystals.


Photo: Keith Wipke/DOE

Photovoltaic (PV) panels are the most common solar technology. These are the shallow, box-like devices becoming increasingly visible on rooftops and ground-mounted assemblies across the country. PV panels have been a part of renewable-energy plans since the energy crisis of the 1970s, and have proven their reliability since then.

Newer products are significantly more efficient than original offerings. Some commercially available units now capable of converting more than 17% of the sun's energy into electricity.

Building-integrated photovoltaic (BIPV) products are created from thin photovoltaic film that can be manufactured into roofing tiles, laminated glass, and other common building materials. This integration results in a cleaner, more aesthetically pleasing design than that created by bulkier PV panels; architects appreciate the resulting design flexibility.

But this advantage comes at a cost. While most BIPV products are manufactured using thin-film materials that cost less than standard panel technology, these products also are less efficient at converting the sun's rays into electricity…so more of them are needed to generate the same amount of electricity.

As a result, overall BIPV project costs can be higher on a per-kilowatt basis.

Wind turbines

Wind power is another technology promising "free" electricity by capturing the energy contained in an almost ever-present natural resource. Large-scale wind farms, featuring hundreds of turbines capable of producing up to 2 megawatts, each, have become one of the fastest growing sources of new electric-utility generating capacity.

What's more, smaller turbines sized to home or small-business needs also are growing in popularity.

Obviously, wind power is practical only in areas where wind is frequent and plentiful. Turbines also

require at least an acre of property to meet needed clearances. In addition, the site must meet some basic requirements.


Photo: Ginger Wilson

- Wind speed typically increases with height, so turbine towers can rise to at least 80 feet; in some places area zoning may not allow structures that tall
- The turbine needs to be at least 30 feet higher than any buildings or trees within a 300-foot radius—which could require an even taller tower.
- Noise regulations also should be investigated; residential and small-business-sized systems run at an ambient noise level of approximately 55 decibels.

However, if you "see" only a tall turbine when you think of wind power, be aware that things are changing. New ***rooftop-mounted wind turbines*** are beginning to enter the market, and could offer more options to interested building owners.

These units run approximately 7 feet in diameter and need a minimum clearance of only 2 feet from the roofline. They are designed to be run in series, with multiple turbines connected together.

Microturbines

The term "microturbine" may create images of futuristic, nano-sized generators—and, indeed, the smallest models can be held in your hand. But these devices also range up to commercial-sized units capable of generating hundreds of kilowatts of electricity Microturbines can be powered by a range of fuels, from natural gas and diesel to biodiesel or even kerosene, and they produce very low levels of harmful emissions.

With their waste heat focused, primarily, into their exhaust, they make good prime-power candidates in ***combined heat and power*** (CHP) designs (in which the waste heat is used productively, instead of vented into the atmosphere).

Obviously, CHP maximizes energy efficiency. On a large scale, electric utilities have run CHP operations for decades—ConEdison, New York City's utility, uses the steam produced by its seven cogeneration plants to provide heat to thousands of Manhattan buildings. On a smaller scale, an automobile's engine operates as a CHP plant in the winter, providing power to drive the axles and waste heat to warm the interior.

Note that CHP turns a microturbine into a very efficient source of power. Efficiency ratings top out at approximately 35% when producing electricity, alone, but a microturbine can reach up to 80% efficiency when waste heat is captured and used.

To what uses could your building put that waste heat? It could replace boiler steam for process and space heating. Alternatively, when teamed with an absorption chiller (which uses heat to power its operations) a microturbine can help lower an owner's cooling costs significantly.

Installation considerations

Increasing demand for renewable generating technologies is spurring manufacturers to create even more efficient products and helping to create price-lowering economies of scale. And new renewable onsite options are on the horizon.

Hydrogen-powered fuel cells, for example, are now operating at a large-commercial scale. Manufacturers hope smaller systems suitable for businesses and homes will be marketable in the next decade or so.

Deciding which technology would work best for any given facility means taking a realistic look at the

location's drawbacks, as well as its opportunities. Building owners should take some time to understand each system's capabilities. Investigate applicable rebates and tax credits. Local utilities may have programs in place to help owners through the learning curve.

In addition, area environmental groups may be of assistance.

Regardless of the technology selected, any renewable-energy installation will be sized—and priced—to the facility's existing energy requirements. Owners considering onsite power generation should take steps to maximize their buildings' energy efficiency before they start specifying their output requirements.

Investing in more efficient lighting systems, building insulation, more-modern heating and cooling systems, and refrigeration can pay off in savings when it comes time to shop for the generating equipment, itself.

Insist on experience

Owners also should take some time to ensure their installation professionals have experience installing onsite power systems. This is especially important if the system also will be connecting to the local utility's distribution system.

Note that interconnection between onsite generation and the local grid is a critical safety component. Electricity being fed back to the grid could be deadly to utility personnel who may be working on connected lines if equipment isn't installed correctly. As a result, building officials and utilities set high standards for onsite-power projects.

Hiring a knowledgeable and experienced electrical contractor is an owner's best insurance against possible installation problems.

Energy Solutions Summit: Talkin' Green Building

NECA held an **Energy Solutions Summit** at midsummer 2008, gathering contractors from around the U.S. to talk about how the electrical construction industry will respond to demand for more efficient energy systems. To access a 1,066-word report on the event, see ***http://tinyurl.com/6gotel***

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