Alternative Energy – For Your Building?

Alternative, renewable energy is still a small contributor to overall U.S. energy supplies, but that contribution is expected to increase at a stunning rate over the next 20 years. Across the country, states are initiating "renewable portfolio standards" (RPSs), which require utilities to purchase from renewable sources a specified percentage of the electricity they sell to consumers.

Texas, as one example, is already well on its way to meeting its goal of generating 5,000 megawatts (MW) of renewable electricity by 2015. That target grows to 10,000 MW of renewable energy by 2025. That's fine, but what about your building?

Not only can renewable technologies generate power in centralized stations, they also offer the opportunity for smaller, "local" electricity generation.

- Solar power, using photovoltaic cells, is generated in large-scale collector facilities, but also using residential rooftop installations.
- Wind power may be harvested in massive "farms" of wind turbines or by a single machine installed next to a home or business.
- Fuel cells, which have the same footprint as diesel or natural-gas generators, are installed easily onsite.

Best of all, many electric utilities—a growing number—are offering "net metering" programs. Under this arrangement, utilities pay building owners for excess electricity which an on-site electricity generating system feeds back into the utility's grid.

Solar Power

The phrase "solar power" refers to several technologies, all using energy from the sun to power activities here on earth. Photovoltaic cells are the most common approach to generating electricity from sunlight in smaller installations; these products are rapidly becoming both more compact and more efficient.

Photovoltaic modules, made up of a collection of individual photovoltaic cells, can be installed on top of—or adjacent to—existing buildings. They are wired into the electrical panel to help supply the facility's electricity needs.

"Building-integrated photovoltaic systems" represent one approach, in which thin-film photovoltaic cells are incorporated into the building's fabric. Photovoltaic roofing shingles, awnings, and even clear-glass glazing are now available for such applications.

On the home front, solar tiles are the photovoltaic material of choice for many homebuilders. The tiles are still noticeably different than standard products, but they're also significantly less bulky than old rack-based panels.

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Not surprisingly, given its sunny climate, California leads the United States in solar installations. The state's California Solar Initiative and Million Solar Roofs legislation, both enacted in 2006, are helping drive photovoltaic market economies across the country. One production homebuilder in the state, Lennar Corp., is making photovoltaic systems standard in all the houses it erects. With state and local-utility incentives helping to foot the bill, these solar homes will cost about the same as standard models.

Additionally, the Solar America Initiative component of the Bush Administration's Advanced Energy Initiative aims to make solar energy cost competitive with conventional electricity sources by 2015. A 30% investment tax credit for home and business owners who install solar equipment is now in place through 2008. Goal: Reducing the cost of photovoltaic-produced electricity from today's 18 to 23 cents per kilowatt hour (kWh) down to between $0.05 and $0.10 per kWh.

Small-Scale Wind Turbines

Wind power has grown rapidly over the past decade, becoming an important contributor to the portfolio of U.S. renewable-energy resources. Some 2,400 MW of wind-energy generating capacity was installed in 2006, alone, according to the American Wind Energy Association (AWEA), and that capacity continues to grow by more than 20% annually.

Headline U.S. wind power is generated through large wind farms, such as the 735 MW Horse Hollow plant in Texas. However, residential- and small-business-based systems also are gaining popularity. Such designs can be less expensive than comparably productive photovoltaic systems—although, of course, productivity is dependent on reliable wind resources. AWEA estimates small-system costs at $3,000 to $5,000 per kW of generating capacity.

Most commonly, smaller turbines resemble less-imposing versions of commercial-scale models, with outputs ranging from 3 kW to 10 kW. The units may be mounted on tilt-up or guyed towers—towers supported by guy wires are less expensive, but tilt-up designs enable easier turbine maintenance. For maximum wind exposure, towers should be designed so that the bottom of the turbine's rotor blades is at least 30 feet above any obstacle within 300 feet.

In addition to the tower, systems typically include a rotor, with its attached blades, a generator or alternator mounted on a frame, and a tail, which helps orient the system so it remains facing into the wind. "Balance-of-system" components include the wiring, controllers and inverters that help connect the turbine's electricity output to your building's electrical system. Additionally, batteries may help store excess electricity in systems that aren't connected to a utility grid.

Turbine-tower height requirements can raise clearance issues where smaller properties are concerned, and local zoning ordinances also may prohibit such high structures in urban or suburban areas. New building-mounted offerings incorporate multiple numbers of much smaller turbines. One design has been created especially for tilt-up concrete structures, and installs along a building's parapet walls. Each module weighs approximately 200 pounds and measures about 4 feet in diameter.

Solar Installer Training & Certification

While it has a tough name, NABCEP ("nab-sep") is a voluntary organization that has taken on the job of working with the renewable and energy efficiency industries to develop certification programs for those working in the fields.

NABCEP = North American Board of Certified Energy Practitioners. See www.nabcep.org.

Certification exams administered by NABCEP are important to NECA, the publisher of this document. NECA and IBEW are, together, training more electricians—by far—for solar PV installation than any other operation in the United States.

Fuel Cells

Hydrogen-based fuel cells have garnered a lot of attention over the last few years as potential automobile power sources, but commercial adoption for automotive applications awaits future developments.

However, "stationary" fuel cells, providing both backup and prime power for buildings, are already up and operating. Worldwide, more than 5,000 small (less than 10 kW) stationary fuel cells and 800 larger units are now in operation. Japan, where electricity rates can reach $0.21 per kilowatt-hour, is in the midst of a major residential deployment of fuel cells.

Fuel cells produce electricity through a chemical process that combines hydrogen and oxygen, and gives off water and heat as waste products. The hydrogen can be drawn from a number of different fuels, from natural gas to ethanol and methane—water treatment plants, which produce methane in their operations, are becoming popular fuel-cell customers.

Whereas solar and wind depend on the weather, fuel cells can operate around the clock.

Fuel cells are 40% to 49% efficient, meaning that as much as 49% of the energy going into fuel cells comes out as electricity on the other end. In cogeneration designs—in which waste

heat is captured and reused—efficiency rates can climb to 85%. More importantly, fuel cells are extremely clean burning, with zero SO_2 and NO_x emissions and limited CO_2 emissions.

One benefit fuel cells offer over other renewable resources, such as solar and wind power, is that they can be used as a primary power source. Solar and wind power depend on weather conditions; fuel cells, in contrast, can operate around the clock (as long as the hydrogen supply continues to flow). Around-the-clock reliability is helping to drive fuel-cell installation in applications where power reliability is more important than first costs, such as in computer-chip manufacturing plants.

This NECA-IBEW advertisement has appeared in several industry magazines.

Conclusion

As rebates, tax credits, and other incentives vary widely from state to state and utility to utility, it's difficult to offer generalized cost or payback information on these technologies. You'll need to check with your local utility and state renewable-energy office to determine what your costs will be. In addition, your municipality may have regulations regarding how this equipment is installed or operated, so be sure to let building officials know your plans, as well.

Before investing in a renewable-energy-based system, though, take a hard look at your building's energy efficiency. You can save money on two fronts if you reduce your energy needs before installing solar, wind, or fuel-cell equipment:

- lower energy bills will help pay for the efficiency improvements, and,
- with your energy demands reduced, you'll be able to buy a less-expensive, smaller-capacity renewable system.

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