

Six Ideas That Will Change Your Building's Energy Profile

It may be hard to see anything positive in the current economic environment, but a slower economy can provide the luxury of *time*. Savvy building owners and developers can invest some of that resource into learning about a new generation of promising building technologies now hitting the market.

Energy—saving it and producing it—is the common denominator tying these useful ideas together. Since energy also promises to be one of the critical issues owners will have to face when building picks up again, learning about these new technologies now could give you a boost in the near future.

Working with an experienced electrical contractor to determine the right bright ideas for your next project could help ensure that new facility costs less to operate and contributes less to global greenhouse gas concerns.

Add DC to your AC

Think about your own laptop computer, if you have one. That “black brick” that you must lug around with you converts the alternating current (AC) power that comes out of receptacles to the direct-current (DC) power that your computer needs.

Now, expand that thought to your building (especially if you have a data center on one or more floors). Your building today is very inefficient—by design! AC is supplied building-wide to every electronic ballast, air-conditioning actuator, daylight sensor, and variable-speed fan. Each device must then incorporate a transformer to convert that power to the DC it requires. That has three costs:

- a. The cost of the converting device.
- b. Energy is lost in each AC-to-DC transformation
- c. Energy is generated by the transformers, creating an additional hurdle when your building is being cooled.

Engineers are taking a new look at the way much of the equipment in your building can be powered. These efficiency experts see the potential for energy savings by providing high-voltage DC to floor-level junctions for distribution to the range of electronics on which we've come to depend.

New idea: Transform power once, at the floor level, rather than multiple times at each individual appliance. This means your power distribution system has two elements—AC and DC power. Standards now are in development for just such designs. Proponents note that eliminating those device-level transformers could help free up some ceiling real estate, making overall wiring schemes easier to implement.



Wind generators that aren't gigantic

The typical vision of wind turbines may be of structures reaching a height of 400 feet (above a hill-top, perhaps). Or you may have seen (or read) about the 75-foot-tall versions popping up where wind conditions—and local ordinances—allow.

But look around. Buildings parapets and parking-structure rooftops are, in some locations, sporting new, smaller wind turbines. They produce moderate amounts of electricity at a more affordable price.

Currently, two general designs are on the market for such small-scale energy generators. Both are engineered for building-mounted, as well as standalone, installations. As you would hope, there are provisions in place to reduce distracting noise and vibration.

One of these resembles a hoop, with spoke-like fins connecting to the central turbine. The structure, capable of producing 1.5 kW in peak conditions, is mounted on a mast at least two feet above the building and can rotate 360 degrees to catch the wind from whatever direction it may be blowing.

Another new design takes a vertical approach, with three parallel fins suspended from a central 30-foot spine. This option is said to be capable of generating up to 1.2 kW

Both options are supplied as turnkey packages, with required inverters and wiring. And both models can be installed in multiples, where greater energy production is a goal.



Photo: Windspire (www.windspireenergy.com)

Charge! (occupant vehicles)



With plug-in hybrid electric vehicles scheduled to begin hitting the road in significant numbers late in 2010, auto manufacturers and electric utilities still are working out the details regarding where, exactly, these cars and trucks will recharge their batteries.

Recharging a typical plug-in electric vehicle (PEV) with a standard 120-volt feed could take eight hours or more. That's unlikely to "work," many believe, if PEVs are to find a market.

What does all this mean for a building owner? Employees and tenants working in your building likely will require charging capabilities at their workplace to provide power for their commute home. At the very least, it is thought, buildings may want to make charging stations available in parking areas—a few, at the beginning; perhaps more later, if and when PEVs are present in larger numbers.

Auto industry experts and electric industry specialists are now shaping what a charging station installed at a business or school might look like. Will a day come when every parking space comes with a charging station?

In the most advanced planning scenarios, connected vehicles could be used as short-term electricity resources, with utilities drawing on car batteries to help meet a period of peak power demand (the hottest summer day). This is called "V2G" (vehicle-to-grid)—and is seriously being discussed as a part of the future.

Wired 'shades' instead of windows

What if your building's windows could darken and lighten like certain sunglass lenses? *Electrochromic windows* (also called "dynamic" windows) do just that. Your building's appearance won't be altered; these windows look like standard, insulated-glass offerings, but feature three thin layers of electrodes deposited on the inside face of the assembly's exterior pane. That coated surface then changes from clear to tinted when a small electric field is applied.



While this idea may be new to most of us, the concept has been around for more than a decade. Manufacturers are only now developing products that stand up to real-world exposure. These products can be operated manually, with a simple switch. More efficient systems tie these windows into a building energy management system (one that includes daylight sensors and lighting and environmental controls).

Where's the pay-off? Computer simulations run by the National Renewable Energy Laboratory (a unit of the Dept. of Energy), electrochromic windows can reduce cooling-system energy consumption by up to 49 percent, and peak power demand by up to 16 percent. What about the need for electricity to "power" the windows? They reportedly use about as much electricity as a 75-watt light bulb.

Further, researchers are looking at ways of adding small solar cells to each unit, eliminating even that small amount of demand from the building's electrical load.

At this moment, electrochromic windows are expensive; it's believed that prices will drop as demand rises. Manufacturers suggest that building owners may substitute use of these windows for exterior light-screening systems and interior window treatments.

Directing change for data centers

It's no news to anyone who runs a data center—or even a good-sized computer room—that these facilities are enormous energy users. As servers have become smaller, designers now are able to fit many more of them within the same amount of floor space. And each unit, with its own transformer and other electrical equipment, also produces waste heat, extensive cooling systems critical to maintaining performance.

IT industry estimates now say the cost of power over a given data center's lifetime will now approximate the initial server fit-out cost. As that cost is a major investment, the energy number has become a problem.

Strategies for reducing data center energy use draw on commonsense design to arrange server aisles for better airflow around heat-producing equipment. Efficiency promoters also call on operators to incorporate advanced "virtualization" strategies to maximize their servers' computing capacity.

Another option now coming to market, though, uses DC power distribution to reduce energy losses and heat gain at each individual server. Researchers at the Lawrence Berkeley National Laboratories (a unit of the Dept. of Energy) have studied the potential savings.

Reportedly, a building-wide DC system could reduce equipment electricity use by 7 percent over standard AC distribution designs. Delivering AC power to rack-level converters could cut use by 5 percent. In addition, both approaches showed the capability of reducing cooling-system electrical demand by up to 28 percent, because of reduced transformer-related waste heat.

Researchers and manufacturers have established voltage-level standards for such designs and developed ZUL-listed connection components.

Integrating solar into your structure

Sure, you've heard a lot lately about solar electricity. It's not a new idea: Solid, boxy photovoltaic panels have been turning the sun's energy into usable electricity for decades. Mounted in rows on rooftops or in sunny ground locations, these units can be both expensive and less than aesthetically pleasing.

But don't limit any decision on what you've seen and heard. There are new approaches, using thin films—some manufactured from advanced, organic materials. These are making it easier to integrate electricity generation directly into a building's architectural design.

BIPV is the shorthand for these technologies, standing for building-integrated photovoltaics.

For the last several years, a number of roofing manufacturers have offered flexible photovoltaic film as an electricity-generating add-on to their standard metal and membrane roofing offerings. The film is manufactured in standard-width rolls and can be applied using simple peel-and-stick adhesive methods, so a building owner won't need to worry about penetrations through a roof.

Even more advanced, a new generation of solar films, manufactured from organic materials, can be printed onto a backing material. Incredibly, the manufacturing process is similar to newspaper production. This technology already is being used to create flexible sheeting that can be applied to patio umbrellas (to power laptops) and handbags (to help recharge cellphones).

Further, prototype curtainwall applications now undergoing testing feature near-see-through solar sheeting—sandwiched between layers of insulating glass. The material allows about the same visual light transmittance as UV-protecting solar film, so building occupants still have a view. And because the material captures energy from both sides, it can help recycle energy from interior lighting once the sun has set.



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