Green Policies in Action

Discover how different building owners are utilizing green technology in North America to make the case that green building = long-term savings.

BY LORI KASALLIS

UL Laboratories in Northbrook, IL, installed a system that uses an ice-storage cooling system that dropped 400 hp-800 hp from its daytime cooling demand—when energy is *most* expensive.

What once was merely considered a color in a box of crayons, the term "green" has grown into an often misunderstood global catchphrase—the definition of which has many ideas, standards and even consequences attached to it. While the concept in and of itself is not new—in 1930, Albert Einstein and Leo Szilard designed a refrigerator that required no electricity and had no moving parts—the level to which "green" has grown and the demand for its application among the masses has forced a remarkable evolution of products and technology in all industries, especially HVACR. Likewise, the speed with which that evolution has occurred also has meant the need for a certain level of standardization and regulation of those products and technologies, which is a point of much debate.

With seemingly different ideas about how to repair some of the damage that the Earth has already incurred and to prevent further harm, generally, the HVACR industry is starting where it can—with the systems that heat, cool and ventilate. And while slow-going, progress is being made.

According to a World Research report released by the International Energy Agency, "Energy-efficiency policy action continues to be a priority and, with a few exceptions, significant funds continue to be dedicated to this policy area—primarily through economic incentives, in both new and existing buildings."

This bittersweet cacophony of form, function and policy for global environmental health, and financial savings for both home and building owners, has launched the deployment of both funds and projects on a variety of levels. These efforts have been undertaken to better the buildings that already exist and change the way structures—from houses to high rises—are designed and built. Following are a few examples of buildings that are on the road to "going green," and what that means.

Solar savings

While it is easier to design a building from the foundation up to achieve energy efficiency, that can be rather unrealistic considering how many buildings already exist. There are several examples around the world of buildings once considered energy hogs that are presently receiving several levels of renovation to qualify as green.

Ontario-based Chatham-Kent Health Alliance hospital has entered into a $5.7-million facility renewal and conservation program with Honeywell, which will combine a roof-mounted solar array with several traditional facility upgrades. The renovation is expected to help reduce CKHA's environmental footprint and save approximately $494,000 in utility costs per year—savings guaranteed by Honeywell through a 15-year performance contract.

Additional conservation measures at the Wallaceburg and Chatham campuses include:

- → Updating lighting fixtures to more energy-efficient alternatives;
- → Optimizing the cooling, heating and ventilation systems, including the addition of insulation to pipes throughout the facilities;
- → Upgrading mechanical systems, including chiller controls and variable frequency drives; and
- → Building envelope improvements, such as sealing windows and doors.

Other building maintenance and facility upgrades are planned at both campuses using Hospital Infrastructure Renewal Funds and annual capital investments. Honeywell expects to complete all upgrades by the end of 2010.

Another example is the Homestead Family Restaurant located in Blackfoot, ID, which is the first building in southeastern Idaho to install a solar water-heating system. Solar Panels Plus' SPP-30 evacuated tube collectors, installed by K&M Refrigeration, consist of five solar collectors—each with 30 evacuated tubes that function in almost any environment, including cold or freezing climates. The SPP-30 works well in environments where water temperatures up to or above 150ºF are needed or in cold or cloudy climate conditions.

Bill Dishman, owner of the Homestead Family Restaurant, estimates he is saving $500 a month in electricity in the nearly 5,000-sq-ft establishment, which seats 130 guests. The restaurant currently has two water heaters, one solely for the dishwasher and the other for hand-washing, food preparation and cleaning.

John Williams, COO, Solar Panels Plus, said, "The evacuated tube collectors utilize special optics, and double-wall glass tubes that work similar to a thermos bottle to prevent heat from escaping, therefore the energy is more concentrated and more efficiently harvested and used."

Cool as ice

Like energy prices, hybrid cooling is on the rise, and there are many buildings today using both traditional and non-traditional systems. The managers at Underwriters Laboratories Inc. in Northbrook, IL, took a close look at the facility's cooling system and determined the time was right to replace it in its entirety (if it could be done with minimal interruption to the daily operation). The Roseville, MN-based engineering firm Sebesta Blomberg was commissioned to design a system that was flexible, efficient, easy to operate and allowed room for expansion. It also had to be affordable and last 25 years.

SB designed 8,000-ton-hours of thermal storage into the system with two screw chillers that could make ice, chilled water or both at the same time, using low-cost, off-peak energy at night. Ice-storage cooling allowed UL to drop 400 to 800 hp each day from its daytime cooling demand, when energy is most expensive.

The project uses an ice-storage system from Calmac Manufacturing Corp., located in Fair Lawn, NJ. The system uses 50 Model 1190C tanks for a total of 8,000-ton-hours, the optimum size to complement mechanical cooling and fit into the available space. The modular design allowed individual tanks to be lowered into an existing area well and slid into the basement, eliminating building modifications that would have been necessary to transport the tanks down main hallways. Fifty tanks, each measuring 7.5-ft wide by 8.5-ft tall and weighing 1 ton empty, were set and temporarily bolted together in three days.

An additional building houses two 800-ton chillers to cool the facility during ice production, and adds flexibility and redundancy to the system.

According to the UL's Director of Facilities Operation Volker Kotscha, "We can cool the entire facility with ice for a minimum of six hours to take advantage of any energy-curtailment incentive windows offered by the local utility. And we can produce 8,000 tons of ice in six hours to take advantage of night-time energy incentives starting to appear in the market. Overall, the new system reduced operating cost from $0.14/ton to $0.066/ton—a 52% savings."

Installation of the Calmac system was completed on schedule and ice was made the first time the equipment came online. UL had a fully charged thermal-storage system within days. SB estimates UL will save $10–$11 million in operating costs over the next 25 years and help the environment at the same time.

The Homestead Family Restaurant in Blackfoot, ID, is installing a solar water-heating system that will save an estimated $500 a month in electricity.

Florida Gulf Coast University currently has 21 buildings with 900 full-time employees and over 10,000 students. Cooling from the main chiller plant is shared by a wide variety of campus buildings—from academic classrooms and computer rooms to laboratories and child-care facilities. Cooling requirements can reach 2,700 tons/hour with peak electrical demand as high as 3.375 MW. Since building a power plant to cover the on-peak energy needs of a college-campus cool-

ing system would be very expensive, both fiscally and environmentally, FGCU decided on a thermal-energy-storage system to make ice and store it at night—a more cost-effective option to support campus cooling needs during the day when outside temperatures reach 95°F and the relative humidity reaches 70%.

In 2002, the university completed an engineering study and individual facility hydraulic and ventilation review to determine what potential energy savings options might be available. Some of the ideas eventually implemented were:

1. Construction of chilled water valve control on facilities using existing tertiary pumps;
2. Implementation of reset of demand control ventilation; and
3. Introduction of TES systems.

As in many warm-weather states, Florida electric companies have offered incentives to encourage the use of TES for cooling. FGCU's local utility provided storage incentives to help defray the cost of the ice-storage tanks necessary to operate the system, an investment of approximately $800,000.

In the TES system, ice is produced nightly during off-peak hours when utility rates are lower and stored in large tanks using a plate and frame heat exchanger, water-cooled chiller plant and variable-speed pumps. The tank contains a plastic coil filled with Dowtherm SR-1 heat-transfer fluid chilled to a temperature of 23°F–31°F, which circulates inside the coil and freezes the water to make ice. During the day, the same fluid is used to melt the ice in the ice tanks when the system is in cooling mode.

More than 44,000 gallons of heat-transfer fluid circulates through the heat exchangers, chillers, piping, pumps and tanks at two FGCU sites. The fluid is mixed with water at 25% concentration to meet service temperature requirements.

Prior to investing in TES, energy costs at the university were approximately $6–$7/sq ft; now, the plant and building pump energy costs are $2.10/sq ft. FGCU currently has 92 thermal-energy-storage tanks, 14,760 tons of ice storage with a planned expansion to 146 tanks and 23,360 tons of ice storage. In four years, the university documented a total savings of $1.4 million.

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Breathing better

According to Ryan Rex and Robert DiBetta—the authors of, "Green Building: The Inside Story (Benefits We Can Breathe In)"—while eco-friendly construction practices are about preserving the environment and creating a cleaner, more natural habitat for humanity, the real story in green building is not its impact to the outside environment, but inside where people live and work. IAQ is the crucial component in any evaluation of environmental conditions (more than 70% of the criteria necessary to achieve LEED certification).

During construction to qualify for LEED certification, Freedom Enterprise Inc. in East Norriton, PA, covered the ends of all ends open ductwork to ensure no dust or airborne pollutants would be circulated back into the space when the HVAC equipment was started again.

At Freedom Enterprise Inc., located in East Norriton, PA, specific practices were utilized by the HVAC team during construction to qualify the building for LEED certification. Some of the building practices include: elevating stored building material to separate the material from any dirt or debris that may accumulate on the floor; isolating a designated area for cutting all material to limit the circulation of construction dust; covering the ends of all open ductwork during installation to ensure that no dust or other airborne pollutants are circulated into the space when the HVAC equipment is started up; utilizing adhesives and solvents containing little or no VOCs to remove a long-lived residual source of respiratory irritants; and keeping smokers and idling vehicles at least 20 ft away from the building at all times.

After construction is completed, green building mandates a forced air-flush-out period that must take place before the building can be occupied. A calculation based upon the square footage and occupancy is performed to determine the amount of outside air needed to flush any remaining allergens from the indoor air.

A dense MERV-8 air filter was used to prevent any dust that may have been missed from being blown outside preventing the harmful particles from re-circulating back into the building. Following the completed flush-out period, the MERV-8 filters were replaced with MERV-13 filters. The filter upgrade increased the indoor air quality by catching the dust particles down to the 0.3-micron level.

Smart buildings

Green building can sometimes be achieved via a building automation system. By adding a layer of intelligence, elements of a building—including temperature, electricity, ventilation, water, waste management, telecommunications, and physical security—can be integrated for better management and control. Smarter, more sustainable buildings can quickly sense and respond at every system level possible.

One BAS example resides at the University of Texas at Austin's District Cooling system. There, Optimum Energy implemented its OptimumHVAC software in chilling station 6 on the campus, which will enjoy an estimated first-year savings of 6 million kWh and an operating cost-reduction of approximately $500,000.

Chilling station 6 is one of four plants within the university's 46,000-ton District Cooling system that together serve the campus' 17 million sq ft of building space. Using the software, the annual wire-to-water performance range for the chilling station is expected to be 0.33–0.78 kW/ton—compared to the design performance range of 0.57–0.79 kW/ton. In the first month, the system operated as low as 0.28 kW/ton.

OptimumHVAC is a bundled, third-generation software solution that includes OptimumLOOP control software and OptimumHVAC Performance Assurance services. OptimumLOOP continuously adjusts the all-variable-speed chillers, pumps and tower fans in the university's chilling station 6 to maintain cooling and optimize equipment efficiency based on real-time load conditions. OptimumHVAC Performance Assurance provides ongoing, Web-based monitoring that enables the university's plant operators to track historical and real-time HVAC-system performance and verify that energy savings persist over time.

Another BAS venture exists between IBM and Johnson Controls Inc. Building on an existing relationship formed between the two organizations in 2007 to create energy-efficient data centers, key elements of the latest offering are designed to address critical building-performance areas, including systems integration, energy management, enterprise reporting, space utilization and asset management.

The Johnson Controls Metasys BMS integrated with the IBM Maximo asset-management solution provides tools and services that deliver between 10%–20% savings across enterprises by enabling visibility across a building portfolio, boosting the efficiency of facility operations, and improving occupant safety and comfort, use and lifecycle management.

What the future may hold

Green appears here to stay, especially as more regulations and specifications are being generated at the federal/state levels. But what does this mean for contractors and service technicians?

According to Christopher G. Hill in his article published in *The Virginia Lawyers Weekly*, "While the move to sustainable building is a laudable one, this new paradigm brings with it new legal risks that have yet to be explored. New technologies are being created and old methods are being used in new ways. This alone creates liability risks for the simple reason that we do not have years (or even decades) of engineering data. Insurance companies continue to struggle with comprehensive general liability and errors and omissions coverage relating to these issues, as well as the design- and construction-related issues. Questions abound relating to how insurance carriers will insure (if at all) for potential failure of certification or for the specter of de-certification or failed energy-performance benchmarks."

Training and certification are more important now than they have ever been, and technicians not keeping up with both could have a lot to lose. Hill mentions that, "Issues of third-party action relating to energy efficiency and appeals of or challenges to the certification of a building under LEED require that contracts be drafted in such a way as to protect the parties from unforeseen liability well beyond the time frame of any warranties. The USGBC requires energy reporting at certain intervals and also allows for challenges to the LEED certification of a project by third parties after the fact and possibly well after the project is complete. These last two points create the possibility that a contractor could be held responsible for the energy-efficiency or state of LEED certification of a building long after it leaves the project."

As more policies/mandates and programs surface, so too does the level of confusion for contractors and technicians. Failing to know about these changes—and more importantly, falling behind on training and certification—could be detrimental to many business owners. However, this may not be a bad thing for those who have "played by the rules," for new opportunities will come to light as moonlighting HVACR technicians not properly trained and certified are flushed out. Holding these technicians accountable for the installations and/or retrofits they put their name on is the next logical step in this evolutionary process. Preparation, education and certification will become fundamental in the industry, especially as the government's involvement increases.

No matter what new technology delivers the industry into greener pastures, it will be critical for technicians to remain as up to date on the technologies as it is to educate themselves on how the technologies work, how to install, troubleshoot, and likely, how to retrofit for the next advancement that comes along.

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