

Cool Energy Savings

By John Vastyan

Commercial applications for harvested rainwater are no longer a rarity in the U.S., though few uses of this heaven-sent water match the AdvancED facility in Alpharetta, Ga., for sustainability and energy efficiency. The U.S. Green Building Council thought so, too—the new global headquarters facility earned LEED Gold status.

AdvancED is the largest school accrediting agency in the world. Its accreditation process creates a universal standard that levels the playing field for schools across the globe when students look to transfer credits between countries.

The organization's three-story, 60,000-sq-ft headquarters achieved its LEED Gold certification for its use of

the latest green products and materials, eco-friendly building designs, energy conservation techniques, and state-of-the-art technology, including rainwater applied for what some experts consider its ultimate use: energy reduction on a commercial scale.

Keeping it Green

One of the biggest contributors to the building's green status is unseen and underground. Located below a parking area is a 30,000-gal BRAE rainwater cistern that stores water for irrigation and cooling the air conditioning system coils for greater efficiency.

The rainwater harvesting system collects rainwater and condensate from the rooftop packaged air conditioning system, draining runoff to the

subterranean tank. The water moves through underground inlet filters that keep debris from entering the tank. If the tank's capacity is reached, overflow is directed to the storm water drainage system.

"A key concern was to apply the tank's use at the facility toward achieving LEED points," said Jennifer Losurdo, P.E., engineer of record for the project landscape architecture plan. "Outside the walls of the building, property owners are very limited in the amount of points available; site selection and water efficiency are the two main categories, so clearly, harvesting rainwater had a positive impact."

"There are a lot of bushes and trees on the property to irrigate, and the BRAE catchment tank and delivery system is used chiefly for that," said Jarrett Keim, senior project manager for JE Dunn Construction Group Inc., the general contractor for the building.

Cooling System

A 5-hp submersible pump moves water into the building to a Rainset control station that monitors tank water level. The control station also supplies pressurized water to the irrigation system or to a series of spray nozzles that cool rooftop packaged air conditioning condenser coils, increasing the system's energy efficiency. The pump is sized for the irrigation peak flow; the spray system requires only a small percentage of this flow.

"When rainwater use is considered, irrigation is typically the first consideration," Keim said. "What we'd like to see more of is the use of rainwater as a means to reduce energy consumption. We later learned that the AdvancED building is only the third facility in the state of Georgia to use rainwater for evaporative cooling of central air conditioning coils."

"No doubt, this is innovative use of rainwater," said Eddie Van Giesen, policy director for BRAE. "During the air conditioning season—which, in Atlanta, may be April all the way through October—rainwater is directed to the roof, or to piping that carries it to rooftop units modified with spraying heads that deliver water mist into the air [that is] drawn onto refrigerant coils."

Building leverages rainwater for HVAC energy savings



AdvancED's new global headquarters in Georgia earned LEED Gold status due in part to its rainwater harvesting and reuse system.



Installation of the 30,000-gal rainwater cistern that stores water for reuse for irrigation and evaporative cooling of the building's air conditioning coils



The harvested rainwater is filtered for debris and disinfected with UV treatment before being delivered to spray nozzles that distribute it to the air conditioning condenser coils.

Water & Power Paradigm Shift

“We use the rainwater mist at AdvancED to reduce the current drawn by air conditioning compressors,” said Gregory Jeffers, P.E., LEED and ARCSA AP, senior project engineer for Atlanta-based McKenney’s Inc., the commercial mechanical contracting firm chosen by JE Dunn to handle the design/build aspects for all plumbing and mechanical installations for the project.

“The air conditioning equipment’s energy use is based on compressor refrigerant pressure, which varies directly by outside air temperature at its condenser, so a key advantage of the misting system at AdvancED is [that it] reduce[s] this temperature, [thereby] reducing the amount of electrical current drawn by the system. This makes the compressor ‘think’ it’s cooler outside,” Jeffers said.

Jeffers began experimenting with

harvested rainwater and air conditioner compressor efficiency in 2003. In 2005, when JE Dunn (formerly RJ Griffin & Co.), as part of a consortium of general contractors, was tapped by the South Face Energy Institute in Atlanta to help build its new facility, it turned to McKenney’s to help it achieve LEED Platinum status for its new, über-green “Eco Office” structure with integrated mechanical systems. There, McKenney’s proved that a rainwater spray system could save energy and installation costs.

In 2007, McKenney’s also was involved with the Georgia state building codes and guidelines for rainwater use. The company opened its own research facility in 2008 to study the viability of commercial applications while providing research data to groups such as ASHRAE.

“The water delivery systems are

basically categorized as either ‘direct,’ spraying water directly to the condenser coils, or ‘indirect,’ where water is first delivered to media, each having advantages and disadvantages,” Jeffers said.

At AdvancED, Jeffers specified an indirect system—an installation that now increases the energy efficiency of the air conditioning system by about 15%. Typically, percentages rise and fall based on the time of year, type of facility and cooling equipment, use of direct or indirect spray, and location. McKenney’s research indicates that water spray systems can reduce energy use by as much as 50% in the Southeast.

More importantly, Jeffers said, “As freshwater supplies are taxed, the use of rainwater to reduce energy is playing an ever more important role. By harvesting and using rainwater, we avail an otherwise wasted resource.”

“According to [U.S.] Department of Energy estimates, more than 35% of the nation’s water use is tied to energy production,” Jeffers added. “As a rule of thumb, 1 gal of water is used to produce 1 kWh of energy in the U.S., and can be more in some areas. That’s in addition to energy required to move and distribute water.

“Applied in this way, we reduce power without tapping the Earth’s freshwater resources,” Jeffers continued. “It’s a paradigm shift in sustainable use of water for saving both power and water at the regional level. This has gained even greater significance because it mitigates recent legal battles currently going on for regional and interstate water resources.”

Rooftop ‘Shower’ System

Three Trane Intellipak packaged rooftop air conditioning systems serve the AdvancED facility: a 60-ton unit and two 40-ton units.

According to Ryan Duncan, McKenney’s project manager for the AdvancED project, the company’s crews ran 1-in. schedule 40 non-potable plastic tube from the pumping station to the roof to a distribution box to serve the rooftop unit systems. From there, a network of flexible ultraviolet (UV)-resistant ¼-in. line delivers water to four sprayer heads at each of the three rooftop units.

Modifications to the rooftop units included metal-framed screen/filter media membranes at condensing unit intakes. Each of these is served with a single attached spray nozzle. When condenser fans draw air into the large A-frame coils, the spray nozzles deliver a fine mist into the mesh screens. Moist, cooler air comes in contact

with the refrigerant coils, lowering the power draw from the compressors.

Before delivery to the spray nozzles, the rainwater is filtered to eliminate debris and is run through UV treatment to neutralize biological contaminants. According to Jeffers, water lines and filter media are checked for cleanliness twice a year and washed or replaced when needed.

Change in Plans

“The initial plan for HVAC systems at AdvancED called for small chillers, a cooling tower and fan coil units,” said Reed Thomas, preconstruction director for JE Dunn. “But, thanks to the successful use of the coil-cooling technique at South Face’s headquarters building and at McKenney’s own facility, we were excited to recommend coil cooling as an option to the far more expensive initial plan.”

Thomas added that after accepting the recommendation for simple evaporative cooling of the packaged system coils, it was apparent to AdvancED managers that the switch to a simpler approach not only would save \$200,000 that could be reinvested into the project, but also would bump the facility from LEED Silver to LEED Gold.

‘Treat According to End Use’

“In the rainwater harvesting business, an often-used adage is ‘treat according to end use,’” Van Giesen said. “This refers to the appropriate, sensible treatment of rainwater based on its ultimate purpose: water for irrigation and, also in this instance, water to reduce energy consumption. Fortunately, because water from the roof is quite clean, there’s no need for treatment for either use at the AdvancED facility.

“What we’re especially pleased with on this job, beyond the use of harvested rainwater for irrigation, is the link between rainwater and energy efficiency,” Van Giesen added. “The use of rainwater to cool HVAC coils is something we should see much more use of here in the South, where cooling loads are so high. It’s an application with huge energy-saving potential.” *wqp*

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