Cooling System Cuts Costs And Consumption

Since becoming energy manager for the Poudre School District in Fort Collins, CO in 1994, Stu Reeve has been involved in more than 100 sustainable projects to save upwards of $1.5 million. The use of thermal energy storage, in three schools thus far, is one approach used in the district's energy conservation program.

What is your position? How many years have you been involved in the facility management profession?
I've been energy manager with the district since fall of 1993. Prior to that, I was an electrician for the district. I've been working for the school district for more than 30 years.

How did you become interested in environmental issues?
It started when I was an electrician. I was following [emerging] technologies and seeing the evolution, as well as evaluating what the savings were. The dollar impact on the district was the first thing that caught my eye. Then, environmental stewardship was in there when I started seeing that the impact of saving energy was not only just the dollars.

What sustainable project or vision (aside from your own) has impressed you most?
There's a company called Xilinx in Longmont, CO that did a tremendous job on their building. I visited there about four years ago. It's a high tech electronics firm and the sustainability effort was focused around the comfort of employees. There were wonderful examples of natural daylighting, sustainable building materials, and—at the time—the latest fluorescent lighting that interfaced with the natural daylighting. It was really the epitome of sustainability at the time.

Other schools around the nation have also been good examples. We went to McKinney, TX and were exposed to some of the things they were doing in schools.

In 1998 and 1999, when [the U.S. Green Building Council] LEED [program] was very much in the early stages, those types of resources were hard to come by. There weren't nearly as many resources as there are now.

The evolution in the nation in the last six years has been amazing. Because we couldn't find resources inside the United States, we were actually looking at Europe. They've been doing this for years. Their costs have driven lots of technologies and techniques.

What best defines the green philosophy your organization would like to convey?
A lot of our responsibility in facilities management—as well as energy management—is redirecting dollars away from the utility company and back into public education. So we have a comprehensive conservation program. This leads us to the approach of when building something, build it right. That's really where we came together as a team to make sure we were making good decisions with new buildings as well as additions or remodels.

What has highlighted our district in the last three or four years is that every building we've built and every remodel we've done since our newest bond passed in 2000 has been sustainable and high performance. These accomplishments are a reflection of the partnerships we have, which include other school districts, utility companies, and government programs.

The green philosophy has gotten a lot more popular in the nation since we [in the Poudre School District] started building sustainable, high performance schools. But it has been a path over the past 10 years of continually trying to improve one year to the next.

Back in the late 1980s and early 90s in Colorado, there was a lot of financial pressure on school districts. Basically, we had to run more like a business and look at where the money was going so we could get more of it to the educational mission of the district. That's when I was hired [as energy manager]. Because the state was cutting our funding so tightly, there were also other districts involved in collaborating on how to save energy.

How did you come to learn about thermal energy storage? Why was the decision made to pursue this goal?
When we were modeling different mechanical systems for our new elementary school prototype in 1999, we looked at several choices; thermal energy storage rose to the top. It offered tremendous benefits for us on the energy side, the cost side, and the comfort side.

We could basically control the demand costs for our school by making ice in the thermal energy storage tanks in the middle of the night when it's cooler and electric rates are cheaper. By the morning, we've got a full tank of ice and we can shut the chiller completely off. We can then use that ice for cooling through the HVAC system during the daytime when school is in session.

When people start to arrive in the morning and HVAC is coming on, lights are coming on, and kitchens are firing up, the chiller is not part of that equation anymore. Rather than running the water through the chiller, we're running it through the ice and cooling the building that way.

That was the start of bringing the technology into the district. It was very effective and very trustworthy. In the fall of 2003, another prototype—Bacon Elementary School—became operational with thermalized storage. And, in the fall of 2004, Fossil Ridge High School went online with the system.

Our electric rate structure was a factor here as well. Often, when we look at solutions for heating or cooling buildings, rate structures help to determine different systems that may qualify. When we were doing the research on the best systems for performance, the thermalized storage system became attractive and won out.

We found that by using the thermalized storage system, we could downsize our chiller, because the more capacity we had for thermal storage, the smaller the chiller can be. We didn't need to support the full demand of the building all in one shot. There was only about a $5,000 difference for adding thermalized storage—with the combination of the chiller—to the whole mechanical cost of the building.

The payback on that was less than a couple of years, based on the fact that we could provide cooling in an off peak scenario. We have time of day rates here where the rate changes from about $4.50 per kWh for off peak demand up to about $13.05 per kWh for demand in peak times.

What was the reaction of upper management to the decision to embrace elements of sustainable design in this project?
The biggest selling point of sustainable design with a school administrator is that


IMAGE PROVIDED BY POUDRE SCHOOL DISTRICT

the building will save money. Our ultimate goal is to build the best classroom possible for the educational process, so if we can give occupants the best, save money, and be environmentally friendly, the bottom line is good for everyone.

What were some of the (non-economic) challenges or highlights of this project?
When dealing with new technology, we need to be sure the staff is comfortable with maintaining systems that may be a little bit different.

In 1999 we formed "The Green Team," a collaboration of educators, maintenance, and outside partnerships. We all came together to learn about different technologies and what the challenges were from everyone's perspective.

It was really important to bring a team together. If we don't do that, there is a cost, and it's one that we might not be able to quantify.

What was the vendor selection process like? Did you feel limited?
There are several good companies out there, and I'm sure there's more. We have an open bid system, and for the first installation, we used a Trane chiller in combination with CALMAC thermal energy storage tanks (seen in photo above). Those are also in the high school. We used a York chiller and Baltimore Air Coil High Storage in the Bacon Elementary School.

The technologies and the vendors have all been successful in the installations.

Have you applied for—or achieved—LEED certification from the U.S. Green Building Council for this project? If so, what level and type?
Yes, we just got word that we have earned LEED 2.1 silver certification for new construction for Fossil Ridge High School.

Was the application investigated before, during, or after construction?
We were using LEED as a

guideline right from the design stage but we were getting pressure about actually LEED certifying. So we chose the flagship project of the high school for LEED. It's a process we followed from design to documents to construction and post-construction.

How did thermal energy storage play a part in the LEED certification process?

When its energy performance is compared to a baseline model from the U.S. Green Building Council, Fossil Ridge High School outperforms by 60% in energy efficiency. Thermalized storage and the chillers were a large component of this performance during the cooling season.

As a green project, did thermal energy storage cost more, less, or the same as a standard project of the same size?

The thermal storage system resulted in a difference of about $5,000 more compared to a traditional system.

Overall, for the three schools, we have come in under budget. These budgets were based on a standard, so they didn't have sustainable components built in.

The Zach Elementary School, for instance, was budgeted for $115 per square foot. It came in at $99.50 per square foot. The Bacon School was budgeted the same and came in at $100.50 per square foot. The high school was budgeted at $135 per square foot and came in at $122.

Those first three projects really set the tone that we could accomplish sustainability on a standard budget. It comes down to integrated design and making sure we're all working together. It's also about taking advantage of every opportunity to reduce the size of things. By combining those ideas, all the systems start to downsize.

What was the anticipated ROI for the sustainable aspects of this project?

We anticipated return on the thermal energy storage investment in less than two years.

I estimate savings of approximately $5,000 per year for the elementary schools and about $10,000 per year for the high school.

What has been the reaction to the project inside your organization?

Overall, I would say 95% of the staff is happy. There was even a teacher at the Bacon Elementary School who thought the sustainable design of the building was great. She started teaching her fifth and sixth graders to give technical tours of the building. She consulted with us, and she taught the kids how to explain the mechanical and electrical systems. We have hard hats for the students that read "Student Ambassador for Environmental Stewardship."

How has the community responded to this project?

We give tours of the Fossil Ridge High School to people from all over the country. We've even had visitors from British Columbia.

The number one comment I hear during the tours we give of the building is, "I wish I would have gone to high school in a school like this." It's about how comfortable it feels. The general public embraces these schools in a tremendous way.

It is a changing focal point for our community. We see a lot of businesses influenced by the things we're doing. A lot of them are saying we want to build them like the school district does which is interesting, because usually that's not the way it works. Obviously, they're influencing us too, so there's a back and forth.

What did you learn from this project?

We've proven to ourselves that this is a system that's going to be effective for us. That's always the question when we venture into something new. Is it truly going to perform? We've found that thermal energy storage is an effective way to manage the building. We're not sacrificing comfort for energy savings.

The energy savings are there. The two elementary schools are scoring in the 80s [on a scale of one to 100] on the EPA Energy Star benchmarking system. And, in its first year, the high school scored a 75.

What was the most professionally rewarding aspect of this project?

The networking aspect has been the most rewarding part of all of our sustainable projects. Sharing experiences has been very professionally rewarding. I learn something on every tour I give. If someone asks a question I can't answer, I need go back and figure it out.

Also, I'm collaborating with several people working on their Masters and Doctorate degrees, and they help us to learn. We're doing studies right now on the thermalized storage with a student at Colorado University working on his Ph.D. The focus is how we can anticipate weather and bring that into the programming of our building automation system and use the ice storage around that. □

Questions about this project can be sent to Stu Reeve at stur@psdschools.org.

To share your Green Solutions, send an e-mail to avazquez@groupc.com.

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