

CASE STUDY: Boulder Community Foothills Hospital

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An Industry First

Boulder Community Foothills Hospital Sets an Example for the Health-care Industry

When observing Boulder Community Foothills Hospital (BCFH) in Colorado, one's eye instantly is drawn to what's behind it. Boulder's Flatirons and the Colorado Front Range mountains rise majestically to the west behind the hospital, dramatically defining its physical context and establishing themes that are integrated into the facility's design and material selection.

But BCFH, one of two hospitals operated by non-profit Boulder Community Hospital (BCH), is connected to the natural environment in more ways than just this. Faced with expanding its facilities to meet the growing health-care needs of a community with lofty environmental standards, Boulder Community Hospital (BCH) embarked upon a journey that ultimately would construct the first hospital to achieve Leadership in Energy and Environment Design™ (LEED™) certification from the U.S. Green Building Council. In doing so, the organization has broken new ground and raised the bar for the health-care industry while making a strong statement to the community it serves about its commitment to the environment and public health.

Project Goals

Boulder is an environmentally conscious city so the fact that its community hospital would pursue "green" design and construction standards may not come as a surprise. However, the decision to go green also has roots in BCH's management approach.

“Our decision to pursue the LEED standard for the new hospital was not one made in the spur of the moment,” says Joe McDonald, BCH’s vice president of finance. “It’s just one more example of this organization’s long-term commitment to the environment.”

BCH established a recycling program at its main campus in west central Boulder in the mid-1980s, which earned the hospital the 2001 “Recycler of the Year” award from the Colorado Association for Recycling. For more than 10 years, the hospital has provided free bus passes to all its 3,000 employees; has purchased wind power for its facilities; and has a full-time environmental coordinator on staff. During May 2001, the BCH board of directors recommitted itself to a set of environmental principles that include actions to “protect and preserve the environment.”

Unable to expand its main campus, from which it has served Boulder residents since 1922, and with its patient base drifting toward the growing towns in eastern Boulder County, facility expansion meant new development. Land was secured in east Boulder, no small task in this growth-managed city of 100,000, and the project team consisting of Boulder- and Denver-based firms was pulled together. Their charge was to design and build a “green” hospital, one with a reduced environmental footprint that reflects the community’s values and sets an example for the health-care industry.

BCFH is a 222,000-square-foot (20,624-m²), comprehensive 60-bed hospital that includes 24-hour emergency care services; an intensive care unit; and surgery, radiology, and laboratory services. Maternity care and pediatrics also are major components of the new facility, and two medical office buildings adjoin the hospital. Overall project cost, excluding land costs, was \$45.6 million, yielding a cost per square foot of \$294. The hospital opened to the public in September 2003.

The LEED Influence

“Foothills Hospital is the largest capital expenditure in BCH’s history,” McDonald says. “At the outset, we asked ourselves, ‘How do we want to do this?’ It was our desire to make a strong statement.”

Although BCH originally had not intended to pursue LEED certification, the project team included Boulder-based Architectural Energy Corporation (AEC), whose role was to perform energy modeling and serve as sustainable design consultant for the project. The principal design firms, Oz Architecture (core and shell) and Boulder Associates (medical architecture), both of Boulder, had no previous LEED experience but were familiar with sustainable building principles and techniques.

“Given the stated project goals of our client, we adopted the LEED criteria during the schematic design process as a measurement of success, as a tool to shape the design process,” says Kristi Ennis, a LEED-accredited professional, senior associate, and sustainable design director for Boulder Associates. “LEED required us to think about a lot of elements of the project and led us to make choices that might not have technically met the LEED criteria, but which we felt were certainly meeting the spirit. As we committed to more and more points, we eventually made the call to formally pursue LEED certification.”

With this decision made, AEC’s role shifted to one of LEED coordination. “We took our knowledge of LEED and sustainable design and integrated that into the work of the design team,” states Caroline Clevenger, team leader of the sustainable design assistance group at AEC. “We had literally started with the LEED checklist from the get-go, and so continued to make front-end decisions about which points to pursue. As we got into the work, some of the points fell off the table for a variety of reasons.”

For example, the use of electric eye faucets in patient areas to conserve water is not always practical. While these faucets provide exceptional infection control, they have limited functionality in terms of temperature control, filling of basins, bathing newborns, and the dry use of sinks for such things as medication mixing. “We ultimately pursued the LEED points that made the most sense and fit our needs,” Ennis adds.

Pursuing LEED certification generated much discussion amongst the project team about how to incorporate new and emerging technologies into the building. “The lack of a track record for some of these technologies makes it challenging,” McDonald says. “It makes it tough to be on the bleeding edge.”

In addition to the fact that no hospital had yet achieved LEED certification, pursuing LEED was a new experience for most of the project team. Kai Abelkis, BCH’s environmental coordinator, describes the process: “We were attempting to put a square peg into a round hole. We had established a goal no one had yet achieved; we didn’t have the luxury of looking to another project for guidance.”

Teamwork between the project team and client was critical to making the project work, according to Abelkis. He and McDonald were cheerleaders and advocates, nurturing the hospital’s environmental commitment through the design and construction processes. An integrated, iterative approach evolved between the design firms.

“The hospital’s program had to work,” Ennis says. “We worked out the interior spaces and the building shapes necessary for accommodating the uses simultaneously with designing the look of the building.” Weekly project team meetings often included the contractor, mechanical engineers, electrical engineers and other important players, all helping to make early decisions to meet LEED standards and develop the construction schedule and budget.

Achieving Certification

The LEED-NC (New Construction & Major Renovations) criteria are focused into the categories of sustainable site development, water efficiency, energy efficiency, materials and resources, and indoor environmental quality. In addition to meeting the prerequisite criteria, BCFH earned 33 additional points, qualifying for a Silver certification level.

Sustainable Site Development (sub subhead)

BCFH sits on a 49-acre (20-hectare) site that continued to function as a cow pasture even as Boulder's high-tech industrial base was built around it. The hospital footprint, including parking, courtyards, and other open spaces, rests on 17 acres (7 hectares) located in the southeast corner of the site, with the remaining 32 acres (13 hectares) dedicated as open space through a conservation easement. Prairie dogs have replaced cows as the primary inhabitants of this land.

As a long-time proponent of alternative transportation modes, BCFH received four LEED points for the site's proximity to high-frequency transit service and the provision of employee transit passes, providing bicycle storage and easy access to showers and changing rooms for employees, as well as offering dedicated parking spaces for carpools. Because of its policy of providing employees with free transit passes, the hospital was able to vary the city's building code requirements and build 25 percent fewer parking spaces than required. The hospital has reserved on-site space to build more parking in the future if necessary.

BCFH also employs an R-30 ENERGY STAR[®]-rated cool roof to reduce the building's heat-island effect.

Water Efficiency (sub subhead)

BCFH incorporates numerous xeriscape strategies into its landscaping plan. These strategies, which heavily rely on the use of native and drought-tolerant vegetation, reduce the hospital's irrigation water requirements by more than 50 percent.

Xeriscaping is a good example of how the green approach, while initially more costly, becomes the smartest environmental and economical approach over time. McDonald expects to realize a relatively quick payback through reduced maintenance costs and lower water usage,

Although not receiving any LEED credit for its effort, the hospital also is experimenting with waterless urinals. Abelkis suggested they pursue this technology because "they work and require no additional maintenance beyond that of conventional urinals." The

project team decided to play it safe, however, by using the waterless urinals only in public restrooms, which also incorporate electric eye faucets, and installing traditional water piping in the restroom walls should the need arise to revert to conventional urinals. This redundancy added some cost, but the waterless urinals achieve large water savings and are a visible demonstration of BCH's desire to model environmental leadership to the Boulder community.

Energy Efficiency (sub subhead)

AEC analyzed three mechanical systems for the hospital: rooftop, central utility plant and remote central utility plant.

“Through energy modeling and life-cycle costing, we walked BCH and the project team through numerous policy and design decisions regarding the central utility plant,” Clevenger says. “We ultimately decided to go with the remote central utility plant, which will provide significantly more flexibility to BCFH as the site builds out over time. The remote plant allows the mechanical equipment to be grouped together, and it was built large enough to make future additions relatively easy and painless.”

The incremental first cost of \$1.3 million seems steep, but the remote central utility plant showed 21.2 percent operational cost savings compared with distributed mechanical systems and has a 12-year discounted payback period.

In addition, payback studies were completed for photovoltaics and solar hot water. The inability for non-profit BCH to qualify for federal tax breaks for implementation meant a financially viable payback period for photovoltaics could not be achieved. The solar hot water study showed an acceptable 12-year system payback period, but the project team had moved too far into the design process to integrate the additional structural measures necessary to support a solar array on the hospital roof. Cogeneration also was considered, but no realistic opportunities existed to share power with nearby uses, rendering the concept infeasible.

Numerous energy-efficiency measures are employed throughout the hospital, including high-efficiency glazings, T5 lamps, occupancy sensors, building shading devices, variable speed high-efficiency chillers, high-efficiency fans and fan motors, outside air economizers, high-efficiency lighting controls, and demand ventilation and carbon dioxide (CO₂) detectors for air-quality monitoring. Energy modeling shows BCFH operating at a 27.6 percent savings above ASHRAE 90.1-1999.

Materials and Resources (Sub subhead)

Continuing the tradition it has established on its main campus, BCH has developed a strong recycling program for BCFH, which also is a prerequisite for meeting LEED. The project also received a LEED point for diverting construction waste, achieving a 64 percent recycling rate. Getting the numerous contractors and subcontractors onboard to divert construction waste was a real challenge, according to Abelkis, who also designed the hospital's internal recycling program.

A strong focus was placed on integrating recycled-content building materials and locally harvested and manufactured materials into the project. A significant percentage of the materials used in construction contain recycled content, and as many locally manufactured and harvested materials were used as possible, most visibly in the building's façade where the brick and sandstone came from local suppliers.

Indoor Environmental Quality (sub subhead)

The quality of the indoor environment was paramount to the BCFH design team. As Abelkis describes it, "We were focused on creating a healthy environment for people trying to get well and for their caretakers. I see this as the biggest benefit of LEED."

The hospital received 10 of a possible 15 LEED points in this category, and the list of efforts taken to improve indoor air quality is long. Highlights include implementing an Indoor Air Quality Management Plan for the construction and pre-occupancy phases of building construction; the pre-occupancy plan required a two-week building flush-out using 100 percent outside air after construction ended. A temperature and humidity

monitoring system was installed to provide control over thermal-comfort performance, and a CO₂ monitoring system also is in place to ensure the indoor air maintains consistently healthy oxygen levels.

The project team also aggressively pursued the use of low-VOC (volatile organic compound) finishing materials, including adhesives and sealants, paints and coatings, carpet and formaldehyde-free composite wood products.

“We wanted healthy materials so we didn’t compromise our health-care environment,” Ennis says. Finding these materials was easier said than done, however. Research by the project team, contractor and subcontractors finally led to securing the necessary materials, in some cases just days before they were needed.

The project team also made significant efforts to incorporate daylighting strategies into the hospital design to provide healthy, natural light to patients, staff, and visitors, as well as take full advantage of the majestic mountain views available from BCFH’s site.

Additional Sustainable Attributes (sub subhead)

In addition to LEED, BCH and the project team incorporated additional techniques that contribute to the sustainability of BCFH and the Boulder community. For example, much of the hospital’s furniture is made with recycled content, and the art placed in rooms, waiting areas and corridors are works completed by Boulder County artists.

To remove the building site from the 500-year floodplain, fill excavated for a downtown underground parking garage was trucked to the site at no cost to BCH. And as part of its development agreement with the city, BCH agreed to make improvements to a flood wall that protects a neighborhood located south of BCFH.

Working with LEED

Pursuing LEED certification presented the project team with challenges and opportunities above and beyond those typically seen when constructing a conventional

building. For McDonald, “the biggest challenge was designing and building the hospital with a whole new set of parameters.” As the client, McDonald saw more time and money spent on consultants compared with typical construction projects with which he and BCH have been affiliated.

Ennis agrees, but with a twist: “We saw more consultant and project time dedicated to the schematic design process but less on construction documents. Our experience was one of re-allocated work, not more of it.” LEED requires you to be accountable to the standards from the very beginning, she adds.

An additional challenge was becoming educated about the various green technologies that were available in the market to assist in meeting LEED criteria.

“We found it difficult at times to get information about the green materials and technologies that were under consideration,” Clevenger says. “This is becoming easier and easier, even in the short time since the hospital’s completion.”

Despite this frustrating challenge, McDonald feels no compromises were made as a result of pursuing LEED: “At the end of the day, we got what we needed and were able to meet our goals for the project.”

Lessons Learned

BCFH is the second LEED-certified building in Boulder, the first being a renovation of the city’s North Boulder Recreation Center. (For more information about the center, see “cool roofing,” January/February issue.)

Abelkis says this is no coincidence: “We certainly were inspired by the city’s commitment to walking its environmental talk. But beyond that, the two projects are similar in that the city and hospital are public institutions that can more easily adapt to longer payback periods that may be unacceptable to the private sector.”

Clevenger agrees, adding that it was easier to make the LEED component work with BCH as the client. “We were constructing an owner-occupied, single-purpose building with a 50- to 75-year expected life for a client that has a long-term commitment to the building,” she says. “Because of this, 12-year paybacks were acceptable, which may not always be the case in the private sector.”

Clevenger adds project developers should be aware up-front that pursuing LEED certification will add length to the project horizon. And in regards to the health-care industry, the American Society for Healthcare Engineers is in the process of developing green-building guidelines that will be tailored specifically for the health-care environment.

A Model for the Industry

In addition to BCH’s desire to meet the environmental principles of the organization and community it serves, the project team established the goal of seeing BCFH become a model for the health-care industry. By achieving LEED Silver certification, there is no question that this goal has been met.

McDonald sees the timing as propitious: “There is a growing awareness of environmental issues in the health-care industry. Breaking the mold, so to speak, will help clear the way for new LEED projects. The health-care industry is about improving the health of people. With the new hospital, we also can begin thinking about and acting to improve the health of our planet.”

Clevenger emphasizes that BCFH not only proves to the health-care industry that green building is possible, but it can be accomplished without resorting to high-profile, and often expensive, “gee whiz” technologies.

“I like to call BCFH solidly sustainable,” she says. “It has very little ‘wow’ factor when it comes to what makes it green. The sustainability is in the little things--the things you don’t see, the things you don’t notice. This enables us to more easily integrate green building techniques into commonly accepted construction practices.”

Project interest has been running high since its completion. “We are getting inquiries about the project from around the world,” Abelkis says.

Ennis continually receives requests for presentations, proof to her that “we are making a difference in the health-care industry, which always was our hope. We have set the bar high for future projects. I am convinced that there will be future LEED-certified hospitals, projects that will take inspiration from Foothills Hospital.”

BCFH will be serving Boulder-area residents for decades to come. In the short term, building the first LEED-certified hospital “is something to be proud of, and it has cemented BCH’s reputation as a community environmental leader,” Abelkis remarks. In the long term, he adds, “The hospital is bigger than us. Today, we are struggling with the environmental effects of decisions made long ago, and we must begin now to make wise choices for those who will follow us. Children will be born in this hospital, in a place that is demonstrating that we can tread lightly on this planet; we can do things better. That’s the real value of what we have accomplished.”

Mark Ruzzin is a program associate at the Southwest Energy Efficiency Project (SWEET). Founded in 2001 and based in Boulder, Colo., SWEET collaborates with utilities, state agencies, environmental and consumer organizations, universities, and the private sector to promote energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. Learn more at www.swenergy.org.