

Going Green in Greensboro

City known for southern hospitality is now home to the world's first LEED Platinum-certified hotel

It has been named one of the world's 50 best hotels for business^{1,2} and talked about³ as one of "50 fabulous U.S. travel ideas."⁴ And now, it can be called "America's greenest (indoor) spot to spend the night."⁵

"It" is Proximity Hotel in Greensboro, N.C., which recently became the first hotel in the world to be certified Platinum under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

Though, with its warehouse-inspired architecture, it brings to mind a cotton mill of the city's past, Proximity

By **JOE MILLIKAN, PE, LEED AP,**

Superior Mechanical Inc.,
Randleman, N.C.,

and **TRISH HOLDER,**

Trish Holder, Marketing Communications,
Greensboro, N.C.

utilizes some of the most technologically advanced mechanical equipment available today. As a result, it costs 40-percent less to operate than the baseline building in the LEED energy model.

Approximately 60 percent of the eight-story, 147-guest-room hotel's domestic-hot-water needs are met by 100 solar panels covering the

4,000-sq-ft roof. Inside, the energy-saving features are less obvious. The owner—Quaintance-Weaver Restaurants & Hotels (see sidebar, Page 24)—was adamant that guest comfort not be sacrificed for the sake of mechanical efficiency.



Photo by Mark File

Completed during the fall of 2007, Proximity Hotel is named after Greensboro's historic Proximity Manufacturing Cotton Mill.

With a bachelor's degree in mechanical engineering from North Carolina State University, Joe Millikan, PE, LEED AP, founded Superior Mechanical Inc. in 1986. Over the years, he has worked extensively with Weaver Cooke Construction LLC, the developer of Proximity Hotel. Trish Holder, president of Trish Holder, Marketing Communications (www.trishholder.com), is a writer and marketing consultant specializing in HVAC. Currently, she is building and promoting a home in Greensboro for which she intends to pursue Leadership in Energy and Environmental Design (LEED) certification. For more information about the home, go to www.greenspirationhome.com.

Energy type	Proposed design		Baseline design		Savings	
	Energy use	Cost	Energy use	Cost	Energy use	Cost
Electricity	2,279,478 kwh	\$126,869	3,618,872 kwh	\$192,067	37.0 percent	33.9 percent
Natural gas	49,586 therms	\$74,681	63,252 therms	\$79,887	21.6 percent	6.5 percent
	0		0		0 percent	0 percent
	0		0		0 percent	0 percent
Subtotal (model outputs)	12,736 MBtu per year	\$201,550	18,673 MBtu per year	\$271,954	31.8 percent	25.9 percent
On-site renewable energy	Energy generated	Renewable-energy cost				
Solar panels	14,138 therms	\$23,920	(subtracted from model results to reflect proposed building performance)			
			(subtracted from model results to reflect proposed building performance)			
Exceptional calculations	Energy savings	Cost savings				
High-efficiency elevators, VFD	587 MBtu per year	\$12,146	(subtracted from model results to reflect proposed building performance)			
Total	Proposed design		Baseline design		Savings	
	Energy use	Cost	Energy use	Cost	Energy use	Cost
Total	10,735 MBtu per year	\$165,484	18,673 MBtu per year	\$271,954	42.5 percent	39.2 percent

TABLE 1. Submittal data for LEED-NC 2.2 EA Credit 1, "Optimize Energy Performance."

Air quality and acoustics were major priorities, as was guest control of room temperature.

Various strategies were utilized to qualify for credits under the LEED for New Construction (LEED-NC) Version 2.2 categories of Energy & Atmosphere (EA) and Indoor Environmental Quality (EQ) (Table 1). The hydronic heating and cooling system and air-delivery system were central to the LEED strategy.

CHILLED-WATER SYSTEM

With the equipment room located in the penthouse, directly above the

hotel's 10 luxury suites, noise and vibration were major concerns. Although it cost approximately \$27,000 more than the two 100-ton high-efficiency screw chillers originally specified, a 200-ton modular scroll-chiller system was selected. Weighing 19-percent less and taking up half of the space of the screw chillers, it runs quieter, with very little vibration (Table 2).

Modularity—along with the inherent load diversity of the hotel and adjacent restaurant, Print Works Bistro—allowed the chiller system to be undersized in relation to a 230-ton peak load. Still, the hotel is able

to take advantage of the system's high part-load efficiency (0.54 kw per ton vs. 0.638 kw per ton with traditional screw chillers), further capitalizing on the savings of the variable-primary chilled-water design. Modularity also provides built-in redundancy; if one compressor were to fail, the remaining compressors likely would be able to carry the load under any but peak condition.

The use of R-407 refrigerant helped to put the hotel on track for LEED Platinum certification. Chlorine-free, non-ozone-depleting R-407 meets the standards of the Clean Air Act, which

Chiller option	Qty.	Actual tons	Kw	Kw per ton, full load	IPLV (kw per ton)	Length	Width	Height	Weight	Sound pressure	Power connection (amps)	Cost	Estimated energy cost ¹	Refrigerant ²
100-ton high-efficiency screw	2	112.1	89	0.783	0.638	112 in.	34 in.	70 in.	5,071	77 dB	225 each	\$87,000	\$57,420	R-22
200-ton modular scroll	1	208.3	145.5	0.706	0.54	114 in.	50 in.	64 in.	8,200	76.6 dB	300	\$114,000	\$48,600	R-407

¹Based IPLV, 7,500-hr-per-year operation, 200 tons, 6 cents per kilowatt-hour

²LEED point earned for R-407

TABLE 2. Comparison of chiller options.



Photo courtesy of Multistack LLC

The 200-ton modular scroll-chiller system at Proximity Hotel.

will go into effect in 2010.

AIR-SIDE STRATEGIES

Unlike most hotel ventilation systems, which typically provide outdoor air only when a guest room’s heating or cooling system is operating, Proximity’s mechanical system was designed to provide 125 percent of the American Society of Heating, Refrigerating and Air-Conditioning Engineers’

(ASHRAE’s) outdoor-air requirement. Outdoor-air sensors monitor the volume of incoming air. This earned two points in LEED-NC 2.2’s EQ category.

The desire for so much outdoor air presented several design challenges, including locating the additional ductwork that became necessary. With too little space to route all of the ductwork from the penthouse



Photos courtesy of Annexair Inc.

The energy-recovery ventilator installed in the penthouse equipment room.

equipment room, the designers chose to split the system.

Floors 1 and 2. To serve the first two floors, where ventilation requirements are greatest because of common areas, conference rooms, and the like, an energy-recovery ventilator (ERV) was

installed just outside of the hotel. The unit uses exhaust air from common areas to preheat or precool incoming outside air. Depending on the season, the temperature of the air is increased or decreased by at least 5°F before the air enters the main HVAC system. For

example, on a 95°F day, the unit pretempers incoming air to 80°F before sending it to fan-coil and air-handling units located throughout the first and second floors.

Floors 3 through 8. The third through eighth floors are served by a 7,632-cfm

Hotelier Puts Ideals Into Practice

Dennis Quaintance, chief executive officer of Greensboro, N.C.-based Quaintance-Weaver Restaurants & Hotels, first heard of the U.S. Green Building Council's (USGBC's) Leadership in Energy and Environmental Design (LEED) Green Building Rating System in February 2004, while attending the Greening the Hospitality Industry Conference in Warrenton, Va. Less than two years later, he broke ground for Proximity Hotel, which would become the first hotel in the world to attain LEED Platinum certification.

The discovery of LEED was not exactly a "fluorescent light bulb" moment for Quaintance. Years before, he and his wife, Nancy King Quaintance, vice president of Quaintance-Weaver Restaurants & Hotels, had informally committed themselves to identifying business opportunities that would allow them to put their sustainability ideals into practice. Also, he had incorporated several high-efficiency technologies into his other Greensboro hotel, the O. Henry, built in 1998. But Quaintance envisioned a deeper shade of green for Proximity; he just had to be certain it could be profitable.



Proximity Hotel's social lobby.

retention of the best and brightest staff members.



Dennis Quaintance stands among the 100 solar panels atop Proximity Hotel.

"As a business person, you can't make decisions that don't make financial sense," Quaintance said. "I believe you lose your license to be a capitalist if you go broke too often."

Quaintance believes Proximity will make money because:

- It costs less to operate than conventional hotels.
- Its green features will aid recruitment and

- It will appeal to the growing number of environmentally conscious consumers.

- Its solar-thermal package and some of its HVAC equipment qualify for tax credits and low-interest loans funded by the North Carolina State Energy Office.

Quaintance believes "being green" gives Proximity a competitive edge. Unlike hotels that are built to be sold, Proximity is the result of decisions made by an owner who intends to be around to realize long-term savings. Additionally, Quaintance said, a private company such as Quaintance-Weaver is more flexible than a much larger hotel chain, which tends to be more sensitive to first costs.

"Competition is not insignificant, so we are going to get up earlier, think more deeply, and be more nimble than our competitors," Quaintance said.

Photo by Mark File

Photo by Mark File

ERV with supply and exhaust fans, two heat wheels, and separate heating and cooling coils located in the penthouse equipment room.

During summer, outdoor air passes through an enthalpy wheel, which pre-conditions the air via a separate stream

of air from continuous bathroom exhaust. This “free cooling” reduces the cooling/dehumidification load on the cooling coil. Next, the air passes through a sensible-heat wheel, which reheats the air, eliminating the need for mechanical reheat. This process

provides dry, approximately 67°F supply air.

During winter, the ERV also uses bathroom exhaust to pre-condition outside air; however, only the enthalpy wheel operates. Outdoor air picks up heat and moisture as it passes through

Quaintance estimates he looked at 3,000 hotels worldwide on the Internet and stayed in at least 70 while researching the Proximity concept. Also, he queried building owners who had gone through the LEED process. As much as he wanted to build green, he contends he could have been dissuaded from the idea had the facts and figures not added up.

As “chief design officer” for Quaintance-Weaver, Quaintance took an active role in not only the design and construction of Proximity, but the LEED application process, which has afforded him perspective on both the benefits and demands of the third-party certification program.

“I think they (the USGBC) have done an excellent job,” Quaintance said, conceding that LEED does have its share of critics. He said he respects the work that went into developing the program, which he finds particularly effective in enticing owners to go to the “next level.”

“We really didn’t worry about what level we would achieve,” Quaintance said. “We just got into it and did things we would do even if LEED and the USGBC didn’t exist. Then, we’d see how we could

earn more points and how that would help us out, and we’d say, ‘Well, we oughta do that, too.’”

Quaintance likes the third-party aspect of LEED and the credibility that comes with it.

“I love LEED because they are going to say what we’ve done—not us,” Quaintance said.

GREEN TODAY, GONE TOMORROW?

When asked if he thinks sustainable building is here to stay, Quaintance is surprisingly cautious in his response, but indicates the timing may be right, given that those who were coming of age during the first energy crisis may be more receptive to sustainability.

“I’ve seen this momentum build and fade before, based on energy prices in America,” Quaintance said. “But I do believe that the trajectory of a societal

norm is made when a generation is young.”

Quaintance noted that Germany,

Australia, and Canada have embraced sustainability to an extent the United States has not and do not seem to be



Photo by Mark File

The City Suite at Proximity Hotel.

paying an economic price because of it. Still, he acknowledges that by building Proximity, he is betting on Greensboro and its economy. Then again, given its 42.5-percent energy savings, Proximity is better equipped to weather rising energy prices than are most hotels.

“I don’t know if there is a global crisis or not, but I do know this: When I pull back and look at this tiny orb that’s hurling through space and how brutal space is ... and how it somehow manages to sustain life ... well, I wouldn’t want to experiment with it,” Quaintance said, laughing.

It is the kind of talk that might have had other businessmen smirking a few short years ago—before green became cool and gas prices hit \$4 a gallon. But while others suddenly are competing to find their perfect shade of green, Dennis Quaintance has built what arguably is the greenest hotel in the United States—possibly, the world. Proximity is so green, it is Platinum.

“We really didn’t worry about what level we would achieve. We just ... did things we would do even if LEED and the USGBC didn’t exist. Then, we’d see how we could earn more points ..., and we’d say, ‘Well, we oughta do that, too.’”

the wheel. Thus, the air entering the heating coil is closer to the desired supply temperature and humidity level, meaning less energy is required to temper the final supply air.

By maintaining an average dew point of 47.5°F, the HVAC system significantly decreases the opportunity for mold growth. At the same time, guests enjoy an abundance of fresh air and have control over their room's climate. Bathroom exhaust is a constant 35 cfm, while rooms are pressurized with 40 to 125 cfm of air, depending on the size of the space. The energy-recovery aspect of the air-side design helps the hotel avoid energy penalties associated with bringing in additional outdoor air.

LOAD-MATCHING INNOVATION

For Quaintance-Weaver Restaurants & Hotels, guest comfort—and control—was non-negotiable. But how does one allow guests the full range of thermostat control and still maintain an efficient delivery system? In the case of Proximity, standard variable primary/secondary piping was not the answer because it responds only to a “collective” load, not the compartmental loads associated with a hotel. With a traditional primary/secondary loop system, a large amount of pump horsepower is required to circulate hot and chilled water. Also, control valves are required at terminal units, and pumps must be sized to compensate for associated pressure drop through the valves, which must be balanced.

Proximity was designed with a load-matching system that effectively decouples individual room loads from the overall system. Each terminal unit is designed with two small wet-rotor circulating pumps—one for hot water and one for chilled water—sized according to the space served. Heating or cooling is chosen at a thermostat, with the corresponding circulator activated automatically. Variable-speed



Photo courtesy of Brady Trane

One of many load-matching pumps installed at Proximity Hotel.

drives on large circulators modulate flow through each unit for better comfort and efficiency.

The small fractional-horsepower pumps lower primary pump-head requirements from 70 psi to 45 psi. Furthermore, because loads are kept separate, balancing is not needed.

Correct sizing of pumps, piping, and fan coils was critical to maximizing the efficiency of the load-matching system. That meant calculating mixed-water

temperature after each fan-coil unit in the main pipe loop. A sample calculation is shown in Figure 1. Note that the same calculation was performed for both chilled- and hot-water piping.

The load-matching system eliminated approximately 35 percent of hot- and chilled-water piping. This not only lowered materials costs, it made for a neater design, which was important because of Proximity's open ceilings, which expose much

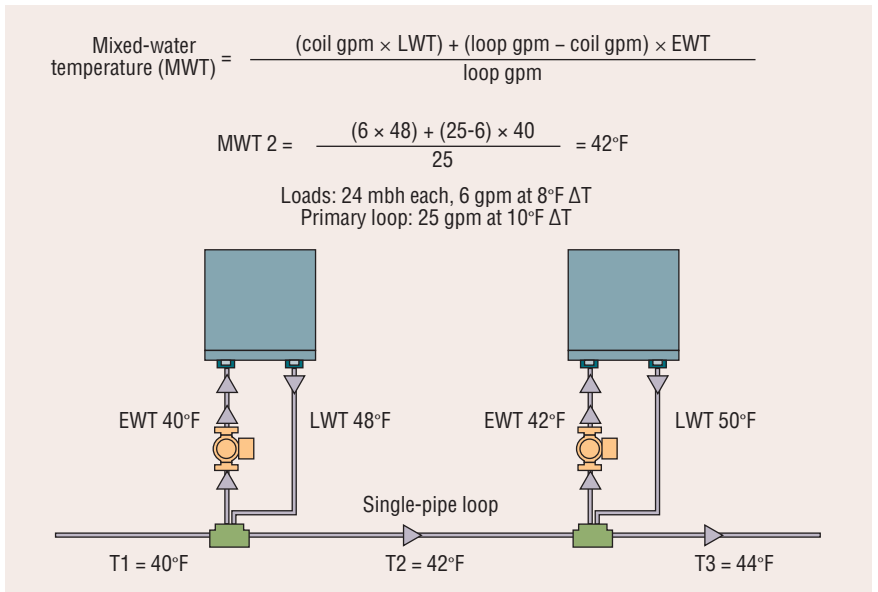


FIGURE 1. Calculation of mixed-water temperature, which varies between circuits.

pipng in hallways. Another advantage of the system is that the pumps are located outside of the fan-coil units and, thus, are more accessible for servicing.

The load-matching system helped Proximity earn points in the EA category by optimizing overall energy performance. The hotel's energy model projected a savings of 35 percent, compared with ANSI/ASHRAE/IESNA Standard 90.1-2004, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, requirements. Also, it indicated the system would be 50-percent more efficient than required by North Carolina energy code (figures 2 and 3).

LESSONS LEARNED

Because of Proximity's industrial decor, hiding long runs of ductwork above ceilings to help disperse noise was not an option. Oversizing grilles and sizing fan-coil units so they would run on medium instead of high helped with the noise issue, as did additional ductwork in the penthouse equipment room. Horizontal fan coils were specified above guest-room lavatories (the only spaces with ceilings in guest rooms) because vertical units would have left little space for servicing.

After startup, it was apparent the chiller system would need to be finetuned to operate in harmony with the building design. Originally, solenoid valves were applied to each chiller circuit to reduce the amount of water running through the system when the load was low. At very low loads, however, flow dropped below what was necessary for the load-matching system to operate properly. Additionally, when the load jumped unexpectedly, and flow through the next chiller module was required, the pumps could not react quickly enough, and the system would have to be reset. This was resolved by raising the minimum flow rate to 50 percent, although other adjustments could

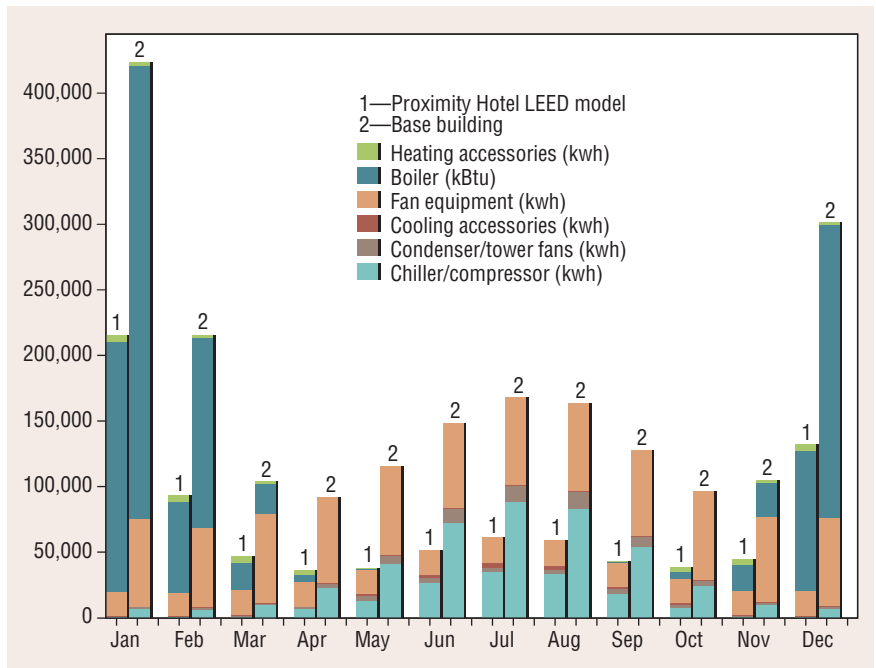


FIGURE 2. HVAC energy consumption.

have proved satisfactory.

CONCLUSION

Hotels usually are not associated

with energy-efficient operation. This is especially true of higher-end hotels, in which ventilation and guest thermostat control must not be compromised.

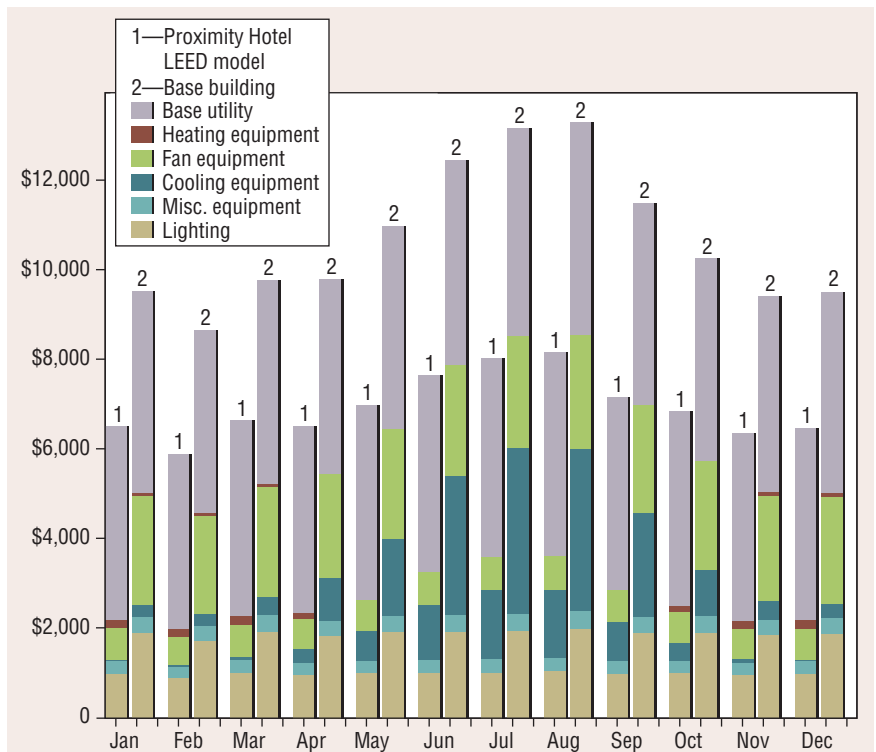


FIGURE 3. Electrical-energy costs.

Sustainable Practices

Following is a sampling of Proximity Hotel's more than 70 sustainable practices:

- Restored 700 linear feet of stream by reducing erosion; planting local, adaptable plant species; and rebuilding buffers and banks. Approximately 700 cubic yards of soil was removed to create a floodplain bench. And 376 tons of boulders and 18 logs were used to maintain grade control, dissipate energy, and assist in the creation and maintenance of riffles and pools.
- Installed North America's first regenerative-drive elevator, which captures energy produced by the brakes as the car descends and feeds it back into the building's internal electrical grid.
- Takes advantage of natural light with 7-ft-4-in. energy-efficient operable windows in guest rooms.
- More than 90 percent of all regularly occupied spaces have a direct line of sight to the outdoors.
- Uses building materials with recycled content.
- Recycled 75 percent of construction waste.
- Installed high-efficiency plumbing

fixtures to reduce water use by 30 percent.

- Does business with regional vendors and artists to reduce transportation and packaging.
- Uses low-volatile-organic-compound paints, adhesives, carpets, etc.
- Uses particleboard made from 100-percent post-industrial recycled wood pulp with no added formaldehyde for guest-room shelving.
- Offers bicycles to guests.
- In its adjacent restaurant, Print Works Bistro, uses tabletops made from solid walnut trees felled by sickness or storm and room-service trays made of bamboo plywood.
- Uses geothermal energy for Print Works Bistro's refrigeration equipment, saving significant amounts of water.
- Is implementing a green, or vegetated, roof atop Print Works Bistro to reduce the "urban heat-island effect" and slow rain runoff.
- Provides tours and outreach programs related to sustainable practices.

Source: Proximity Hotel

Proximity Hotel, however, demonstrates that energy efficiency and high-end hospitality are not necessarily mutually exclusive, having attained the highest level of LEED certification. A total of 16 points were earned through HVAC engineering alone under the EA and EQ categories. This puts Proximity Hotel in finely tuned condition to weather today's rising fuel prices.

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For two case studies related to Proximity Hotel, see Design Solutions, pages 66 and 68.