



Welcome to BOSTON!

Smaller in size but big on style and service, this Boston hotel looked to compete with bigger brands by cutting costs behind the scenes. A chiller overhaul led the list of improvements, which included lighting and controls retrofits, and allowing rooms to recirculate air when unoccupied.

BY PETER FAIRBANKS

Staying overnight at the edge of Boston's Back Bay district appeals to people with all kinds of interests. Rows of tall red-brick homes built in the late-1800s line narrow streets just blocks from the city's financial district. Visitors to the Back Bay, including those on foot, can enjoy an irresistible combination of choices for exclusive shopping, dining, music ranging from symphonic to popular to rock, major league sports, Boston's financial business district, strolling and people watching, theaters, conventions, and smaller gatherings of all sizes. The tempo is upbeat and the mood is exhilarating.

One of several hotels serving the Back Bay is the Colonnade, a gracious hotel located on Huntington Avenue just steps from both the Back Bay and the financial district. The Colonnade is a premium-service hotel sited among its larger hotel brethren. Its personal service has attracted famous-name guests including Ronald Reagan,

Frank Sinatra, Dean Martin, Shirley MacLaine, Val Kilmer, Matt Damon, Vanessa Williams, and Larry Bird.

FINANCIAL BASIS OF ENGINEERING IMPROVEMENTS IN ENERGY EFFICIENCY

From a facility manager's perspective, the financial challenge facing the Back Bay is the startling cost of its electricity. Now and in the future, electricity in Boston is expected to cost more than 17.5 cents/kWh.

Two years ago, the Colonnade Hotel urgently needed an update to handle the challenging cost structure of the early 21st century. Despite its delightful setting in a nationally famous neighborhood and its famous-name guests in the past, it competes in its location with larger hotels carrying widely recognized names. The Colonnade specializes in high levels of personal service. These high service

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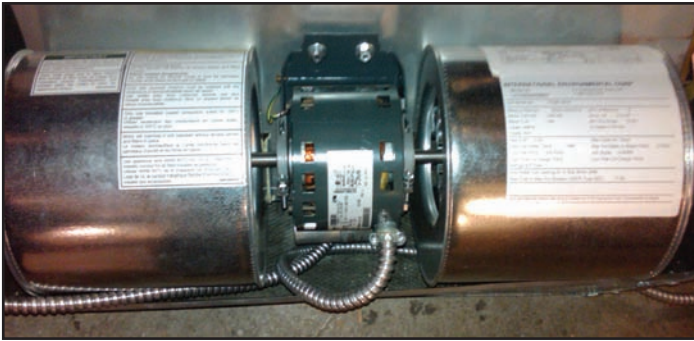


FIGURE 1. Existing fancoil with PSC motor.

levels are expensive, so to compensate, the hotel has to focus operationally on reducing non-service costs invisibly.

The centerpiece of the Colonnade's efficiency concern was the hotel's chilled-water supply system. The chilled-water system consumed 31% of the hotel's total electrical energy load. The high operating cost of the hotel's A/C plant threatened its cost structure. Any meaningful cost-reduction engineering project had to start with the hotel's chiller system.

A potential aid to the Colonnade's effort was its local utility's energy-efficiency incentive program. To maximize its main system energy savings, the hotel chose to add additional savings by replacing its BAS. Management also decided to replace the hotel's existing lighting with energy-efficient lighting and added occupancy-based controls on lighting.

While the inclusion of lighting and the EMS increased the financial scope of the project, the complete package of energy-reduction actions qualified the project for a higher proportion of offsets from the utility. Bundling together all the efficiency improvements that the hotel judged to be cost-effective put the project comfortably into the local utilities' highest reimbursement-rate bracket.

THE PROJECT TEAM

Let me introduce the three teammates in this New England efficiency narrative: the Colonnade Hotel, Bluestone Energy Services, and NSTAR, a public utility.

The Colonnade Hotel is a downtown-focused, 11-story, 285-room full-service luxury hotel built in 1971. It serves both business and personal pleasure travelers. Nearby are many neighboring drivers of business travel. The Colonnade conducts a green tourism marketing program, which fits nicely with its concern for energy costs.

Bluestone Energy Services is a design-build energy engineering firm headquartered south of Boston, with additional offices in Baltimore, Buffalo, Chicago, Inver Grove Heights (MN), and Philadelphia. Bluestone has extensive experience in developing cost-effective, energy-efficiency solutions and obtaining the benefits of utility demand-side management programs for large commercial and industrial customers. It specializes in retrofits of existing building systems just like the Colonnade's chilled-water system. Based on its experience working with utility incentive programs for over twenty years, Bluestone obtained over \$4 million of utility incentives for clients in 2009. Bluestone is also USGBC, and has professional engineers and LEED® Accredited Professionals on staff.

NSTAR is the largest Massachusetts-based, investor-owned electric and gas utility, with annual revenues of approximately \$3 billion and assets totaling approximately \$8 billion. NSTAR transmits and delivers electricity to 1.1 million customers in 81 communities and

gas to nearly 300,000 customers in 51 communities. NSTAR funds its efficiency incentive programs by charging each customer a small fee per month. The fees collected in this program are placed into a fund that pays for energy-reduction projects at customers' sites, prorated to pay larger amounts to those customers with the highest percentage gains in efficiency per project.

GETTING STARTED

For its first step, Bluestone conducted a comprehensive energy-conservation analysis of the Colonnade Hotel. This analysis identified numerous possible cost-effective changes in the Colonnade's controls, lighting, A/C system, chiller subsystem, and electric motors. Bluestone also calculated what utility incentives would be available to the facility's owners for each change in their equipment.

As part of this audit, Bluestone identified a menu of energy-efficiency action items. This took the form of a detailed, comparative spreadsheet prioritizing possible benefits, costs, paybacks, offsets, hazards, and issues, which Bluestone discussed in detail with the Colonnade.

The hotel decided which improvements to approve, considering as it went criteria such as capital investment, utility incentives, appearance upgrades, budget plans, marketing impact, and operating improvements (e.g., staffing effects).

A/C SYSTEM EQUIPMENT IMPROVEMENTS

The existing chilled-water system featured two inefficient 160-ton chillers that were equipped with screw compressors and were at the end of their useful life. The chillers cooled water that was circulated to fancoil distribution units in the public areas and in each guest room. Because of their inefficiency, expected time to failure, and share of hotel energy consumption (31%), the chillers were the key element in the efficiency improvement project.

Bluestone's engineers modeled the hotel to determine the peak chiller load and determined that it was less than 250 tons. Bluestone recommended replacing one of the two existing water-cooled chillers with a 250-ton chiller equipped with two frictionless Turbocor compressors. One of the existing chillers would remain as "deep backup." We selected a McQuay Turbocor compressor-equipped centrifugal chiller for six reasons.

First, it is very efficient with partial-load performance as low as 0.33 kW/ton IPLV. Second, this chiller has very low sound levels, specifically



FIGURE 2. Retrofitted fan with ECM motor.

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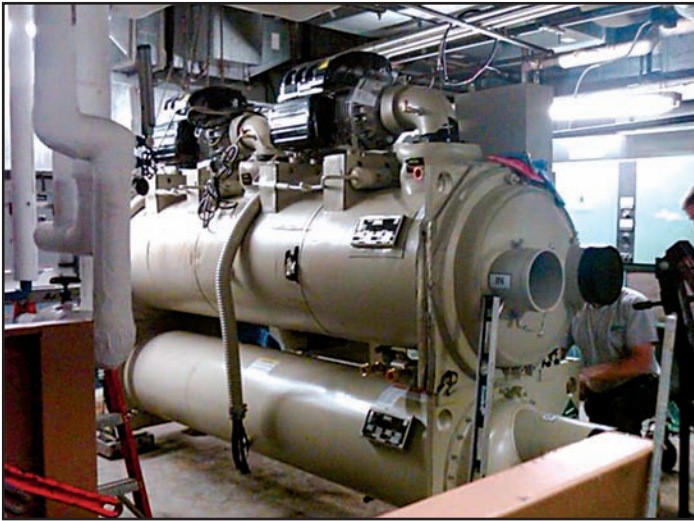


FIGURE 3. New chiller with frictionless compressors.

sound pressure ratings of 77 dBA per ARI Standard 575. Third, owners benefit over its lifetime through its lower maintenance costs due to the frictionless magnetic bearings. Fourth, the oil-free compressor design eliminates the oil support system, which reduces the expense of lubrication system maintenance time and associated potential for errors. Fifth, the unit's R-134a refrigerant has neither ozone depletion potential nor a regulatory phase-out schedule. And sixth, having two compressors on the new chiller provides backup over most of the cooling season if a compressor failed. These are all compelling points for an owner, especially a hotel seeking a green-tourism clientele.

In addition to providing high efficiency at partial load (a benefit for a hotel's irregular cooling load), the two 125-ton Turbo-chillers' quiet operation was also a vital benefit for a hotel installation where the compressors are located beneath the lobby.

Few passersby along Huntington Avenue would guess at the precision equipment in the Colonnade's basement. In fact, the equipment is so vibration-free that when you stand next to it, you have to double check to be certain the unit is actually operating. By comparison, the old chiller was audible in the lobby above it.

Additionally, Bluestone upgraded the mechanical room to comply with ASHRAE safety standards by installing a refrigerant monitoring system, exhaust fan system, and automated control damper to provide fresh supply air to the mechanical room.

In the distribution part of the Colonnade's air conditioning system, we made other changes. In the Colonnade's 285 guest rooms

and throughout the hallways, Bluestone replaced standard-efficiency motors in the fan coil units with Regal-Beloit electronically commutated motors (ECMs). The ECMs are high-efficiency programmable brushless direct current (DC) motors. They suffer no losses due to slippage and have reduced maintenance requirements.

A new motor control card was also installed in the ECM motor circuitry to provide an interface to the Colonnade's Inncom room temperature control system. This allowed the control system to control the motor at three different speeds based on room temperature requirements or guest preference.

CONTROLS

The existing BAS was replaced with a new system developed by Bluestone utilizing Distech Controls components. The new BAS controls all the equipment tied to the existing BAS as well as appropriate additional HVAC equipment. The BAS was configured with scheduling, set-back, and optimum start/stop control strategies. We are also in the process of tying the BAS into the hotel reservation control system, which will allow automatic occupied/unoccupied scheduling of meeting/ballroom HVAC equipment when front-desk personnel enter reservations for the different spaces.

The Colonnade's new BAS features an open-protocol, Internet-enabled distributed architecture and user-friendly graphical interface, allowing the BAS to be managed in real-time over the Internet.

RELATED ENERGY IMPROVEMENTS

The Colonnade's Huntington Ballroom's AHUs were modified to accept return air, which allowed air recirculation during unoccupied hours to maintain minimum space temperature. BAS controls were installed on the AHUs' existing outside air dampers and new return air dampers. Additionally, the BAS was programmed to schedule off these air handlers during unoccupied hours and to cycle on the units and modulate the dampers to maintain minimum space temperatures.

LIGHTING IMPROVEMENTS

Bluestone expanded the package of energy-efficiency improvements by replacing inefficient lighting and adding lighting control. We improved lighting efficiency in 478 fluorescent luminaires by either retrofitting the luminaires with new lamps and ballasts, or installing new efficient luminaires. These measures helped to illuminate various areas of the hotel including offices, the kitchen, and the parking garage.

We retrofitted 894 incandescent luminaires with new LED lamps in guest bathrooms, ballrooms, and restaurant and lobby areas. The LED lamps reduce the energy consumption from 65 W in each fixture to 14 W. An additional benefit of the LED lamps is

	Item	Annual savings (kWh)	Total savings (%)	Cumulative savings (%)
1	New efficient chiller	205,000	16.28	16.28
2	ECM motors in room fancoils	414,000	32.87	49.15
3	Ballroom AHU modifications	38,000	3.02	52.17
4	BAS	336,000	26.68	78.85
5	Energy-efficient lighting	265,000	21.04	99.89
6	Lighting occupancy controls	1,400	0.11	100.00
	Totals	1,259,400	100.00	

TABLE 1. Energy savings summary.

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that they have a 30,000- to 50,000-hour life compared to the 1,500 hour life of standard incandescent lamps, significantly reducing maintenance costs.

In office areas around the hotel, occupancy sensors were installed in the lighting circuits to automatically shut the lights off when the office areas were unoccupied.

SUMMARY OF ELECTRICITY SAVINGS

To verify savings, Bluestone metered the Colonnade's energy use and hours of operation before project installation and after project commissioning. From these data, the actual energy savings for each energy conservation measure was determined. This savings is listed in Table 1.

As you can see, the A/C system improvements (lines one to four) account for 79% of the total project savings.

To paraphrase Willie Sutton, the famous bank robber, if he had worked for a living as an energy efficiency engineer, "We make hotel air conditioning systems more efficient because that's where the energy consumption is."

PROJECT FINANCIAL SUMMARY

Here is a simplified breakout of the Colonnade's savings calculations, by line item:

- Project cost: \$1,050,000
- NSTAR incentive: \$465,000
- Final colonnade cost: \$585,000
- Annual kWh savings: 1,259,400 kWh
- Annual gas savings: 13,000 Therms
- Annual cost savings: \$255,000
- Simple payback: 2.3 years

RESULTS, AWARDS, AND CONCLUSION

High NSTAR incentives of 44% of the original project cost are due to the Colonnade's project exceeding NSTAR's 25% annual electricity savings threshold. (Actual annual savings was 30% of the total Colonnade electricity usage.)

Energy efficiency measures designed and implemented by Bluestone provide cost savings to the Colonnade Hotel of over \$295,000 per year, or \$808 per calendar day.

We were very pleased when the Colonnade Hotel became the recipient of the 2009 Green Business Award, which recognizes the hotel's pioneering efforts towards environmental sustainability.

I hope you have enjoyed your brief visit to Boston's Back Bay. The next time you are in the Back Bay, on your way to Newbury Street, or to a Red Sox game at Fenway Park, be sure to stop at the Colonnade Hotel over on Huntington Avenue. If there are no exciting celebrities in the lobby to draw your interest, please take a moment to contemplate that behind all that old world charm, there is cutting-edge efficient air conditioning equipment, controls, and lighting. **ES**

Fairbanks is president of Bluestone Energy Services, Ltd.



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