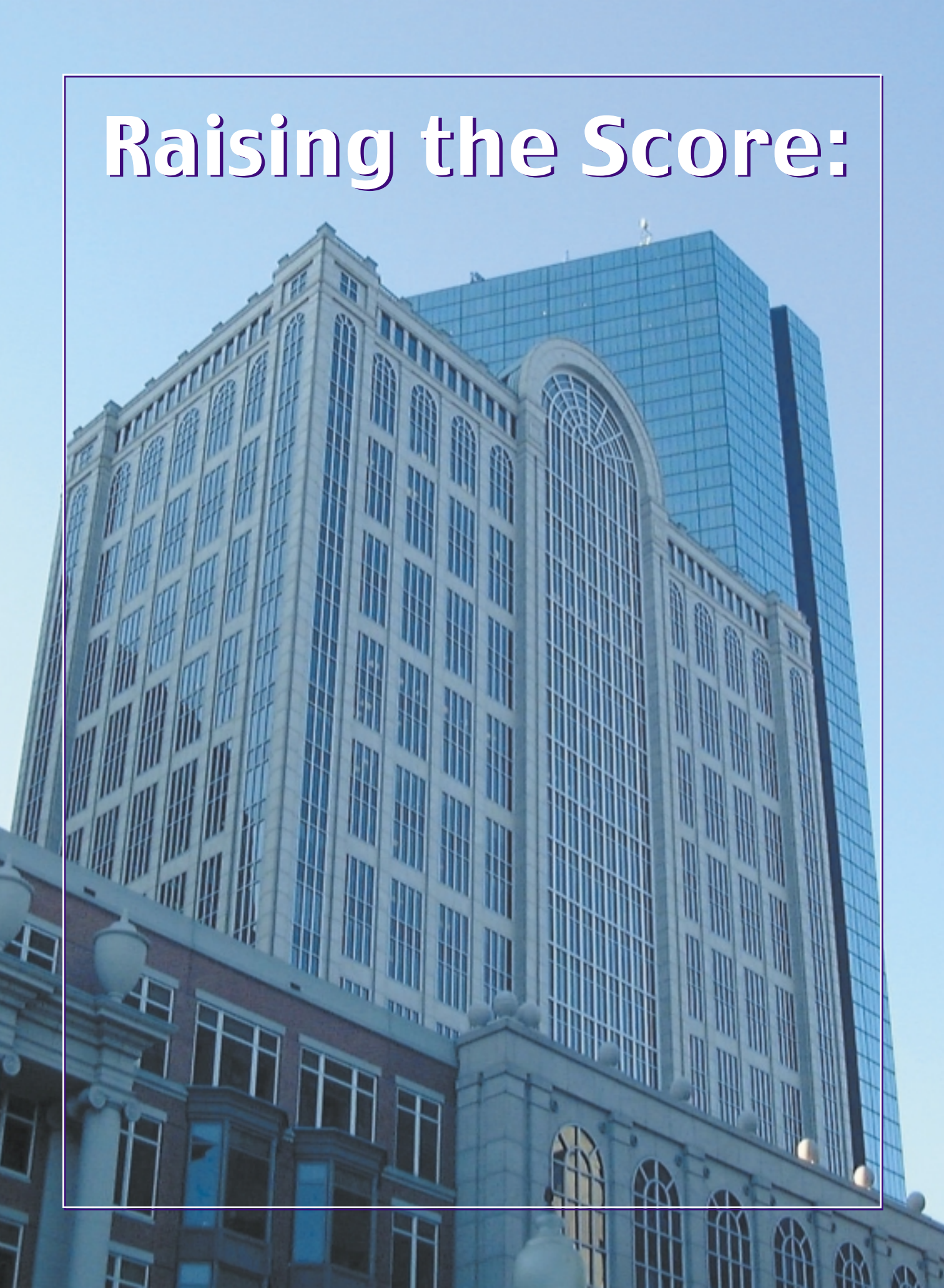
Raising the Score:



Five Hundred Boylston

A re-lamping and lighting control project helped this property management team raise the building's efficiency levels high enough to receive an Energy Star Building Label.

BY JAMES R. GREEN, CPE

In the Third Quarter 2000 issue of ***E&EM*** (see "Energy Star Shines in Boston's Back Bay," p. 22) I reported that Two Twenty Two Berkeley and Five Hundred Boylston, located in Boston's Back Bay, had both earned the Environmental Protection Agency (EPA's) Energy Star Building Label. What I didn't mention was that while both buildings were benchmarked in April 1999 using the EPA's Benchmarking Tool, and while Two Twenty Two Berkeley exceeded the target score of 75, Five Hundred Boylston did not initially qualify.

We had hoped that the similarity in the operating practices, building design, and construction of Two Twenty Two Berkeley and Five Hundred Boylston would have allowed both buildings to attain similar scores. But they did not. The difference in benchmarking scores pointed out that there were variations in the way the two buildings used energy. It was clear that we would have to identify and respond to the those variables to achieve a qualifying score at Five Hundred Boylston.

To begin with, there were differences in tenant uses of office space — namely, substantial areas of some floors housed trading areas that, while not considered data centers as defined in the Benchmark tool, can still be quite energy intensive. These areas tend to be open areas with small workstations housing as many as three PCs per station. Many stations contain even more equipment such as copiers, printers, and fax machines. Banks of overhead and wall-mounted monitors add to the mix, placing the energy intensity of these areas somewhere between typical office and data center use.

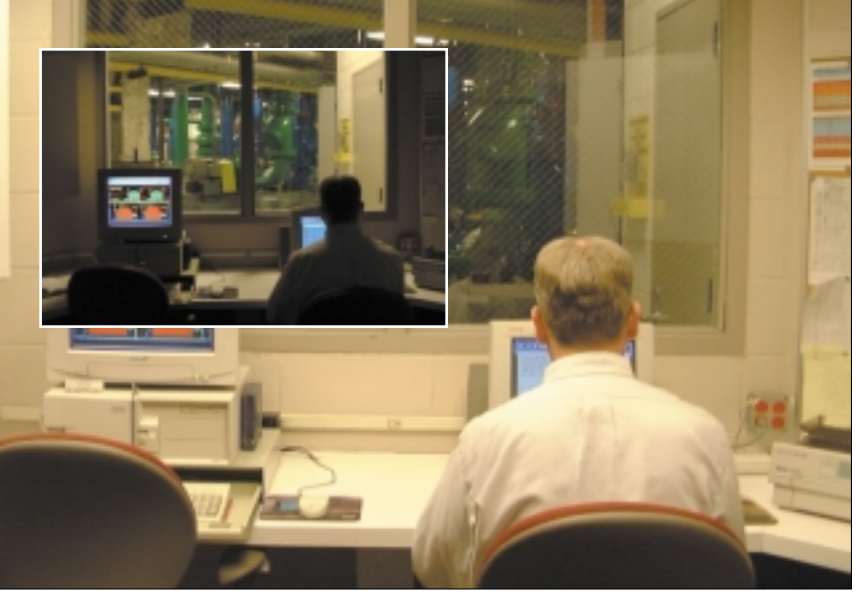
Other factors, such as variations in curtain wall design and solar effects created by nearby structures also impacted the building's benchmark score. However, similar to the tenants' needs for trading areas at Five Hundred Boylston, the design of the curtain walls and the location of the building were not factors we could affect. Our challenge was to identify initiatives where we could improve efficiency — initiatives that would significantly reduce the building's energy use.

We have always maintained a portfolio of energy efficiency ideas. We re-evaluate them every time energy costs rise or use changes at the building. The value we saw in achieving an Energy Star Label gave us the incentive to pull ideas from that portfolio and review them again, as well as brainstorm new ideas. We considered a number of initiatives, including installation of variable frequency drives on water chilling equipment and domestic water booster pumps, heat recovery between building exhaust and outside air supply, and reconfiguring piping to eliminate redundant pump operation in the central plant.

Finally, however, lighting seemed to be the most promising way to produce the savings we needed to boost our score. Lighting upgrades offer direct savings by reducing the energy needed to illuminate, and also indirect savings by reducing heat production from lighting fixtures (cooling loads are correspondingly reduced). Additionally, energy initiative abatement funds from the local utility — tailored specifically for lighting retrofit programs — made the upgrades even more attractive.

Mandated through the Massachusetts Legislature's Electric Utility Restructuring Act of November 1997, the funding for these energy abatement subsidies comes from an Energy Efficiency Charge (formerly known as the Conservation or DSM Charge) collected as a part of monthly electricity invoices. Successful application for a proportionate share of these funds through local utility abatement programs helps us to reduce the payback period for projects that improve energy efficiency through infrastructure and equipment upgrades.

The timing of our application for funds for Five Hundred Boylston was important, as the funds (and assistance) are scheduled to decrease steadily over the next



The inset (above left) depicts how some workstations were before the retrofit. New lighting has improved workstation illumination.

three years. The current level of funding is based on a surcharge to utility customers equal to about one-third of a cent per kWh of consumption, but is expected to be less than a tenth of that by 2002.

So we jumped at the opportunity, embarking on two lighting projects. Together, these were deemed most likely to provide the savings we needed to boost the benchmark score, and to qualify for assistance from the utility. Project one involved replacing existing 32-watt T-8 lamps with 25-watt T-12 lamps. For project two, we installed dual-technology motion sensors for lighting control in most of Five Hundred Boylston's rooms and offices.

These were not the first lighting upgrades we had performed in the building. About five years earlier, we upgraded the original lighting from 34-watt T-12 lamps and magnetic ballasts, to 32-watt T-8 lamps with electronic ballasts. This upgrade, also performed with financial assistance from the local utility, coincided with the approaching end of the original lamps' useful life, so we decided on a building-wide re-lamping, and went the extra mile to upgrade the ballasts as well.

The Energy Star Benchmarking process again coincided with end of the life cycle of the lamps at Five Hundred Boylston, with the five-yr.-old, 32-watt T-8 lamps now ripe for comprehensive replacement. This time, the equation was complicated by an ongoing increase in the number of tenant requests for fixture de-lamping, in hopes of reducing glare on computer monitors in tenant offices.

After extensive experimentation, using mock-up offices and different lamp types, we decided the best way to save energy and reduce glare was to re-lamp with 25-watt T-12 tubes. These lamps twisted into the existing fixtures using the previously installed electronic ballasts, and provided light levels meeting Benchmark criteria. We replaced over 14,000 lamps at Five Hundred Boylston under this program. In addition to providing over 340,000 kWh in annual savings, the 25-watt tubes reduced the glare, virtually eliminating tenant requests for fixture de-lamping.

Lighting Control

Just as we had taken the extra step in replacing the ballasts in the last re-lamp cycle, we felt that the next step in this cycle would be to include some form of lighting control. A number of previous attempts to install point-of-use motion sensors had been met with little enthusiasm from tenants. These earlier attempts employed devices that relied on ultrasonic or infrared sensor technology whose ability to reliably and consistently detect occupancy proved unacceptable, with occupied building spaces periodically plunged into darkness.

New dual-technology motion sensors had recently come on the market, however, utilizing microphonic and infrared sensing technologies together in one compact switching unit. After trying several different brands in actual office settings, we chose one that we felt could consistently detect occupancy and could also reliably respond as room occupancy changed. The sensor we chose has fully adjustable sensitivity and delay settings and can be overridden to the off position via a slide switch on the cover. It cannot, however, be overridden to the on position, a feature of particular importance to the local utility because their upgrade assistance criteria only allow for retrofits that cannot be deactivated, and are sure to remain in service for the life of the program.

We installed over 900 of these motion sensors throughout the building. We expected the program to generate a neutral response from tenants, with perhaps a small number of complaints that accompany almost any change in procedure. But in this case, the response from the tenants was quite unexpected — the installation of the sensors was very well received, and as the program progressed, people on each floor began to anticipate the installation. Occupants of offices where sensors were not installed due to unusual layout or configuration often clamored for installation anyway, and in some cases rearranged their space to accommodate the sensor. If there was any problem worth mentioning, it was that the housekeeping staff had to retrain themselves not to slide the new switches to the off position each night before leaving, as they had done faithfully with the single-pole switches for years.

The motion sensors' automatic turning off of lights in unoccupied spaces directly reduced energy consumption by approximately .75 kBTU/sq.ft./yr. Sensors' cycling

Investing in Energy Efficiency: A Management Style

By David Perry, Sr. Vice President, Hines

As part of our strategy to maximize income and asset value in our properties, Hines aggressively identifies and implements energy efficiency upgrades. These investments are typically low risk with short-term payback and often are combined with additional benefits of tenant comfort and satisfaction, and reduced service calls.

Five Hundred Boylston Street and Two Twenty Two Berkeley Street in Boston are excellent examples of buildings in which our tenants have enjoyed operating expense savings and owners have derived enhanced returns on their investments when Hines operates its buildings at peak efficiency. Energy accounts for about a third of an average Boston office building's operating costs. An office tenant spends about nine dollars per square foot for operating expenses, in addition to rent and taxes. The average energy portion is $2.70/sq.ft.

According to the Environmental Protection Agency (EPA), the average office building can reduce its energy consumption by 30% using off-the-shelf technologies and best-in-class management practices (this article shows examples). The 30% savings would reduce the energy portion of a tenant's operating costs from $2.70 to $1.89, a savings of $0.81/sq.ft. In a 642,000-sq.ft. building like Five Hundred Boylston Street, a tenant with a five-yr. net lease of 50,000 sq.ft. would enjoy an annual savings of $40,500 and a lease term saving of $202,500.

For over 40 years, Hines has operated on the premise that buildings and management of superior quality command higher rents and retain their value longer despite the ups and downs of real estate cycles. Investing in energy efficiency improvements in existing buildings, as well as in new construction, results in enhanced return on investment, greater tenant satisfaction, and benefits for the environment.

off unnecessary lights further contributed to energy savings by reducing the heat produced by those lights, with the associated reduction in cooling load bringing the total savings to over 1 kBTU/sq.ft./yr. Some of this may have been offset by increased heating requirements in the winter, but this is mitigated by the way the building ventilation system is programmed to redistribute warmer air from the building's core to the perimeter where it is needed during startup.

Combined with additional savings provided by re-lamping the building with the 25-watt T-12 fluorescent tubes, whose low energy consumption saved us another 1.5 kBTU/sq.ft./yr., we were able to achieve a new Benchmark score that earned us the EPA Energy Star Building Label.

What We Learned

Our work at Five Hundred Boylston underscores the importance of understanding the overall energy picture of the property and, where possible, seeking out and identifying a number of energy efficiency initiatives for presentation together in a group. By presenting initiatives this way, it allows each one to realize the maximum amount of energy savings available at that time. If initiatives are presented individually over time, then there is the risk that assistance for deferred initiatives will be placed in jeopardy due to diminished energy savings as a result of reductions from the initiative(s) previously implemented.

In other words, as the property becomes more and more energy efficient, each successive initiative may be more difficult to support because the inefficiencies may have been wrung out of associated and inter-related systems. Figuratively, where there is a Btu to be saved for the current project, there will be a fraction of that to help justify a future project. The solution is to group and implement the projects so they can take advantage of the whole Btu at one time.

Another factor to consider is that assistance for energy initiatives may soon have to come from other sources, which may be more difficult to come by. Our hope is that technology will help drive down the cost of energy efficiency initiatives so that projects will stand on their own, with larger returns and shorter payback periods. Time will tell.

In the meantime, office space is ever more densely occupied, and business is increasingly dependent on energy-hungry technology. Our challenge is to keep up with the resulting increase in tenant energy use by working to reduce energy use in the base building and common areas, thus keeping overall energy use fairly static. So far, we've been successful with this at Five Hundred Boylston, but must become even more creative if we are to retain a qualifying Benchmark score. The desire to maintain our Energy Star Building Label creates a constant drive for innovation. EEM

For more information about EPA's Energy Star Programs, call 1-888-STAR-YES or visit www.epa.gov/energystar.

James R. Green, CPE, is regional manager, engineering services, for Hines. His office is located in Boston. He may be reached at Jim_Green@hines.com.