An Owner's Experience with the LEED-EB Pilot Program

by Robin Smith and Steve Wiggins

Emory University of Atlanta, Georgia, recently completed its pilot program for the Leadership in Energy and Environmental Design for Existing Buildings (LEED-EB) process developed by the U.S. Green Building Council (USGBC). The results of the pilot were positive and successful. The process pointed out weaknesses in our existing construction and operations that were previously unknown to us, and these faults have been corrected as a result of this project.

These changes have resulted in considerable improvement in energy usage for the building. The calculated savings as a result of the pilot is $151,000 per year. This operating inefficiency had existed at this level for five years. As with all energy modeling systems lacking actual historic data backup, this figure is +/- 10 percent. Our cost for the total pilot effort was approximately $95,000 and includes all costs of the pilot, such as the changes, adjustments, and retrocommissioning. This process of improved operation will be carried to additional buildings on our campus.

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The LEED Program for Existing Buildings

Unlike the conventional LEED certification program for new construction only, LEED-EB is for existing buildings and focuses on operations rather than on construction. The commissioning aspect of this program is a prerequisite and represents a major portion of this pilot study and, in our estimation, is the primary reason for its success.

The pilot for existing buildings brought a different set of issues to the forefront, particularly those of operation and maintenance of facilities and therefore, it was administered by Emory's Plant Operations Department and funded out of that budget. Many desirable "green" practices are standard operating procedures on our campus, such as recycling, commissioning, alternative transportation, environmentally sound housekeeping practices, as well as others. Considering these existing practices, our participation in the LEED-EB pilot seemed a good fit for us.

The next step was the selection of a suitable subject building for submission to the USGBC. Selection of the particular building was based on several criteria. The basic requirement for energy efficiency is that the building must meet the requirements of ASHRAE/IESNA 90.1-1999. This certification requirement dictates that a rather new or recently rebuilt building be used. Any existing building could be brought up to this level, but it would be a major expense on older buildings constructed before such demanding energy requirements were in place.

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Goizueta School of Business

With these ideas in mind, the Goizueta Business School was selected for the pilot. Goizueta is a 120,000-square-foot general purpose classroom building, constructed in 1997 with typical design mechanicals for an Emory building. The footprint and orientation is excellent for natural lighting of the interior spaces and is a credit to the designers. This facility was considered one of our best buildings by the building occupants, students, and operating staff. A check of the request for service calls over the past year showed only 13 issues, none of which were of a serious nature. People were comfortable in and happy with the building. We did not expect to discover any major issues, or for that matter, any particular opportunity for improvement in this pilot experiment.

But we were wrong.

One of the prerequisites established by the USGBC for these existing building pilots was to commission the facility to verify operation of the mechanical systems, that is, to verify that these systems can deliver functional and efficient performance. This most important requirement was begun with a meeting between the Commissioning Provider and the building occupants along with the facilities staff responsible for this particular building. During the interview various items regarding the operation of the facility were discussed. The management of the building stated that to the best of their knowledge the occupants were very pleased with the indoor environment. As mentioned, service calls verified that there were no serious problems.

The Commissioning Provider outlined the purpose of the planned site visit and how the inspection would be conducted. Occupants would be encouraged to express their concerns or opinions about the building heating, ventilating, and air conditioning (HVAC) system. Again, there were very few concerns in this area.

The visit to Goizueta by the Commissioning Provider started with a test of the building's pressure relative to that of the outside. This pressure relationship is one of the primary indicators of a facility's health and should be maintained in a slightly positive mode at all times. Without this protection a facility can develop environmental impact issues such as high humidity and eventually the growth of mold.

The initial test on the Goizueta building found the facility to be in an extreme negative pressure condition and apparently had been so since the building was first occupied five years ago. One existing condition that bore out this fact, upon later reflection, was that leaves were drawn into the corridors when the outside doors were opened, sometimes as far as 20 to 30 feet. No one paid attention to this abnormality, which was dismissed as "wind currents." A complete inspection of the HVAC system revealed several interesting facts that taught us a lot about basic building operation and occupant environment as well as energy management. The ductwork for three of the four main air handling units in the building was severely damaged and had experienced failure due to metal fatigue.

The Commissioning Provider believed the physical damage was due to high velocity and high static pressure within the mixing chambers of the air handling units. This high velocity was apparently caused by a change (shortly after the initial construction) in the intake side of all air handlers. The size of the outside air intakes was reduced in an effort to better control the intake but the size was too small, given the amount of air needed and considering that the four large relief fans on the top floor were left fully engaged. Additionally, the outside air opening on one air handler had failed in a fully closed position. The remote control's computer indicated the damper was fully open when actually it was fully closed. The outside wall on this air unit was pulled inward about two inches to allow the machine to get air from the outside.

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The Commissioning Provider calculated the proper size for the duct opening for the outside air intakes for all four air units in the building. New sheet metal of the proper gauge and dimension was fabricated and installed. Static pressure transducers were installed in the mixing chambers of each unit. With these changes, testing began on the terminal units for the whole building. More than 90 percent of these units were found to be in the reheat mode, even though the outside temperature was over 50 degrees.

A detailed survey of these units determined that the minimum airflow volumes could be significantly reduced. This was done and resulted in considerable energy savings and an increase in occupant comfort. The energy usage savings was due to the reduction in the amount of heating and cooling that had been occurring simultaneously and the comfort level was improved due to the reduction in the heating and cooling cycle frequencies.

An energy analysis of the facility was conducted in order to determine the energy savings that were obtained with the modifications performed. An energy analysis cannot be verified unless proper historical utility usage data has been recorded. At the beginning of the energy audit it was determined that the metering data obtained for this facility was not reliable. As a result, Emory utility rates were used with energy modeling software to obtain energy usage estimates. The energy rates used in this program were $0.717/therm for chilled water, $1.074/therm for steam, and $0.400/kWh for electricity.

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Classroom, Goizueta School of Business

Further calculations verified that the building design met the ASHRAE/IESNA 90.1-1999 energy standard, which is an additional prerequisite of the USGBC LEED-EB pilot requirements.

One of the most important elements of fresh air intake for a building is the determination that the carbon dioxide (CO_2) accumulations are at a desirable level. This measurement is a reference of levels above the outside and is what ASHRAE 62-2001 is about. The CO_2 measurement for this building taken before the ductwork and fresh air changes showed levels of concentration that were above ASHRAE recommendations. After the modifications, levels met the requirements.

We decided that the implementation of this project would become a learning tool for our operations staff and the process as developed would be then applied to other buildings on our campus. We feel that most owners of campuses such as ours would also consider the total campus needs or effect of starting a program such as this and that the wider use of this "template" would further justify the effort and expense.

Sustainable Operation of Existing Buildings

The LEED-EB is a set of performance standards for the sustainable operation of existing buildings. It includes operations and upgrades of systems and/or processes that do not significantly change the building's interior or exterior. LEED-EB is a key operations issue; it focuses on efficient, sustainable building operation. In addition to cleaning and maintenance, LEED addresses several areas of operations and performance. A few examples include:

☐ Chemical use
☐ Indoor air quality
☐ Energy efficiency performance
☐ Water efficiency performance
☐ Recycling programs
☐ Exterior maintenance

☐ System upgrades improving energy, water, indoor air and environmental quality, and lighting.

In the area of "energy efficiency performance," commissioning is a prerequisite. We have discussed this fully thus far. Recommissioning or retrocommissioning will occur depending on whether a facility has been commissioned in the past. Even though commissioning for both new and existing facilities are similar, there are some important differences. For example, it is too late to affect design in an already constructed building. Design, however, is most critical to building operations. This specifically includes the indoor air quality, the energy efficiency, and the overall environmental impact.

The rating system used by the USGBC for the existing buildings in the Pilot program is based on the rating points for the LEED program for new construction. In calculating point requirements, many owners may find they are already performing several good practices that qualify for the LEED-EB program. Recycling is one example of a good practice in which many owners participate. Also, many owners may be employing various green chemical practices, as well as water conservation measures.

When we looked at the criteria setup for the LEED-EB pilot version, we realized that part of our normal practices covered several of these areas. Not only do we have alternative transportation, recycling, and custodial chemical practices, but commissioning is a base requirement of all construction and renovation. Definitive standards are present to cover the best in maintenance and operation. Furthermore, we have an excellent preventive maintenance program facilitating the ongoing indoor air quality, as well as a chiller maintenance program that helps in overall energy efficiency.

The selection of the Goizueta Business School was based primarily on the building's ability to meet the basic energy efficiency requirements of the USGBC. Our thoughts that this selection would require little effort or resources to successfully participate in the program were considered. This was our assumption but other aspects of the facility became issues as we progressed. Late in the original construction project, five years ago, a decision was made to commission the building. Due to this late start, there was neither a Design Intent document produced nor an opportunity for commissioning input in the design phase. This was our first attempt at commissioning and unfortunately, mistakes were made. As a result of scope and cost issues during construction, commissioning was not completed. Despite these difficulties, the facility was still considered one of Emory's best.

The pilot project criteria (with some modification) follows an outline established for the LEED of new construction. The basic approach is divided into five main areas of emphasis. The first area is "Sustainable Sites." This category has "erosion and sedimentation control" as its lone prerequisite. Under this issue, there are nine credits in a possible point count of 16. The credits are as follows:

☐ Site selection
☐ Urban redevelopment
☐ Brownfield redevelopment (not applicable)
☐ Environmentally preferred transportation
☐ Reduced site disturbance
☐ Light pollution reduction
☐ Green site and building exterior management

By not moving the building and continuing to occupy the site, we wisely availed ourselves of the point allowed for site selection. The location qualified for the density requirement to meet the urban redevelopment point. As noted, the Brownfield redevelopment is not applicable to the pilot LEED-EB program. Qualifications for credit in the environmentally preferred transportation area were met because of Emory's extensive alternative transportation program. Also, the exterior landscape

management practices allow qualification for the green site and building exterior management category.

The second focus area of LEED is "Water Efficiency." There are two prerequisites and three credit points in this category. The prerequisites are "minimum water efficiency" and "discharge water compliance." The credit points under these two requirements are:

☐ Water efficient landscaping
☐ Innovative wastewater technologies
☐ Water use reduction

The landscaping standards at Emory allow for credit qualification in both the water efficiency and water use reduction areas.

The third focus area is "Energy and Atmosphere." This is where the commissioning is housed and is covered in what we have already discussed.

The fourth focus in this pilot exercise is "Materials and Resources." The only prerequisite in this area concerns waste management. There are eight points for credit:

☐ Continued existing building use
☐ Construction waste management
☐ Resource reuse
☐ Recycled content
☐ Local/regional materials
☐ Rapidly renewable materials
☐ Certified wood
☐ Occupant recycling

Of the ten total possible points in this category, Emory expects to garner five. Some of these credits are more closely related to new construction or at least construction to some extent, but our project qualified in the areas of recycling and existing building use.

The final area of focus, not to mention one of the most important to the use and operation of a building, is "Indoor Environmental Quality." There are three prerequisites for this category, "minimum IAQ performance, "environmental tobacco smoke (ETS)," and "asbestos removal or encapsulation." In addition to these requirements, this area has nine points for credit:

☐ Carbon dioxide (CO_2) monitoring
☐ Increase ventilation effectiveness
☐ Construction IAQ management plan
☐ Low-emitting materials (NA)
☐ Green housekeeping
☐ Controllability of systems
☐ Thermal comfort
☐ Day lighting and views
☐ Contemporary IAQ practice

Of the total possible point count for this category, Emory expects to obtain nine. These points come primarily from the housekeeping practices, the ventilation, system controllability, and IAQ practices. A minimum of 29 points is expected for this project, which would meet the basic certification level.

Early calculations, still in progress, indicate that energy saved will result in a savings of approximately $12,500 per month, or savings in excess of $150,000 per year. As important as financial savings are, particularly at this time, the comfort levels and the controllability of the indoor environment will, most likely, have a greater impact on the future of the LEED-EB program at Emory University.

The results of this pilot and the optimism about the future of this program are encouraging. Emory is an acknowledged leader in the LEED movement for new construction, with the LEED certification acting as one of its guiding principles, and will continue to participate in the additional aspects of LEED that USGBC develops, such as commercial interiors, organizational practices, and others, in order to become one of the leaders in the "greening" of higher education.