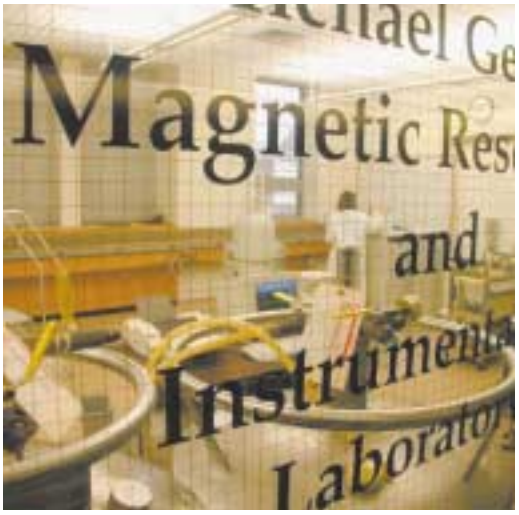
COMBINING
ENERGY EFFICIENCY
AND QUALITY DESIGN

# Boston College

A *know**how***™
Case Study

demonstrating lighting

The Gerson Magnetic Resonance and Instrumentation Laboratory at Boston College's Eugene F. Merkert Chemistry Center is a primary workspace for students and researchers. Approximately 100 students visit the lab every day during the school year, using the nuclear magnetic resonance equipment and compiling computer data. Previously, T12 cool-white fluorescent fixtures lighted the space, but due to poor placement and inferior technology, the fixtures produced considerable glare on the computer screens. This poor visibility problem and a desire to update the lab to more energy-efficient equipment resulted in the installation of a sleek new direct-indirect lighting system. Not only is energy saved and the work of the students facilitated, the building's visitors, students, and employees appreciate the improved aesthetics of the space.




Strong magnets housed in the lab analyze materials and present their constituent spectra to the budding scientists. Analyzing the spectra displayed on computer screens helps determine the chemical makeup of the specimen. Students routinely utilize the lab for their coursework, and post-doctoral researchers spend a good deal of time there. Operating and maintaining the NMR equipment, which is super-cooled with large tanks of liquid nitrogen, is another daily task.

It is very important for any educational space to enable student work. A lab such as this one requires a good balance of perceived brightness in the visual field, particularly when the viewer is seated at a computer workstation. To provide the right amount of light on the desktop requires careful selection and location of lighting fixtures.

Energy-effective lighting incorporates these design principles of comfort and productivity, utilizing the latest energy-efficient lighting equipment.

Boston College and the local utility, Boston Edison, engaged Synergy Investment, an energy management service company, to develop the new lighting design. The solution installed by Synergy uses indirect pendants with T8 lamps and electronic ballasts to replace older inefficient recessed parabolic fixtures. The new system has much better color qualities and energy efficiency, and provides adequate light for operating the equipment and excellent visibility of the computer screens. Because the lab is highly visible to building visitors, the clean look of the luminaires and more spacious appearance of the lab are a definite bonus.

## Problems Overcome

The parabolic fixtures generated a lot of light, but the louvers failed to adequately shield the T-12 lamps. The old fixtures contained six-cell louvers, which resulted in fairly exposed lamps (compared to a true low-glare 12 cell fixture). A line of these fixtures happened to fall almost directly above the line of computers that control the magnets. The fixtures created veiling reflections on the computer screens, obscuring the data displayed there.

The bright luminaires contrasted starkly with other room surfaces. The brightness of the luminaires caused overhead glare that made other objects in the room more difficult to see.

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"This is the kind of project that yields double the benefits. Those who use the space have better quality lighting AND Boston College pays lower annual electric costs. Users particularly like the elimination of glare on the computer screens. The College is very interested in introducing indirect lighting to other areas of the campus, including classrooms, laboratories, libraries, and dining areas."

*Paul Scarnici,*
*Boston College Energy Manager*

The old-style cool-white lamps gave the lab, a space loaded with equipment, a sterile hospital-white look. The light lacked any warmth and failed to promote comfort or aesthetics.

Finally, the gross inefficiency of the T12-with-magnetic-ballast system was costing the university dearly. A redesign using high-quality, energy-conserving lighting was sorely needed.

## Lighting Quality

This installation at the Gerson Magnetic Resonance and Instrumentation Laboratory is an example of the application of the *Classroom Lighting knowhow™ Series* guide, published by the DesignLights™ Consortium. The guide includes sample layouts and specifications for multi-purpose educational space, such as this lab. Achieving quality lighting for educational spaces means supporting comfort, good color, uniformity, and balanced brightness relationships—factors that contribute to long-term work performance and enhance concentration.

Adequate levels of illumination are just as important. In this instance, the necessary high light levels are attained for the lowest lifecycle cost because of the very high efficiency of the lighting equipment.

## Quality Lighting Solution

This showcase laboratory is now evenly illuminated by parallel rows of pendant-mounted indirect light fixtures providing 95 percent uplight. Perforations in the bottom of the fixtures allow about 5 percent of light distribution down. The four-lamp 8-foot luminaires are suspended in continuous rows below the 12-foot ceiling. High-frequency electronic ballasts drive good color rendering T8 fluorescent lamps. Improved color qualities make working in the space more comfortable.

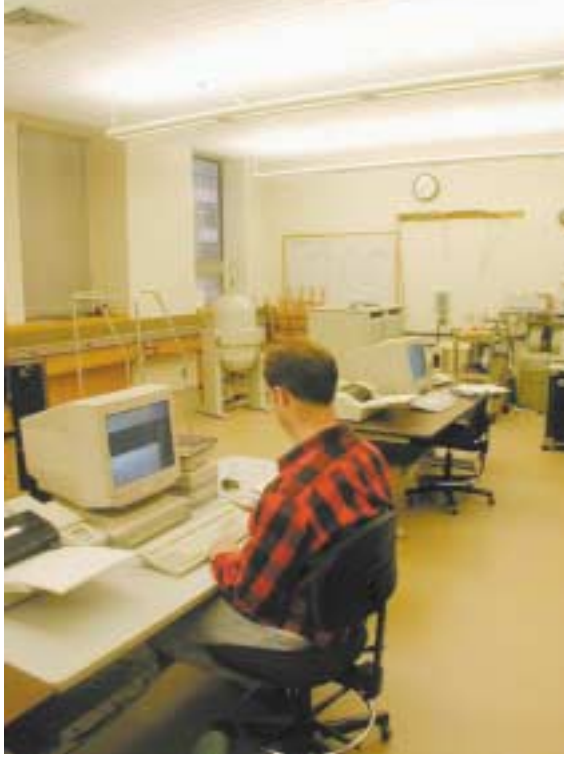
The perforations in the bottom of the pendants brighten the appearance of the luminaire against the very bright ceiling. By lowering the contrast of the ceiling cavity, it is less likely that distracting images of the luminaires will appear on computer screens. In addition, the suspended fixtures in this highly visible space contribute to a pleasant high-tech image.

## Impressions

John Boylan, Director of the NMR lab and adjunct professor of chemistry, was initially apprehensive about introducing new electronic equipment into the lab environment, and was

### Quality Indicators

| | Rating | | |
|---|---|---|---|
| | Acceptable | Good | Excellent |
| Control of Direct and Reflected Glare | | ✓ | |
| Light on Walls and Ceilings | | | ✓ |
| Fixture Location Related to People | | | ✓ |
| Light Patterns and Uniformity | | | ✓ |
| Daylighting Integration | ✓ | | |
| Color Rendering and Color Temperature | | | ✓ |
| Lighting Controls and Flexibility | ✓ | | |
| Quantity of Light on Horizontal Surfaces (fc) | ✓ | | |



The NMR equipment is super cooled with liquid hydrogen.


The director of the NMR lab was concerned with possible interactions with the powerful laboratory magnets. The electronically ballasted lamps have not caused any problems. The college was also concerned about placing pendent fixtures so that there would be adequate space to service the tall laboratory equipment.

concerned with possible interactions with the powerful laboratory magnets, particularly during installation. He considers the new lighting much more comfortable and attractive, and says he noticed the warmer color temperature right away. "They did a wonderful job with the installation, and I'm grateful that they were sensitive to our special needs. It feels like a more open space," Boylan added. The high-tech look of the luminaires suits the lab well. Overall, the atmosphere is a bit more upscale.

John Williamson, of Synergy Investment, helped coordinate and lay out the new lights. The lab was open to students during the entire installation process. "We chose indirect lighting to improve the even illumination of the lab and eliminate the glare on the monitors and above the magnets themselves," Williamson said. "Plus the associated energy savings will pay for the project."

He pointed out that the improved aesthetics of the space, and the fixtures themselves are important. "One of the reasons we selected the space was because it's a very prominent spot within the facility. It's directly across from the administration office and has a half-glass wall," Williamson said. "This high-profile location certainly weighed in our decisions… It looks outstanding."

## And Now the Numbers

Because the lab director demanded no loss in illumination level, a target of 80 fc was adopted for the redesigned layout. Today this level is achieved for half the original connected load, with greater uniformity and no glare. The 90% efficiency of the indirect fixtures, compared to an estimated 40% efficiency for the original fixtures, and the inherent efficiency of the electronically ballasted T8 lamps, made this possible.

| Costs | |
|---|---|
| Total fixtures and lamps | $4,955 |
| Total installation labor | $3,892 |
| Installed system cost | $8,847 |
| Materials per square foot | $4.69 |
| Installation labor per square foot | $3.68 |
| Total cost per square foot | $8.37 |
| **Savings** | |
| Demand reduction | 1.3 KW |
| Watts saved per square foot | 1.54 W/SF |
| Annual utility cost savings[1] | $780 |

[1]Based on 6,000 hours per year usage and local utility rate of $0.10 per kilowatt-hour.

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## Project Summary

| | |
|---|---|
| **Utility:** | Boston Edison Company |
| **Utility Representative:** | Thomas Butler |
| **Customer:** | Boston College |
| **Facility:** | Gerson Magnetic Resonance Laboratory |
| **Location:** | Chestnut Hill, Massachusetts |
| **Space:** | Educational Laboratory |
| **Area:** | 1,056 square feet |
| **Ceiling Height:** | 12 feet |
| **Fixtures Used:** | Finelite Series 3 direct-indirect pendant with two 2950 lumen T8 lamps |
| **Mounting:** | Suspended 18 inches from ceiling on 10-foot centers |
| **Light Levels Achieved:** | 80 footcandles average |
| **Lighting Power Density:** | 1.24 Watts per square foot |
| **Lighting Specifier:** | Synergy Investment |
| **Installing Contractor:** | Synergy Investment |

## The Lighting *knowhow*™ Series

The DesignLights™ Consortium publishes the *knowhow™ Series* for office, small retail and classroom lighting. This *demonstrating lighting knowhow™ Case Study* highlights a specific installation of lighting that showcases quality, comfort and efficient use of energy. With members located throughout the Northeast, the DesignLights™ Consortium is "a regional collaboration seeking to influence naturally occurring lighting events towards quality, comfort and efficiency." The DLC includes among its members many New England electric utilities as active participants, as well as several other interested stakeholders. The DLC created these case studies with the intention of helping contractors and lighting specialists sell and deliver the benefits of high quality, energy efficient lighting to their customers in the commercial building market.

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