Enhancing Light Quality While Reducing Energy Costs

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In 2000, the University of Rhode Island (URI) established a Sustainable Communities Initiative with the desire to become a green campus, incorporate sustainability into all possible curricula, and spark a grassroots level interest in sustainability amongst its faculty and students. The new Center for Biotechnology and Life Sciences (CBLS) was designed in response to the university's goals of elevating their presence in research science and in becoming a green campus.

The URI was oriented traditionally to making planning decisions based on first-costs of building— designing around the most economical cost per square foot. With a construction budget of $44.6 million for a 142,000 gsf high-tech research and teaching facility, URI was motivated to address opportunities for efficiency and sustainability throughout; thus there was a driving force for innovation that led to structuring aggressive operational efficiency targets. The result is URI's flagship research building, which achieves extremely economical academic research lab space at a cost of less than $314 per square foot, while providing design excellence at every opportunity.

How did this happen?

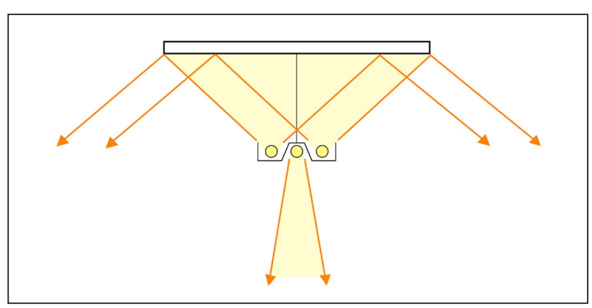
Design professionals are familiar with the principle that the most sustainable lighting fixture is the one that is turned off. Further truth suggests that the most sustainable lighting fixture is, quite possibly, the one that is not installed at all. The integration of direct lighting, indirect lighting, and natural daylighting in the CBLS offers examples that challenge the status quo for lighting principles traditionally employed in similar facilities. The dialogue between user teams, including CLBS scientists, URI administrators, and the design team, about effective use of external light, as well as about strategic placement of energy-efficient lighting fixtures and sensors, proved to be of great importance during design development.

There are lessons learned here that should be considered by all to be involved in planning future facilities for academic research, learning, and teaching in scientific fields.

Labs21 Energy Benchmarking data indicate that lighting energy varies from about 8% to 25% of total electricity use in most laboratory facilities. While previous code minimums and standard practices suggested 70-100 foot-candles of direct lighting in laboratories, significantly lower foot-candles can be achieved with more than sufficient visibility. Within the CBLS, the combination of natural daylight with the intended direct/indirect lighting strategy allowed opportunity to provide less lighting fixtures in lab spaces than often provided in standard practice.

By cutting the proposed lighting fixtures approximately in half, initial savings are self-evident: lower material costs, lower product quantities, less wiring, and a lower cost in installation labor required to hang light fixtures. Resulting electrical operational savings can be seen in the amount of energy required to operate the reduced lighting loads. If properly accounted for, a reduction in the number of available ballasts also can affect baseline energy calculations. Less artificial lighting reduces the need for excessive cooling loads due to a lower ballast count throughout the building. This is a contributing factor in continuing efforts to 'right-size' costly mechanical systems. Further, from a maintenance perspective, significant savings are realized in operational costs for the life of the building through the reduction in quantities for re-lamping and the replacement of ballasts.

In spaces where two light fixtures installed over lab benches is the traditional norm, CBLS uses a single, 20% direct/80% indirect light fixture configuration combined with a highly reflective (0.90 LRV) ceiling "cloud." This optimizes light levels for researchers at the desired intensity, with the light level at the work surface achieving an average of 65 foot-candles without requiring supplemental task lighting for most tasks to be performed in the space. Post-occupancy studies have confirmed that the need for supplemental task lighting in labs is virtually non-existent.



Reflected light is directly related to incidental light. The ceiling cloud configuration provides optimal utilization of the reflective surface area directly affected by the light fixture and adjacent floor-to-ceiling window opening. Instead of fitting-out the laboratory with wall-to-wall ceiling tile, ceiling tile was only installed where the opportunity for ambient reflected light benefited the associated work surface. Not only did this reduce material costs, but it afforded designers opportunity to accentuate the lighting concept through elegant edge detailing which complements the unique ceiling design.

In addition to extensive daylighting strategies, reducing power consumption of artificial lighting controls was a significant sustainable strategy. Lighting conservation includes automated and user controls or switching, all of which allow for a greater degree of human comfort. The strategy was to configure the artificial lighting in laboratory work environments in order to optimize their efficiency and to focus on optimal lighting levels as various functions required. The extensive use of glass in the form of clerestory and interior vision panels provides more than 90% of the spaces with natural daylight and 95% of spaces with views to the exterior.

Users report that the atmosphere and quality of light in CBLS is superior for many tasks, including the unanticipated use of natural lighting, for example, in the aquatic laboratories to grow photosynthetic algal cells to feed oysters. Researchers and academicians indicate that the quality of light in CBLS improves research productivity and occupant well-being, making its users feel like valued URI students and faculty. The faculty in the building are enthusiastic about their new research homes and emphasize that the quality of combined natural and artificial light improves the mood of all who work in the lab and the speed at which students process samples collected in the field.

In retrospect, the energy cost savings and performance contracting achieved by the CBLS allowed the University of Rhode Island to direct funds that would be spent normally on energy bills and maintenance costs into investments within their buildings, resulting in a higher quality of architecture, better learning environments and ultimately, more productive research facilities, aligning with URI's multi-faceted mission to become a green campus and to elevate their presence in research science. ■