SSL DEMONSTRATION:

Wall Washers at the University of Maryland

In a large performing arts center, an LED module retrofit reduces maintenance and energy while retaining lighting quality.

At the University of Maryland (UMD) Clarice Smith Performing Arts Center (CSPAC) in College Park, maintenance and energy costs were reduced considerably, while retaining an acceptable quality of light, when LED modules replaced halogen lamps in existing wall washers. The project began with mock-ups in the spring of 2014, with final installation completed in March 2015.

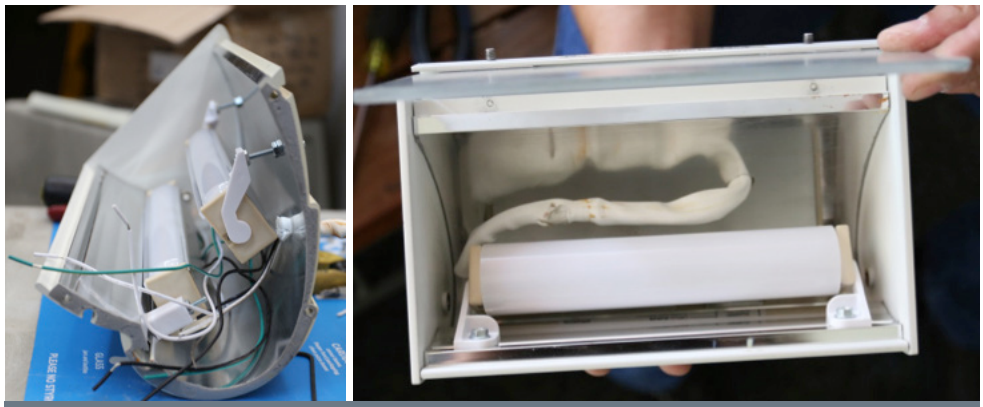
Eighty-seven wall washers light hallways lining the CSPAC's atrium, providing task illuminance for transitioning between spaces and visual interest to the atrium boundaries. The primary goals of the retrofit were to maintain the visual appearance of the space while reducing maintenance costs, with energy savings considered an additional benefit. Operating 7,300 hours per year, the wall washers required continual maintenance, including not only frequent re-lamping, but also re-aiming of re-lamped fixtures to maintain the desired distribution of light on the walls. This was made more difficult by ceilings that are as high as 41 feet, with one area over stairs requiring a scissor lift and scaffolding to service the lights. An additional maintenance concern was the fact that the supply-conductor insulation melted in some of the wall washers, which it was assumed the retrofit would resolve, since the LED modules dissipated much less heat than the halogen lamps.

Exterior view of the University of Maryland Clarice Smith Performing Arts Center. The varying shapes and sizes hint at the diversity of the interior spaces.

Nothing to Mock At

In the spring of 2014, UMD facilities management considered all known LED alternatives, but there were limited LED wall washer options available. One significant consideration was whether the fixtures would fit into the existing openings in the drywall ceiling, because any additional work done to the ceiling would add to the project's complexity and overall cost. A solution that could work for both the small and large wall washers was also a priority. The options were narrowed down to two that were considered financially feasible and were then mocked up: a complete LED wall washer and a retrofit of the internal components of the existing wall washer with an LED module. The mockup provided an opportunity to visually evaluate light distribution (on the wall and floor), glare, color, dimming behavior, and flicker. Many of these factors were unfavorable for the LED wall washer, while the LED module cost less, delivered the desired quality of light, was easier to install, and was selected by UMD as the best solution—with the approximately 80% energy savings over the halogen wall washers viewed as an added bonus.

Wall washing is one of the more difficult lighting applications, for two reasons: first, because any change in color is easily noticeable when illuminating a plain, smooth wall, thus making color consistency an important consideration; and second, because a frequent goal of



LED modules in existing wall washer housings. The left image is a side view of a large wall washer housing with two LED modules, and the right image is a front view of a small wall washer housing with one LED module.

wall washing is to create a smooth gradient, which makes distribution of light on the wall a challenge and typically requires that the luminaires be specifically designed for that. In the CSPAC's existing wall washers, this was accomplished with reflectors that were designed to distribute luminous flux from a tubular halogen lamp onto the wall, but when the LED modules were installed, they blocked those reflectors. However, the mockups showed that the LED modules—being directional sources—could nevertheless produce a distribution that was visually similar to that of the halogen lamps in the existing wall washers.

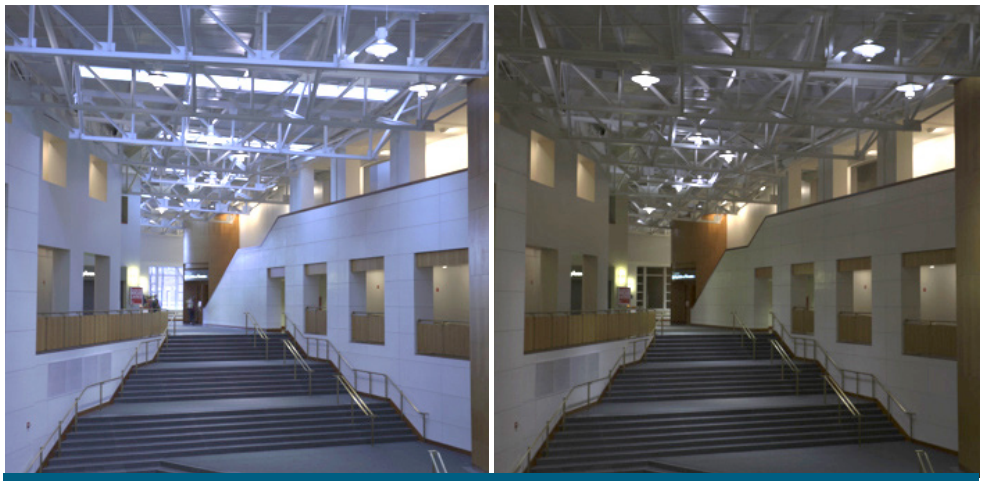
As the efficacy and lifetime of LED technology continue to improve, more demands are placed on the visual appearance of the light. The visual appearance is a concern for many retrofits, even when maintenance or energy efficiency is the primary concern, because changes in appearance typically entail a lengthy approval process. If the quality of light delivered by a new luminaire is similar to that produced by the incumbent product, the retrofit process can often proceed more quickly.

Results of the Retrofit

DOE recorded illuminance and color measurements before and after the UMD retrofit, in order to better understand the performance of the LED module in the existing wall washers, particularly the distribution of light on the walls. Some minor visual changes were noted after the retrofit, but they were considered acceptable by UMD facilities management and key CSPAC staff. The largest such change was the amount of light reaching the walls and the floor, with some smaller changes in distribution. Despite the reduced illuminance levels, the illuminance levels in the hallways still met Illuminating Engineering Society of North America recommendations, and the modules delivered enough luminous flux to serve the original purposes of illuminating the floor, so students could safely transition between classes and spaces, and adding visual interest to the atrium at night. Flicker was noticeable but was considered acceptable for this particular application—but possibly not for others. There were also some changes in the color appearance of the light, which seemed to be related to the fact that different generations of the LED module were used—serving as a reminder of the care that must be taken when ordering products.

All installed LED modules were operational and required no maintenance as of the writing of the report, so the benefits of the LED module wall washer retrofit are already being realized. UMD facilities management is pleased with the results of this retrofit, and continues to initiate LED retrofit projects across the school's campus.

Final reports on GATEWAY demonstration projects are available for download at http://energy.gov/eere/ssl/gateway-demonstrations.



Interior view of the CSPAC atrium. The wall washers illuminate the hallways that line the atrium during the day (left) and at night (right), as well as some surrounding areas. The brightness of the hallways is faint during the day compared to the daylight washing the main walls of the atrium, but in the evening these perimeter hallways play a more dominant role in the visual appearance of the space.