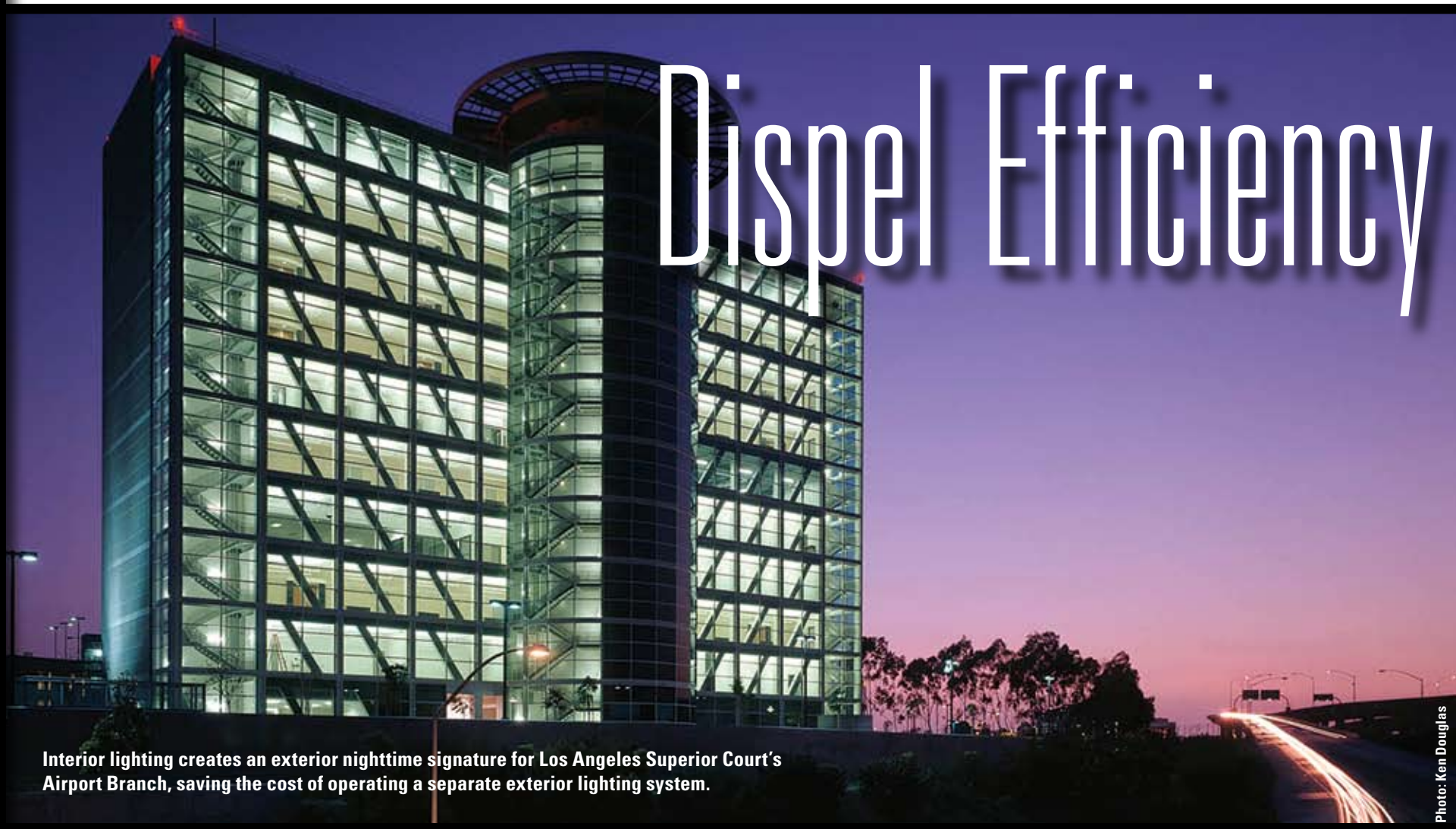
These myth busters shed new light on old beliefs.

Misinformation abounds when it comes to lighting and energy. In part this is due to mounting acknowledgement of the effects of global warming, increased acceptance of the Washington-based U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program and other sustainable-design certification programs, and ever more stringent energy codes. Separating truth from fiction is critical in understanding how to develop good, energy-efficient lighting systems and making the right choices for such systems. Following are some energy-efficient lighting myths and some information to shed new light on them.

1. *Compact-fluorescent lamps (CFL) are good for the environment.* Entire articles have been written on this topic, most of them touting the brilliance of CFL technology. CFLs use significantly less energy than incandescent lamps with similar lumen packages and they last much longer. Both of these attributes can save money and reduce carbon emissions. However, little has been done to quantify the impact of the manufacture and disposal of these lamps. From a greenhouse gas standpoint, the manufacturing process for CFLs may offset some of the gains made by using the lamps. More important is the impact of the mercury used in most fluorescent lamps. Few municipalities have a convenient or reliable recycling program, meaning that this mercury ends up in landfills and potentially in our groundwater. While CFLs are still the best choice for reducing lighting energy consumption in homes and many commercial environments, more information is necessary to make fully informed choices.

2. *If we outlaw incandescent lighting, the world will be a better place.* Descendant of Edison's invention and familiar to virtually every person on the planet who lives in an electrified world, the incandescent A-lamp has been much maligned in recent years. It is less efficacious than any light source, meaning that it produces the fewest lumens per watt and suggesting that it has no place in a warming global environment where lighting energy can be quantified in pounds of carbon emissions. However, many feel that the warm light emitted by the incandescent lamp improves the quality of the indoor environment and is therefore a quality of life (and light) issue. The question then becomes, where are we willing to make tradeoffs in the struggle between the comforts and quality of modern life and the environment? In addition, it should be noted that there are hundreds of varieties of "incandescent" lamps, many with no practical replacement at this time. (The discussion on banning incandescent lamps focuses on the familiar A-type light bulb.) Certainly that must be part of this discussion.

3. *LEDs are the panacea for the lighting and energy industry.* Typically, LEDs use less energy than incandescent and can use less than some fluorescent lamps to produce the same amount of light. Depending upon the color, they can also last longer than any source on the market, except perhaps induction lighting. But there are no standards for LED lighting at this time, and every manufacturer (both of LEDs and of LED luminaires) use different criteria to evaluate and then market their products. When it comes to considering LEDs as a potential substitute for white light sources, there are multitude of things to



Interior lighting creates an exterior nighttime signature for Los Angeles Superior Court's Airport Branch, saving the cost of operating a separate exterior lighting system.

Photo: Ken Douglas

consider and be aware of, ***including:***

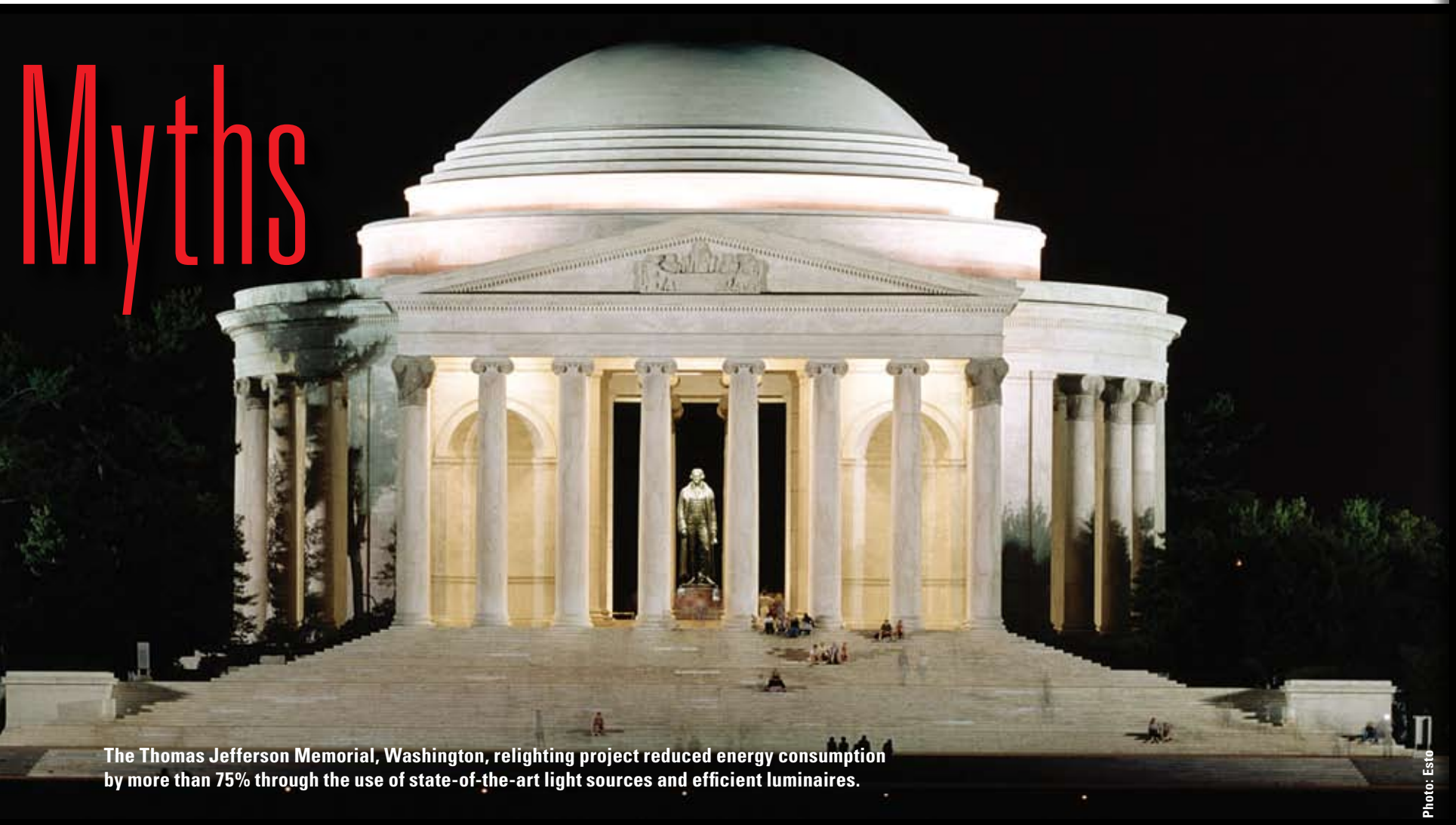
- For traditional light sources, rated life is the point at which 50% of the test lamps have ceased to function. With LEDs, the rated life claimed by some manufacturers is unrealistic, as LEDs do not burn out, but rather become ineffective. This affects both the efficacy and the calculations for the cost of maintenance.
- Many low-wattage LEDs require higher wattage drivers to operate them, so always check the wattage required to operate an LED, not just the wattage of the LED itself.
- Some lower-priced LED manufacturers are not maximizing the efficiency of their LEDs.
- The performance of LEDs is very dependent upon ambient temperature. After they are turned on, LEDs heat up and the light output diminishes to approximately 85% of the initial lumen output. More generally, LEDs are extremely sensitive to heat and generate quite a bit of heat in their normal operation. As a result they require heat sinks to extract heat from the junction between the LED and the board. If the recommended maximum ambient temperature (usually around 104 F) is exceeded, light output diminishes and the LEDs can be irreparably damaged.
- The "white" color that is available in LED technology is created through the use of blue LEDs with various phosphors to produce the desired color temperature. These phosphors will reduce the efficacy of the LED, and often are only available in "warm" and "cool."
- The quality-assurance process for LEDs, known as binning, separates LEDs according to the range of color or color temperature in which that LED falls. The accuracy of the binning can be the difference between a uniform color of light and a patchwork of different colors within that color range.

4. ***One higher wattage fixture uses less energy than two lower wattage fixtures.*** Let's look at an example. If you have two downlights, each with a 26-W CFL, you're using about 30 input watts for each fixture and starting with a total of about 3,400 lumens (what actually comes out of the fixture is covered in Myth 7). So why not use one 42-W, compact-fluorescent downlight for approximately the same lumens and significantly less energy? For lighting designers, there are many obvious reasons why this is a bad idea, including the fact that the 26-W luminaire may or may not be as efficient as the 42-W luminaire and luminaires need to be located so as to give an appropriate distribution of light, minimize glare, and put the light where it's needed. For nonlighting designers, consider this: Just as you wouldn't select a loveseat to replace two chairs in an office environment without affecting the performance of the employees using that seating, you can't consolidate lighting like that without affecting the performance of the lighting system. Using fewer luminaires can save the client money and clean up the space architecturally, but always make sure there isn't a trade-off in the performance of the lighting system.

5. ***I know it's an energy-efficient source, but I can't use metal halide because it changes color over time.*** Though there are still many metal-halide lamps available that do shift color over time (particularly in higher wattages), ceramic metal-halide sources have mitigated this to a great degree. For many applications, these new and evolving lines of low-wattage ceramic metal-halide sources are adding better quality high-intensity-discharge sources to the designer's toolbox, allowing more light to be generated for less wattage in a smaller package.

6. ***I know it's an energy-efficient source, but I can't use fluorescent because it's ugly, flickers, gives people headaches, and/or is bad for you.*** Where have you been for the past 20 years? Certainly, there are applications where fluorescent just isn't the right source. But with smaller sources, better color rendering, higher efficiency, choices of color temperature, and electronic ballasts to

Myths



The Thomas Jefferson Memorial, Washington, relighting project reduced energy consumption by more than 75% through the use of state-of-the-art light sources and efficient luminaires.

Photo: Esto

control/eliminate "flicker," today's fluorescent lamp technology can be used effectively in almost any environment.

7. *It doesn't matter which downlight I use, as long as it takes a compact-fluorescent lamp.* Every downlight has characteristics that affect performance, price, appearance, quality of construction, and ease of installation. When it comes to energy efficiency, performance is the key. It is critical to understand how a downlight performs to know if it is appropriate for the application. A downlight with a low efficiency rating will use energy without giving you the light. Some downlights might be 35% efficient or less, while others are more than 70% efficient. Always make sure that you know the efficiency of the luminaires you specify.

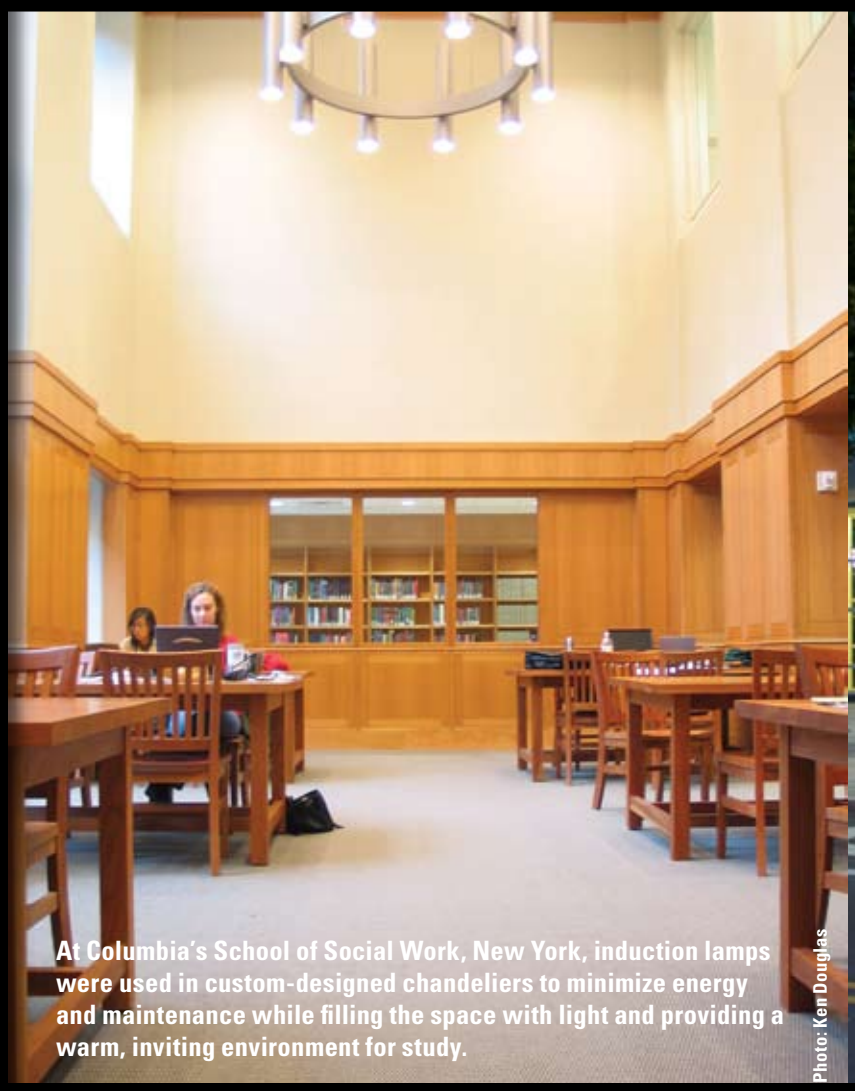
8. *T5HO (high output) lamps are more energy efficient than other linear fluorescent sources.* T5HO lamps provide a high lumen package in a small source, which allows for some very interesting luminaire designs and gives us a tool to solve some previously difficult lighting conundrums. However, when it comes to efficacy (lumens per watt), T5HO is less efficacious than standard T5 and, depending upon the lamp/ballast combination, less so than T8. While the increased lumen output may be necessary in some applications, it is not the more efficacious solution.

9. *Reduce light levels and save energy.* While removing a light source or lowering the wattage of a lamp may seem like the simple way to reduce energy use, it may not be the wisest. As with all features of the built environment, the quality of the light in the space must be taken into consideration. What is the space used for? For example, in a retail space, reducing the wattage of light sources or turning off light sources will inevitably have a negative impact on store sales. It would be much better to study the existing lighting system and look for opportunities to reduce wattage (not light levels) that do not reduce the appeal and usability of the space.

10. *There's no such thing as beautiful, energy-efficient lighting.* In this case, a picture says a thousand words. The award-winning Thomas Jefferson Memorial relighting project reduced energy consumption by more than 75% through the use of state-of-the-art light sources and efficient luminaires. Designers everywhere are creating responsible, beautiful, appropriate lighting systems by using new technologies and finding new ways to use tried-and-true technologies. Even before the advent of LEED, energy efficiency was the right thing to do and sophisticated clients understood that there didn't have to be a trade-off. Just as our definition of beauty has evolved over the centuries regarding everything from architecture to personal appearance, surely a revised definition of beautiful lighting design should include contemplation of the future of this planet. As our world continues to become more and more aware of the consequences of the energy choices we make, the balance between efficiency, comfort, and cost will be in a constant state of change and tension.

The design of an energy-efficient lighting system will continue to become a more complex balance of producing a pleasant and functional built environment for the people who use it, while, at the same time, designing a system that is sustainable in its use of resources and responsible in its effect on the overall environment. ◢

Faith E. Baum, IALD, LC, IESNA, LEED AP is principal and co-founder of Illumination Arts LLC, Bloomfield, NJ. She has designed the lighting for a wide variety of projects, including corporate interiors, ecclesiastical venues, office towers, retail stores, and signature bridges. Baum recently designed the lighting for the National Audubon Society Headquarters, New York, which will be pursuing LEED-CI Platinum certification.



At Columbia's School of Social Work, New York, induction lamps were used in custom-designed chandeliers to minimize energy and maintenance while filling the space with light and providing a warm, inviting environment for study.

Photo: Ken Douglas

Light finishes and well-placed fluorescent luminaires provide a glowing beacon along Newark, NJ's Broad Street business district.

Photo: Ken Douglas