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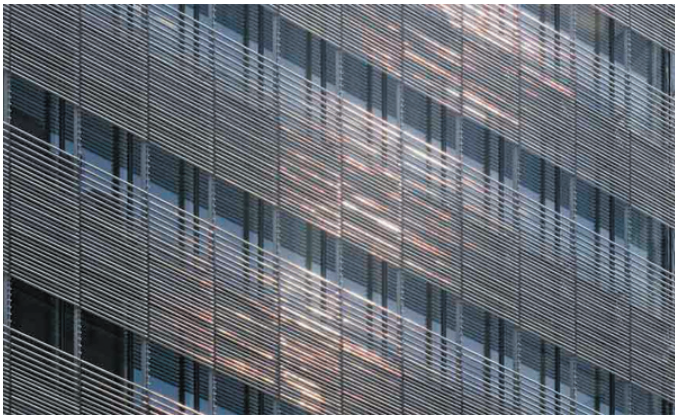
Revisiting The New York Times Headquarters Building upon its completion

Allan Chen, a_chen@lbl.gov

Employees of The New York Times Company (The Times) began occupying their new headquarters on the west side of Manhattan in mid-2007. Three years before this milestone, The Times's facility team had approached building scientists at Berkeley Lab's Environmental Energy Technologies Division (EETD), looking for help. They were searching for reliable and affordable technologies, not yet available in the marketplace, to regulate daylight in the new building.

The team had set very high goals, centered on the comfort and productivity of employees who would be working in the new building's interior spaces at all hours of the day and night. But they were having trouble finding integrated systems that could manage daylight, glare, and cooling loads for architect Renzo Piano's forward-thinking design.



Renzo Piano's design for the New York Times headquarters building features a screen of ceramic rods that diffuses sunlight while maintaining a high degree of transparency.

(Photo Renzo Piano Design Workshop)

Piano's design included an all-glass curtain wall combined with an external open screen, composed of horizontal ceramic rods suspended one and half feet from the facade. His intention was that sunlight streaming into the building would result in more natural interior lighting, and the transparent facade would allow passers-by to see inside: New Yorkers could see their hometown newspaper at work. The fixed array of ceramic rods was intended to help regulate solar gain.

But the building also needed an operable shade system to reduce and control sunlight and window glare—which heats the interior unevenly, causes discomfort, and renders computer screens difficult to see. Since the office staff would be busy creating a newspaper, the system would need to be able to control daylighting dynamically and automatically, as conditions changed with the weather and the rising and setting of the sun.

While the primary operation was to be automated, The Times's team knew that no automated system could satisfy all the occupants all the time; the team wanted manual override as well. All these requirements called for an affordable system of motorized shades and dimmable fluorescent lighting integrated with an automated, computer-based control system. No such system that could meet The Times's cost and functional requirements was to be found off the shelf.

After a day-long meeting in 2004 with Berkeley Lab scientists whose specialty was developing energy-efficient technologies and systems for buildings, The Times team began an R&D collaboration with Berkeley Lab that would lead to an innovative solution for their new building. Success with that one building would soon lead to a broader transformation of the marketplace for automated shading and daylight-control technology.

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A testbed for innovation

With funding from the New York State Energy Research and Development Authority (NYSERDA), and cofunding from the U.S. Department of Energy and the California Energy Commission, The Times and Berkeley Lab constructed a testbed facility at a Times printing plant in Queens, New York. The 4,300-square-foot testbed was a furnished mockup duplicating almost a quarter of the completed building's 1.5 million-square-foot floor plan.

At the testbed, Berkeley Lab researchers Eleanor Lee, Stephen Selkowitz, and others began to evaluate and test daylighting control systems offered by several different manufacturers. Lee is a scientist in EETD's Windows and Daylighting Group and the Lab's co-principal investigator for The Times project. Selkowitz is head of EETD's Building Technologies Department.

The researchers held discussion with manufacturers of automated shades and controllable lighting systems with energy-efficient dimmable fluorescent lights. When the project began, all of these elements were extremely expensive—as The Times team knew from their discussions with equipment vendors, who had told them that the lighting and windows industries did not think there was enough demand for these systems in the commercial sector.

Meanwhile the Berkeley Lab scientists used the Radiance computer program to perform simulations of the interior spaces, creating realistic renderings of inside light levels under different day and night conditions. They provided the resulting data to manufacturers to help them fine-tune their control systems designs. Consultants to The Times used EnergyPlus building simulation software to evaluate the demand-response potential of individual systems, seeking to join the heating, ventilation, and air-conditioning (HVAC) systems with lighting and shading systems to operate as a whole-building, integrated system.

The Queens testbed was monitored from solstice to solstice, producing detailed data that helped The Times team understand the potential energy savings to be had by maximizing the use of daylight—using less electricity for lighting and at the same time lowering the air-conditioning load caused by heat from the lights—and meanwhile maintaining environmental control and employee comfort.

The field-test data revealed that average savings as high as 50 percent of lighting energy were possible at distances of 10 feet from the windows, compared to a conventional office without daylighting and dynamic controls. According to Glenn Hughes, The Times's Managing Director of Construction, these economies will save $15,000 per year per floor in the building's lighting energy costs, plus $5,000 per year per floor in air conditioning costs.

From testbed to bargaining table

Through field testing, the Times-Berkeley Lab team gained a clear understanding not just of energy performance, but of the most efficient and inexpensive ways to configure, purchase, install, and commission the two types of daylighting control systems.

"The Times developed their own unique procurement procedures to ensure that the innovative systems were designed, delivered, installed, and commissioned to minimize field errors, and at very competitive costs," says Lee. "Innovative systems are often value-engineered out, because the project team does not take the time to overcome the typical inertia of the risk-averse construction industry."

To control daylighting for maximum comfort and energy efficiency, computer-controlled shades respond to changing exterior conditions. (Photo Renzo Piano Design Workshop)

As a large, high-profile customer, The Times could help shape the market and negotiate its own terms with its suppliers, using knowledge gained in the field tests to write procurement specifications for automated roller shade systems and dimmable lighting controls for their headquarters building.

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"The Times and Berkeley Lab developed an innovative procurement strategy," says Lee. "The strategy combined the lure of a large-volume purchase, a well-publicized showcase demonstration, and objective third-party data to push the marketplace to offer better technology solutions at a lower price."

A constant stream of visitors to the testbed from architectural firms, facilities owners and operators, manufacturers, and the trade press helped spread the word that automated daylight systems were becoming more practical and affordable as a result of this project. It was market transformation in action.

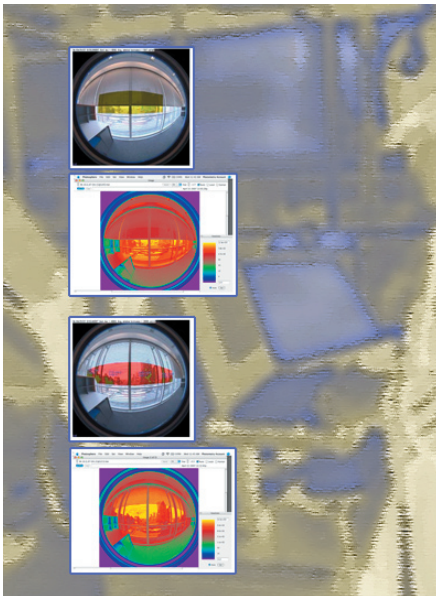
The Times requested bids for the systems and chose two companies as their suppliers. Word of their success has spread. With the project's R&D reports and procurements specs publicly available to anyone, others planning new buildings have begun to consider incorporating this technology, and manufacturers are now competing to offer even better technologies and drive prices down further. At least one major developer in downtown Manhattan is considering incorporating daylighting technology with automated shade controls in a new project.

The Times building's final system consists of mechanical shades controlled by electrical motors, six shades per motor. A network of photosensors continuously measures the lighting levels, and a computer decides when to raise the shades to let in more light or lower them to reduce glare from too much sunlight.

"We used Radiance simulations to determine what kind of shade fabric would best control the daylighting," says Lee. "We asked questions like 'are there floors with different conditions that don't need such a dense solar-control fabric?'"

The shades themselves were carefully designed, says Lee. "The study of the shades was among the most innovative aspects of the work. We used high-dynamic-range photography, a technology that has only recently become available, to measure the luminance in the testbed with different shade fabrics, to help us evaluate whether the shades were operating as effectively as possible to control glare from windows and on computer screens."

The lighting system also incorporates innovations unusual for a large commercial structure. The fluorescent office lighting is dimmable. Dimmable fluorescent systems are expensive, but The Times was able to negotiate pricing appropriate to their budget—and in the process helped drive down the price of these systems in the larger marketplace. Each lighting fixture can be controlled separately by computer through the direct addressable lighting interface (DALI) protocol, the lighting control industry standard.



Some results from shade commissioning cart: in top images, showing photo and data display, shades have been closed automatically to reduce luminance (potential glare source is in pink), as shown in false color in the data display. In bottom images, shades have been manually raised, creating glare.

Commissioning an innovative building

Prior to occupancy, The Times and Berkeley Lab worked to verify that the daylighting control systems were operating according to the procurement specifications—vendors would not be paid if the systems did not perform as required. The team constructed two commissioning-verification carts holding unique instrumentation. The resulting data enabled The Times and the manufacturers to resolve errors quickly.

Commissioning is the process of testing every system in the building to make sure it is working to design specs. The goals are to maximize energy efficiency, keep maintenance costs down, and ensure as comfortable an environment as possible for the occupants.

Although it seems like an obvious step, research at Berkeley Lab has discovered that most buildings in the U.S. are not commissioned—something that might change as green and sustainable practices come into vogue, and building owners and operators begin to look for new ways to harvest energy savings and reduce complaints from building occupants. Berkeley Lab has conducted studies of several hundred commissioned buildings, which demonstrate the value of making commissioning a standard practice in the future.

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Most employees have now occupied the new Times building. When fully occupied, a key issue will be to determine employee attitudes toward the daylighting system. After employees have had a chance to size up their new environment, the EETD team intends to survey their level of satisfaction with the lighting and indoor conditions.

"The question now is, will the occupants like the new system and the resultant work environment? Once the building has been 'live' for a while, and the dust has settled, there should be follow-through to quantify occupant satisfaction and the systems' actual energy performance," says EETD's Lee.

With the help of Berkeley Lab researchers, The Times has embarked on a related effort to respond to emergencies during periods of high demand on the electric grid. The Times facilities team has identified nonessential energy uses that could be reduced during grid emergencies. They have worked with their consultants and Berkeley Lab to determine what HVAC, lighting, and shading control strategies to deploy to achieve the desired level of demand reduction during emergencies, a practice known as demand response (DR). There is considerable research activity at Berkeley Lab and elsewhere to develop automated, web-based technologies that could lead to the wider use of DR practices.

Mary Ann Piette, Research Director of Berkeley Lab's Demand Response Research Center, and several of her colleagues worked with the local utility, Con Edison, and the New York Independent System Operator to estimate the benefits of participating in various automated DR programs. Once The Times has validated the DR potential of various proposed strategies, demand response could become a routine tool of the building's managers for responding to grid emergencies during New York's hot summers. The demand response work has been funded by NYSERDA, the U.S. Department of Energy, and the California Energy Commission.

The new headquarters of the New York Times recently opened for business in Manhattan. (Photo Renzo Piano Design Workshop)

The New York Times has shown that a major building owner has the market clout to challenge the industry to develop innovative, energy-efficient technologies at more affordable prices. Time will tell the degree to which this one project has been able to trigger the transformation of the industry for the benefit of smaller players. Ultimately, all those who have a stake in greening our buildings will find useful lessons in this work.

Additional information

More on Berkeley Lab's participation in the New York Times Project is at http://www.lbl.gov/Science-Articles/Archive/sb-EETD-NYT-building.html.

More about daylighting the New York Times Headquarters Building is at http://windows.lbl.gov/comm_perf/newyorktimes.htm.

"Bold Print," by Marisa Bartolucci, takes a first look at the New York Times Building in the July 4, 2007 *Architect's Newspaper*. See http://www.archpaper.com/features/2007_12_bold_print.htm.

More about Berkeley Lab's Automated Demand Response Research is at http://drrc.lbl.gov/

Additional publications on daylighting systems and demand response, including project R&D reports and procurements specifications, are at http://windows.lbl.gov/comm_perf/nyt_pubs.html.