

# An Rx for

By Timothy Krawetz

# daylighting

Using the sun's natural rays to enhance patient comfort and healing while saving energy



Looking out from a sixth floor patient room, across the retention pond and over the parking lot at University Medical Center of Princeton at Plainsboro in New Jersey, a river and acres of open field can be seen. From above, the sun's rays stream into the room providing a warm glow to the space and distributing a bit of Mother Nature's organic remedy to each patient.

With prescriptions for life that endure generations, Mother Nature's formulas can be harvested to provide a heightened level of patient comfort, healing and energy savings to today's high-performance hospitals. Patients at the new UMCP will experience these therapeutic powers first hand.

Using today's innovative technologies including energy and performance modeling to implement daylighting, state-of-the-art MEP equipment and environmental lighting and temperature controls, an energy-efficient approach will promote patient healing and comfort while reducing energy expenditure and operational costs for UMCP, scheduled to open its doors in late 2011.

One of the most significant sustainable initiatives for the hospital is daylighting its six-story, 600,000-square-foot facility. With east-west access, the building will have a 600-foot arched south facade which stands to gain the most exposure to the sun. Since it also serves as the hospital's entrance, the architectural team wanted to create an embracing, healing environment even from the exterior.

Moving inside, the design goal was to maximize the amount of shading on the south perimeter, keeping the sunlight out of patient rooms during the warmest six months of the year to prevent the heat from having a direct impact on the facil-

## Fast facts about UMCP

Sitting on a 160-acre expandable site, UMCP's new 600,000-square-foot hospital in Plainsboro Township, N.J., will feature an education center, a skilled nursing facility, an attached medical and many other elements when it opens in late 2011.

- > 238 single patient rooms
- > 28 private emergency room patient rooms
- > Eight, 320-square-foot labor and delivery rooms
- > 24 mother-baby post-partum rooms
- > 600-square-foot operating rooms
- > Decentralized nursing stations
- > Reception and waiting areas featuring computers with internet access
- > A 32-acre public park

ity's air conditioning loads, while trying to maximize sunlight into the patient rooms during the coldest six months of the year to have a direct impact on the heating systems. Tweaking the architecture to reduce air conditioning and heating loads was the solution, a joint effort by Syska Hennessy Group and architect HOK.

## Harvesting the sun's rays

In order to create an architectural statement that would also provide calculated energy savings and allow natural light into the patient rooms on the hospital's south perimeter, Syska analyzed and modeled dozens of daylighting options.

Using a stereo-graphic chart, which graphs the sun's rays at different times of the year at the hospital's precise location, the team was able to examine different daylight scenarios to determine the most viable shading options. From glass and other window materials to veils, a climate wall and screens, multiple scenarios were tried using high-performance modeling tools, including Autodesk™ ECOTECT™, a 3-D building design and environmental analysis software.

RENDERINGS COURTESY OF HOK/RJM/HILLIER

Exterior shading shelves quickly became the right option, but determining which type of shelf would require more analysis. Plugging in fixed, horizontal, vertical and automatic blades of different widths into the base model, the team evaluated their options.

Using building information modeling software, including Autodesk Revit, Syska collaborated with the architects to make sure that the shelves as designed would fit with the desired architectural statement as well as the hospital's MEP demands. The final daylighting solution will include a continuous exterior shading shelf above every patient room on the south facade. Set six inches off the perimeter, each blade will extend from the curtainwall, creating a cumulative effect from the hospital's entrance of a 600-foot-long shading block. Custom-made, the blades will be manufactured together with the curtainwall as a comprehensive package. This prevented the daylighting from becoming a premium to the project both financially and architecturally and made it an integral part of the facility's base design.

### Reaping the benefits

While sustainability was an early mandate for the UMCP project, the Princeton HealthCare System took a common-sense approach to facility optimization. They challenged the design team to develop sustainable solutions that would deliver a proven, measurable contribution to the hospital, both financially and for the wellness and comfort of patients, staff and the overall facility.

To obtain performance data that would establish the exterior shading shelves as a significant sustainable initiative for UMCP, Syska's team used eQUEST energy modeling software. Plugging the stereo-graphic chart into the software, Syska's team modeled the potential energy performance of the South facade both with and without the proposed shading, during summer and

## Additional sustainable initiatives at UMCP

Research shows that a hospital's architecture, layout, interior design and even landscaping can reduce patient and caregiver stress. In an effort to promote a comprehensive healing environment, UMCP followed U.S. Green Building Council guidelines to conserve energy and minimize their carbon footprint throughout the new facility, providing optimal conditions for patient comfort and healing.

In addition to the hospital's energy-efficient curtain wall system with horizontal sun shades on the south facade, sustainable construction materials and finishes were chosen, while environmental control systems regulate interior temperature and lighting. An energy recovery system minimizes energy expenditure within the heating and cooling systems, while low-flow plumbing fixtures and high-efficiency motors, transformers, lighting and air handling ducts promote systems optimization.

Finally, a 32-acre public park along the neighboring Millstone River as well as bikeways, walkways and shuttles all promote patient and staff wellness, providing access to nature as well as public and alternative transportation.



winter months, accounting for high and low temperatures and the positioning of the sun. Focusing on the south facade's four patient floors, the team developed two energy models: a base model without sun shading and one with the shading shelves as designed. Running calculations in both, projected

air conditioning and heating loads were then estimated and analyzed. With the use of the shading shelves, the modeling software revealed an annual energy savings of \$228,000 in annual operating costs. This significant effect on the hospital's bottom line was exactly the type of optimization the Princeton Health Care System was looking for.

While high-performance energy modeling has allowed today's designers to visualize each scenario and perform multiple design iterations in a short amount of time, it is just a model, with the potential for variations in real-time performance. The hospital's building automation system, or BAS, will be programmed to track HVAC system use and demand, including room temperature and the use of artificial lighting in the patient rooms on the south facade, both of which will be a direct indication as to the success of the daylighting system.

After a year in operation, Syska will return to the facility and use the same energy modeling software to evaluate the daylighting system as installed and determine the accuracy of its original predictions. Gaining a greater understanding of the systems' real-time performance will result in future systems optimization, through the tweaking of the BAS and the MEP systems that both support and are directly affected by the daylighting system.

For UMCP, the forces of financial responsibility and accountability for its patients, staff and the environment, united in the hospital's design to create a series of sustainable initiatives that will surely prove to be the best prescription Mother Nature could write. ■

**Timothy Krawetz, P.E., LEED AP, is a vice president at Syska Hennessy Group and the healthcare team leader for the firm's New York office. Krawetz has 23 years of experience in the planning, design, construction and peer review of healthcare, laboratory and research facilities as well as commercial tenant interior and infrastructure projects.**