School Construction NEWS
design, construction, maintenance & operations
www.schoolconstructionnews.com
MARCH/APRIL 2008
VOLUME 11, NUMBER 2

GREEN SCENE – ENERGY FOCUS

Energy Modeling: Programs Help Planners Predict Sustainable Outcomes

By David Linamen, PE

MEDIA, Pa. — When a Delaware County school district received the green light to build the first new school building in more than 50 years, the opportunity was greeted with high hopes, anticipation and some very specific needs.

With a district-wide goal of achieving a 100 percent literacy rate for all students by the fourth grade, the district initiated planning in 2006 for the Springfield Literacy Center, which would house all of the district's kindergarten and first grade students and serve as an outreach literacy center.

The plan for the 50,000-square-foot center was developed to reflect new and progressive teaching methods that the district has adopted in recent years, while providing flexibility between grades in an environmentally friendly setting. The building is expected to open in 2010.

"We did not want to build a square or a rectangle building; it has to be flexible, with every space helping to achieve our mission," says James P. Capolupo, Springfield School District superintendent.

With these goals in mind, the plans aim to achieve LEED certification with points for indoor air quality, daylighting and geothermal heating and cooling systems. Students will be taught the value of sustainable behaviors and green living, not only in lectures, but by touching, feeling and experiencing their surroundings.

To meet the goals under budgetary constraints, planners paid early attention to all of the engineering and environmental components that had to work together.

Integrated architecture and engineering firm Burt Hill conducted energy modeling to determine efficient ways to achieve LEED points, while maintaining a design conducive to the learning experience the district wished to cultivate.

Utilizing Virtual Environment software by Integrated Environmental Solutions Ltd., alongside Autodesk's Revit Architecture, the performance analysis team created daylighting and ventilation models that influenced the building's design early in the process and showed options for design alterations to achieve LEED goals and create a comfortable learning environment.

The site posed numerous challenges for daylighting, particularly because of its orientation and a bank of trees that forced the building to take on a split form and increase the necessary classroom depth required to meet the LEED criteria.

In addition, the size and shape of the windows necessary to achieve the district's goals for daylighting would have implications on the annual energy usage.

"To get better daylighting, we would need to use more glass, which uses more energy in temperature control," says Matthew Rooke, architectural engineer with Burt Hill's performance analysis team. "With integrated modeling we were able to assess the impact on energy use and propose a plan for daylighting that allows for the views and natural light that the district desires and remains energy-conscious by cutting down on electrical lighting."

With the integrated models, the team also identified potential glare and overheating issues with the size and shape of the proposed windows. To negate the potential problems, Rooke and his team developed a solution with light shelves, manipulated overhang sizes and glazing to achieve optimal daylight quality while minimizing summer heat gain and glare.

The early models were able to show the architectural and engineering team how small changes in the design plans could mean large advantages in student comfort.

"By integrating the energy and daylighting models with the Revit design model, we are able to save the project from change orders in the construction phase and from occupant discomfort that could negatively impact the learning experience," Rooke says.

Natural ventilation studies were also conducted to determine the feasibility for limiting mechanical ventilation and conditioning while maintaining a steady and comfortable interior climate.

The team determined that natural ventilation could significantly reduce the hours that mechanical ventilation was required, particularly during the spring and fall when school is in session. In addition to reducing energy needed for fans and cooling, the abundant fresh air brought into the school would result in improved indoor air quality.

While the school's commitment to its students was its first priority in applying an integrated approach to the design process, the ability to assess future cost savings also influenced the decision.

Energy models integrated early in the design process also provide the data necessary to predict future savings in heating and electric costs with better certainty than ever before.

"We are estimating this building will use 33 percent less energy than a baseline facility of this nature," says Michael Corb, senior associate with Burt Hill. "In addition, our payback analyses for the HVAC systems tell us that the systems will pay for themselves in approximately seven years."

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