

# **Case Study: Watkinson School**

## **Center for Science & Global Citizenship**

Watkinson School utilized a revolutionary building system to become the first independent school in New England with an energy neutral facility. By integrating a host of energy saving features and by using sophisticated predictive modeling during the design process, Watkinson School is using over 70% less energy than traditionally designed New England Schools. The school is tracking their performance through an integrated energy and indoor environmental quality monitoring system that also functions as a learning tool for students, teachers and the community.





## Searching for a Bright Building

When John Bracker, headmaster of an independent school in Hartford, Connecticut, decided it was time to expand his school's facilities he set out on a cross-country search to find a building system that reflected the school's forward-thinking educational philosophy. In order to properly house Watkinson School's new Center for Science and Global Citizenship, the solution needed to be a sustainable learning complex that excited young people about science, taught kids how to be global citizens and stewards, and reflected the creative spirit of the school as a whole.

Not only was the exuberant headmaster looking for a building solution that was on the cutting edge of sustainability, but to garner support from alumni and donors he needed the new building faster and at a lower price point than regular construction. This left few options for the project and John wouldn't settle for the poor indoor air quality, minimal lighting and high energy costs of traditional modular buildings.

### He was looking for a bright idea.

"If we're really going to find something that is a catalyst to what we're trying to do here as a school, it can't just be a [traditional] Butler building, or even a traditional modular building, because that's not going to excite anybody," the Headmaster said. "We needed to find a way to inspire kids, teachers – donors."

His search led him to San Francisco-based technology company Project Frog, who had just designed their new net-zero energy building system. The building system, which is designed and manufactured by Project Frog, is comprised of a set of proprietary products integrated with best-in-class components from their partners, and results in bright, healthy, and inspiring spaces that are energy efficient, environmentally responsible, faster to build, and cost competitive. For John and his staff, the panelized building system provided by Project Frog looked like the right fit.

## Testing the Frog Fit

For Project Frog, Watkinson School seemed like the perfect opportunity to build New England's first energy neutral school. Frog proposed a 3,500 sf fast-track facility to meet the school's requirements for three interconnected high-performance classrooms, an administrative office and two restrooms.

Project Frog has worked closely with an experienced design team of energy consultants, architects and structural and mechanical engineers in order to give Frog buildings excellent energy performance, daylighting, and indoor air quality for several climates, without breaking the bank.

Achieving energy neutrality was the primary goal for the project. The school believed an energy-neutral building would serve as a model of

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innovation and would provide cost savings over the lifetime of the building. To accomplish energy neutrality, the project team strove to both reduce demand and use a clean energy supply.

Project Frog worked with leading energy consultancy Loisos + Ubbelohde to optimize the building's envelope and orientation to create the right balance between solar heat gain, daylighting, energy consumption, thermal comfort, and PV energy production. Predictive modeling enabled the team to run multi-dimensional analysis that not only anticipated building energy usage, but helped optimize materials like insulation, shading, and glazing. The result is an envelope that features R-19 walls, R-33 roofs, low-e glazing and a cool membrane roof as well as a 14 kW rooftop solar array that is expected to offset all the building's energy usage of the course of the year.

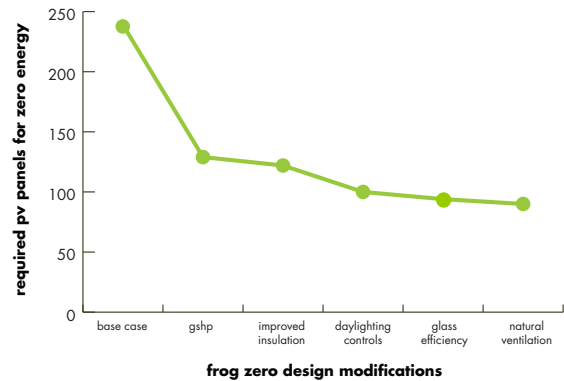
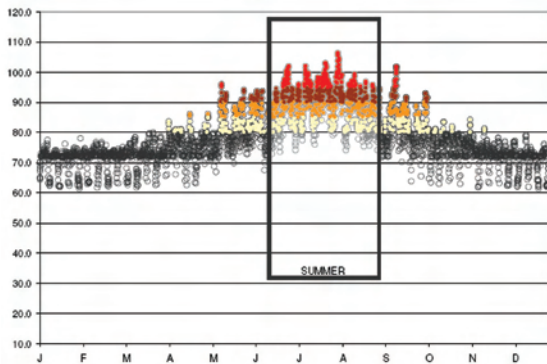
The envelope was designed to reduce mechanical and lighting loads and support passive heating, cooling, ventilation and daylighting. For times when active heating or cooling is required, the building features a ground source heat pump composed of three 400 foot geo-wells. Conditioned air is evenly distributed through an underfloor plenum created by a Tate Access floor. The system is extremely flexible and allows building users to regulate their thermal comfort through the operable floor diffusers by changing the volume of air distributed.

The building was also designed to promote natural daylighting – which has been proven to support student learning and performance. Automatic

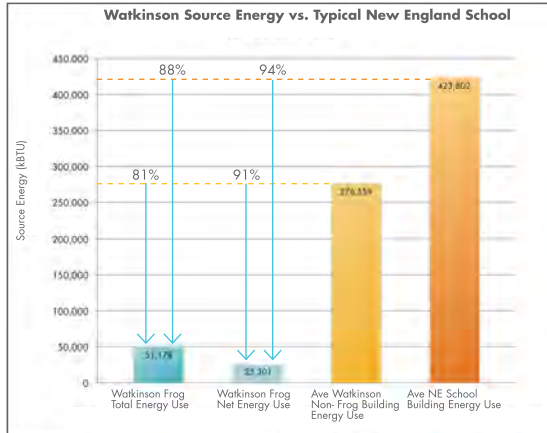
daylight dimming ballasts work with occupancy and daylight sensors to optimize light levels for classroom tasks.

To compliment the high level of academics at Watkinson School, Project Frog provided a building that would not only support but enhance the productivity of the students. Materials were selected to improve acoustics, indoor air quality, lighting and thermal comfort. An exterior rainscreen system enhances moisture resistance of the envelope, improves resistance to mold and increases the insulation performance of the walls. Clerestory windows allow abundant indirect natural daylight to enter the building, reducing the need for electric lighting while enhancing student performance. Lastly, an underfloor air distribution system (UFAD) efficiently transfers conditioned air from the heat pump to students and teachers with less noise and energy use than conventional overhead systems.

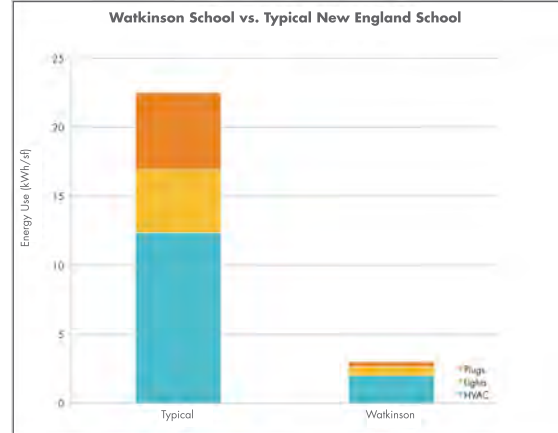
The design team recognized that providing an environmentally responsible facility means more than just being energy efficient. The Center was designed to incorporate a host of other eco-friendly features such as low-flow toilets and water fixtures that reduce water consumption by over 30%. Materials for the building were also selected for their environmental characteristics. Reclaimed and newly milled redwood siding from an old railroad tunnel provides a beautiful and unique finish for the building's exterior. The building kit provided by Project Frog also contains over 35% recycled content including the structural steel frame, light gage wall panels, Interface carpet and ceiling tiles.



Analysis performed during the design stage predicted thermal comfort (right) and energy efficiency (left). Other predictive analysis performed by Project Frog looked at daylighting, orientation and expected solar production.



This graph compares the total and net energy use of the Frog building (blue) to the average energy use of the rest of the Watkinson campus (yellow), as well as the average energy use by a New England School.



This graph compares the energy intensity of the Frog building by end use (HVAC, lights and plug) to the average energy intensity of a typical New England School.

## Measuring Results

Project Frog set out to design and build a state-of-the-art learning environment that provided a high degree of environmental, economic and human performance. The new Center was completed in December 2009 – after only 6 months from the groundbreaking – and has been exceeding expectations across these three areas.

To help the headmaster, students, teachers and donors track the Center’s path toward net zero energy, a building monitoring and dashboard system by Lucid Design was installed to monitor energy consumption and generation as well as thermal comfort. The monitoring system has provided valuable insight into the building’s energy performance including that the building is currently using over 80% less source energy than a typical New England School.

The PV panels – which were turned on in late March – are generating clean renewable energy for the building. The monitoring system, which tracks energy consumption on a circuit by circuit basis, is also helping to actively commission the building’s mechanical and electrical systems by allowing Project Frog and Watkinson to compare the predictive performance generated during the design stage to the actual building performance. This analysis allows the staff and students to keep on target for energy neutrality.

The dashboard is also providing an inspiration for the teachers to develop an environmental curriculum around the building. The teachers are

having students track how their actions impact the building’s performance, detect any changes that occur over the year and problem solve ways to improve the performance of the building.

One of the initial appeals of the Frog building system was the lower price tag. John Bracker initially worked with an architect on designing a traditional building but the \$10 million price estimate was unappealing to the donors and school board. The high performance solution from Project Frog was only 1/5 the price. The lower first cost coupled with the decreased lifecycle costs expected from energy savings is proving to be great value for the school. The speed at which the new Center was designed and built is also helping the donors capture a greater return on their investment, as well as helping students and teachers capture all the health and performance benefits of the new building.

“As a school head, it is exciting to hear our students and faculty talk about how the classroom environment created by Project Frog impacts their learning and their teaching. The warmth, the light, the air and the space all factor into how they perceive their learning or their ability to capture their students’ imagination.

For John Bracker and the Watkinson School, what started as a quest for a bright idea resulted in an innovative building solution that’s on track for net-zero energy consumption and healthier, happier students that are better prepared to be environmental stewards and global citizens.

## Project Fast Facts

**Client:** Watkinson School

**Project:** Center for Science and Global Citizenship

**Location:** Hartford, Connecticut

**Size:** 3,500 sf

**Product:** 2series

**Program:** 3 middle school classrooms, administrative office, restrooms

**Completion Date:** December 2009

### Features:

- Energy Neutral via 60 rooftop solar panels;
- Integrated energy dashboard;
- Energy efficient ground source heat pump;
- Automatic daylight dimming lamps;
- Reclaimed redwood siding;
- High efficiency water fixtures.

## Featured Products

**Access Floor:** Tate Access Floors

**Glazing System:** Jeld-wen

**Flooring:** Interface Carpet Tiles; Armstrong Linoleum

**Lighting:** Acuity Brands Lighting

**Lighting Controls:** Lutron Ecosystem

**PV System:** Canadian Solar

