

COMBINING
ENERGY EFFICIENCY
AND QUALITY DESIGN

A *knowhow*[™]
CASE STUDY

SAINT CATHERINE OF GENOA SCHOOL



demonstrating lighting



The Saint Catherine of Genoa School has been educating the children of Somerville, MA, since 1927. Rebuilt in the 1940's, no major lighting work had been done to the building since that time. Original "schoolhouse" incandescent pendant fixtures lit classrooms, offices, and hallways. Their lamps produced inadequate light, high electrical bills and constant burnouts.

The first priority of the school facility is, of course, to provide a rich learning environment. "Energy-effective" lighting for classrooms can assist by providing

high quality lighting while using minimal electricity. Cost savings can be invested in education instead of overheads.

A desire to update the older fixtures resulted in the installation of a sleek direct-indirect lighting scheme with advanced energy-conserving controls. The bright, upbeat environment now inspires children and faculty.

The Boston Archdiocese called upon Trapani + Associates to design the new lighting system. Direct-indirect pendants with T-8 lamps and electronic ballasts now light the majority of the school.



Dual-technology occupancy sensors and an advanced daylight harvesting dimming system have cut electricity costs month after month.

PROBLEMS OVERCOME

Today, incandescent lighting in institutional spaces is grossly inefficient, producing far more heat than light. The four 200W "schoolhouse" pendants that used to light each classroom are classic examples of this. Light levels were woefully unsatisfactory for the myriad of different tasks the children perform. Modern fluorescent light sources produce up to 100 lumens per watt of electricity consumed (LPW) compared to 15 to 20 LPW for incandescents.

Lights with conventional switch controls are sometimes left burning all nightlong! With a lifespan of less than a thousand hours, incandescent lamps burnt out often and had to be replaced by maintenance personnel.



demonstrating classroom lighting *knowhow*[™]



"It's just wonderful. You can see the whole room now—the writing on the blackboard and everything on the walls."

Teresa Dempsey, St. Catherine's Principal

LIGHTING QUALITY

The *Classroom Lighting knowhow™ Series* guide, published by the DesignLights™ Consortium, promotes quality lighting design in classrooms. Providing adequate levels of desktop illumination is paramount, but lighting the walls and ceilings and reducing glare are also important. Good color, uniformity, and balanced brightness relationships—all work together to produce a productive and comfortable setting.

The updated lighting system at St. Catherine's School achieves this balance with the updated, uplifting atmosphere fostering well-being and creativity. Indirect lighting uses the freshly painted ceilings and walls to reflect light throughout the room.

High light levels should illuminate horizontal surfaces and walls for many visual tasks. The lighting fixtures, layout, and controls all work together to optimize energy use. Reduced glare increases visual comfort.

QUALITY LIGHTING SOLUTION

A typical classroom has two 24-foot rows of suspended indirect fixtures housing three T-8 lamps each. The T-8 lamps were specified with a 3500K color temperature and color rendering index (CRI) of 82. This produces a relatively warm ambiance and good color rendering of students' works.

The small perforations in the bottom of the aircraft-cable-suspended fixtures give about 6 percent downlight for a soft luminous appearance. Lowering the contrast between the bright ceiling and the luminaires creates a virtually glare-free environment.

Occupancy sensors turn lights on and off in classrooms, combining both passive infrared and ultrasonic technologies for increased reliability. Once a room is vacated, the lights remain on for an additional 15 minutes. Light savers, which "harvest" the daylight, control the fluorescent luminaires located near windows. When natural daylight is plentiful, the photocells signal the electronic ballasts to dim the classroom lighting, thus saving energy.

QUALITY INDICATORS

	RATING		
	ACCEPTABLE	GOOD	EXCELLENT
Control of Direct and Reflected Glare			✓
Light on Walls and Ceilings		✓	
Fixture Location Related to People		✓	
Light Patterns and Uniformity			✓
Daylighting Integration		✓	
Color Rendering and Color Temperature			✓
Lighting Controls and Flexibility		✓	
Quantity of Light on Horizontal Surfaces (fc)		✓	

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IMPRESSIONS

St Catherine's Principal, Teresa Dempsey, contrasted the previous 1940s-era lighting with the new design, "There's absolutely no comparison. They didn't shed much light, so the rooms were very dull. And we were constantly changing bulbs. We went through cases and cases of bulbs.... Now all of a sudden we have these absolutely beautiful lights. You walk into a room, and it just fills with light."

She explained that the new lighting system reveals colors well. "It's just wonderful. You can see the whole room now—the writing on the blackboard and everything on the walls."

The quality of the light is much softer, but far from dim. According to Mrs. Dempsey, on a dull winter afternoon, the overall brightness of the classrooms is refreshing, "It makes a much more pleasant learning environment to spend the day in."

AND NOW THE NUMBERS

Maintained light levels range uniformly from 30 footcandles at the edges of the classroom (away from the windows) to 65 footcandles toward the center—three times the previous light levels!

The occupancy sensors and daylight dimming systems will reduce the hours of usage; shaving off perhaps 4,000 kW hours a month!

At 1 watt per square foot, the design's connected load is under the DesignLight™ Consortium's suggested maximum power limit for a school building of 1.5 watts per square foot. A typical classroom has 1.5 watts per square foot and average light levels of 45 footcandles on work surfaces. The typical corridor within St. Catherine's has a connected load of 0.9 watts per square foot and average light levels of 25 footcandles.

COSTS

Total fixtures and lamps	\$60,000
Total installation labor	\$15,700
Installed system cost	\$75,700
Materials per square foot	\$2.50
Installation labor per square foot	\$0.65
Total cost per square foot	\$3.15

SAVINGS

Demand reduction ²	11.8 KW
Watts saved per square foot	0.5 W/SF
Annual utility cost savings ¹	\$3,635

¹Based on 2,200 hours per year usage and local utility rate of \$0.10 per kilowatt-hour. Demand and annual energy savings reflect estimates for added savings from controls (both occupancy and daylight on/off).

²Demand reduction assumes coincidental control usage.

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PROJECT SUMMARY

Utility:	NSTAR Electric
Utility Representative:	Cherie Miles
Customer:	Roman Catholic Archdiocese of Boston
Facility:	Saint Catherine's of Genoa School
Location:	Somerville, Massachusetts
Space:	Classrooms
Area:	23,988 square feet
Ceiling Height:	12 feet
Fixtures Used:	Litecontrol SAE Systems P-I-98PF direct-indirect pendants with three 3500K T-8 lamps, Visa School Haus pendants and surface mounted fitted with two 26W quad compact fluorescents.
Light Levels Achieved:	Average of 50 footcandles on work surfaces in classrooms
Lighting Power Density:	Average of 1 watt per square foot
Lighting Specifier:	Tranpani + Associates, Inc.
Installing Contractor:	Prior Engineering, Inc.

THE LIGHTING KNOWHOW™ SERIES

The DesignLights™ Consortium publishes the *knowhow™ Series* for office, small retail, classroom and industrial/warehouse lighting. This *demonstrating lighting knowhow™ Case Study* highlights a specific installation of lighting that showcases quality, comfort and efficient use of energy. With members located throughout the Northeast and the Mid-Atlantic, the DesignLights™ Consortium is “a regional collaboration seeking to influence naturally occurring lighting events towards quality, comfort and efficiency.” The DLC includes among its members many electric utilities as active participants, as well as several other interested stakeholders. The DLC created these case studies with the intention of helping contractors and lighting specialists sell and deliver the benefits of high quality, energy efficient lighting to their customers in the commercial building market.

Efficiency Vermont

Long Island Power Authority

National Grid

- Massachusetts Electric
- Narragansett Electric
- Granite State Electric
- Nantucket Electric

Northeast Energy Efficiency Partnerships, Inc.

Northeast Utilities

- The Connecticut Light and Power Company
- Western Massachusetts Electric Company

New York State Energy Research and Development Authority

NStar Electric

United Illuminating Company

Unitil

- Fitchburg Gas and Electric Light Company



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