

SBEA Small Business Energy Advantage



Historic and existing buildings benefit from energy-efficient measures.

[**Case Study:**
The Mark Twain House & Museum



Connecticut
Light & Power

The Northeast Utilities System



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The United Illuminating Company

Energy Efficiency Case Study: The Mark Twain House & Museum

CL&P, through the Connecticut Energy Efficiency Fund (CEEF), can help you manage your energy costs and protect the environment the way we did for The Mark Twain House & Museum.

[The Starting Point

With energy-efficient measures estimated to deliver more than annual savings of 125,231 kilowatt-hours, it was proved that innovation is alive and well in New England. Mark Twain would have been proud.

“Every little (bit) counts. We are very glad to have it, thin as the slice may be.”

— Mark Twain, in a letter to Charles Dillingham, 8/22/1892

In response to the growing costs of maintaining its facilities, The Mark Twain House & Museum in Hartford turned to The Connecticut Light and Power (CL&P) Company's Conservation

and Load Management (C&LM) Department for help. With an 1874 Victorian mansion on one hand, and a 2003 Leadership in Energy and Environmental Design (LEED) silver-certified green museum on the other, the project posed a full range of challenges, from the electrical systems of the old house, to the long operating hours and large, open spaces of the new Museum Center.

But CL&P's Small Business Energy Advantage (SBEA) program administrators facilitated a solution that was so creative it even surprised the stewards of the witty writer's legacy: solid state, light emitting diode (LED) technology.

Through SBEA's technical and financial support, the Museum Center's lighting was retrofitted, occupancy sensors were installed to control the lighting on pathways and in restrooms, and the existing lamps and some fixtures throughout the Twain House were replaced. The organization's electrical expenses were reduced by 50 percent and its energy consumption by 60 percent. These energy-efficient measures will save more than 1.5 million kilowatt-hours over their life and thousands of dollars that can now go toward preserving the integrity of the historic collection and expanding the exhibits.

As the cost of energy continued to rise, and expenses for maintaining the museum took a larger portion of hard-won funding, there was less money for collection preservations, educational programs and exhibits. Times were tough and getting tougher.

The Museum Center

The Museum Center opened in 2003. Constructed as a “green building,” the facility earned the honor of being the first museum in the nation, and the first building of any kind in Connecticut, to earn LEED certification from the U.S. Green Building Council. It was also presented with the Environment Leadership Award and the 2004 GreenCircle Certificate at a ceremony in April of that year.*

Green innovations at the Museum Center included environmentally safe paint, cement, geothermal wells as a source for heating and cooling using a closed-loop system to eliminate water loss, a design to accept photovoltaic solar panels at a later date, use of local materials and recycled material content, native vegetation and more.

It was beautiful and inviting, “but it was an energy hog,” said Jeffrey Nichols, executive director of The Mark Twain House & Museum. The new building did not address some of the challenges facing the museum, including spiraling energy costs, its long hours of operation, protecting the collection from harmful ultraviolet (UV) rays and justifying any further expenditures to the board of trustees.

** The LEED Green Building Rating System, developed by the U.S. Green Building Council between 1994 and 2006, includes a list of standards aimed at environmentally sustainable construction.*

The council's rating system addresses six major areas, including sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, and innovation and design process.

In 2007, in the interest of conservation, The Mark Twain House & Museum switched some of its lighting to compact fluorescent lamps (CFLs) in the house, a step that required neither architectural changes nor large layout of funds.

In 2008, CL&P reached out to the museum and invited it to participate in one of its business solutions programs, the Small Business Energy Advantage (SBEA), funded through the Connecticut Energy Efficiency Fund (CEEF).

“We thought it was a good cause,” said Randy Vagnini, program administrator of SBEA. It was the beginning of a very successful partnership.

[Small Business Energy Advantage (SBEA)

Overview

Formed in 1998, the SBEA was designed to assist small commercial and industrial businesses in reducing their energy consumption, improve their efficiency, and provide technical and financial support through CEEF incentives and zero-percent interest loans.

The program started out as a simple lighting retrofit program, matching pre-qualified lighting retrofit vendors with customers who typically did not have a pre-existing rela-

The House

Designed by architect Edward Tuckerman Potter, Mark Twain's house reflects both the whimsy and progressive thinking of one of America's most beloved writers. A luxurious Victorian mansion built in 1874, the home was a dazzling showcase of the time's latest innovations: central heating, hot and cold running water, gas lighting fixtures and was one of the first telephones to be installed in a private home.

Many changes and upgrades followed, but by 2008, the modern systems were costly to maintain. Besides the energy, operation, and preservation considerations, the house represented a special challenge: Any improvements could not compromise the originality of the historic structure and its contents.

tionship with an electrical contractor, and then expanded to include cash incentives for those retrofit projects. Today the program's authorized contractors perform energy-efficient upgrades for heating, ventilation and air conditioning systems, air compressors and refrigeration systems. They utilize energy-saving technology including variable frequency drives, premium efficiency motors and LED technology.

“For many Connecticut businesses, efficient use of energy is key to growth and staying competitive. The SBEA program is designed to help owners find the means to implement cost-effective, energy-efficient solutions.”

Jeffrey Gaudiosi, chairman,
Connecticut Energy Efficiency Fund

SBEA is a turnkey program that provides small business energy customers with the expertise and means to analyze and reduce their energy usage. CL&P-qualified contractors provide program fulfillment vendor services and assess the facility to determine potential energy-saving actions, prepare a proposal detailing possible measures, estimate the energy savings, and calculate the complete cost to effect those actions. The contractor assessments are then reviewed by CL&P energy-efficiency experts to ensure reasonable energy savings before any work begins. SBEA contractors work with business owners to minimize the imposition on business hours and the project is completed with that in mind.

SBEA 2008 Savings

The SBEA served 1,999 customers in 2008.

kWh Annual Energy Savings	kWh Lifetime Energy Savings	CO ₂ Emissions Reduced	Annual Savings
46,734,459	557,060,249	25,060 tons	\$8,072,547

[A Little Yankee Ingenuity

Goes a Long Way

SBEA assigned qualified fulfillment vendor Con Serv, Inc., an energy efficiency specialist from Tolland, Conn., to the project. Representatives of Con Serv and The Mark Twain House & Museum met in February 2008 to assess the energy-efficiency potential at the museum and house, and to discuss the special needs and considerations of the facility with the staff. Among their concerns were costs,

interruption of business hours, disturbance of visitors, minimizing the impact on the integrity of the buildings, and preservation of the collection by reducing ultraviolet (UV) ray exposure and temperature fluctuation.

The museum's use of fluorescent lamps, a common source of UV radiation, put collection objects at risk of discoloration and fading.

About Con Serv

Located in Tolland, Conn., Con Serv, Inc. was founded in 2003 by Darin Hanna to meet New England's needs for energy conservation, bringing more than 25 years of experience in residential, commercial and industrial electrical construction and energy conservation.

Con Serv has a Master Electricians License in every state of New England and is a National Fire Protection Association (NFPA) member, an NFPA Electrical Special Sections member, as well as an Associate member of the International Association of Electrical Inspectors (IAEI). Con Serv has strategic alliances with every electrical utility throughout New England and is a qualified fulfillment vendor for CL&P and United Illuminating. It employs more than 30 local residents.

"The UV rays can be damaging to the items on display here at the Mark Twain House," said Patti Philippon,

"The man with a new idea is a Crank until the idea succeeds."

— Mark Twain

Beatrice Fox Auerbach chief curator, "especially paper products, which are of particular importance commemorating America's most beloved

author, Samuel Clemens. First edition books, manuscripts, photographs are susceptible to damage."

An inventory of all light fixtures, lamps and space considerations was then taken. Con Serv determined that retrofitting the existing lighting in the Museum Center and the Carriage House with LED lighting and installing occupancy sensor controls in areas where lights were on constantly but frequently unoccupied, would help the museum reach both its energy-efficiency goals and special needs. LED lighting was selected for its 10- to 12-year lifetime, its efficiency, and lack of UV ray emission.

Because some of the museum's existing fixtures would require custom-made LEDs, Con Serv immediately began



Exterior of the Museum Center

to search for a manufacturer that could fulfill those needs in order to streamline the process once the project was approved. LED Power, located in California, was selected to fabricate the custom side light LED strips for the hallways.

“We were proud to be chosen by CL&P to work with The Mark Twain House & Museum. We were able to bring them the latest technology on the market today and help with their energy-saving measures,” said Darin Hanna, Con Serv president.

Con Serv submitted the energy efficiency proposal, which included a CEEF incentive of \$19,714 and an estimated annual energy savings of more than 125,000 kilowatt-hours (approximately \$18,000 in electrical savings). The proposal received enthusiastic approval by the museum’s board of trustees and the project began.

[The Mark Twain House & Museum

Energy Impact

Estimated annual energy savings: 125,231 kilowatt-hours

Estimated lifetime energy savings: 1,592,622 kilowatt-hours

While waiting for the fixtures from LED Power, Con Serv kept the project moving forward by offering samples of different LED lamps varying in color, shape, and beam dispersal so the museum staff could choose the appropriate one for each area.



Philippon explained that because the Twain House originally employed natural gas, it was important to emulate the softer glow of gaslight so a flame-shaped, yellow-toned LED was chosen for the rooms there.

In the Museum Center, an LED with blue light tones was chosen for its clarity and brightness to provide exhibits and displays good contrast to the ambient lighting, thus delivering exhibit definition and illumination that was easy on the eyes.

About LED Technology

- **Applications:**

Commercial, retail, residential: outdoor signage and street lighting; recessed downlighting and under cabinet lighting in art galleries, museums, hotels and restaurants; portable lamps throughout offices and homes



- **Various Color/Ambience:** Red, pink, blue, green, white, amber

LEDs are part of a family of lighting technologies called solid state lighting. LED lighting is a rapidly evolving technology that has the potential to revolutionize the lighting industry over the next decade. It is already beginning to surpass the quality and efficiency of existing technologies, but not all LED lighting is created equal.

LED lamps are more rugged and damage-resistant than compact fluorescent lamps and incandescent lamps. LEDs don't flicker and don't require a warm-up time. They also have eco-friendly characteristics since they don't emit UV radiation and don't contain lead or mercury. However, they should be disposed of like any other electronic waste.

The useful life of LED lamps is about 35,000 hours compared to 1,000 hours for an incandescent lamp. The lifetime for LEDs is a matter of the overall system reliability that includes the LED lamp, the ballast or driver, electrical connections, the housing and lenses. The key to long LED lamp life is thermal management. The LED must be kept cool. Since LED lighting is a rapidly developing technology, many products have not been on the market long enough for the lifetime claim to be put to the test.

During the installation, Con Serv employees adjusted their working hours to minimize disruption to museum visitors. However, according to Jeffrey Nichols, executive director of The Mark Twain House & Museum, most visitors who did see the workers seemed intrigued and impressed by the museum's efforts to conserve energy. Many asked questions about the process.

The work was completed on Feb. 18, 2009 without a single museum operating hour lost or a visitor turned away. There had been no construction noise, no dust, no debris.

Results Beyond Expectations

The results from the energy-efficient measures were immediately evident: warmer tones in the Twain House; and in the Museum Center, better clarity and directional lighting in the display areas, particularly the gallery, and a reduction of heat output from old incandescent lamps, most noticeable in the gift shop, which was always very warm. But the most



“Apparently there is nothing that cannot happen.”

— Autobiography of Mark Twain

Energy-efficient Measures at the Museum Center

- 457 total fixtures replaced including 371 halogen and CFLs replaced by LEDs
- 19 occupancy sensor controls installed in hallways, restrooms and some offices
- Reduction of number of different lamp types used in facility from 8 to 3
- 13-watt CFL night light retrofitted to a 2-watt LED bar strip
- 79 50-watt MR-16 incandescent fixtures retrofitted to 79 12-watt LED screw-in lamps

Energy-efficient Measures at the Mark Twain House

- 9 retrofits (4 60-watt incandescents to new 2-13 watt PL Drum fixtures)

remarkable result of all was the electric bill, which was cut in half.

“We expected that time would pass before we saw savings, but we’ve had dramatic savings,” said Nichols. “The efficiency has exceeded our expectations. In fact, we contacted the utility company several times after receiving the first few bills to make sure they were right. We couldn’t believe it. Now it’s pretty much a fixed bill, which helps us budget our money.”

And the benefits didn’t stop there. Because of the reduction in heat from the lighting, the temperature is more comfortable and even, reducing the need for air conditioning. Replacing incandescent lamps was part of the maintenance department’s routine. “There was always some burned-out bulb that needed replacing,” said Philippon. With the new LEDs in place, that task has been all-but-eliminated. “Now our guys’ time spent on replacing bulbs is spent on other things to help the museum.”

The project is an extension of the museum’s mission to continue leading the green path. “Mark Twain was very interested in gadgets, progress, technology, inventions. This innovation continues his legacy and allows us to be better stewards of that legacy,” said Nichols. “It also shows the public that we are good stewards of the collection. More money is going toward preserving the collection instead of energy costs. It confirms our conviction to continue on our green path.”

Nichols continued, “This project really helped our image. It shows skeptics that we are trying to keep our expenses down. The best way this project will help us is the estimated cost savings of approximately \$68,000. A portion of that can be allocated to support programs and other necessary activities at the museum. For example, next year is the 125th anniversary of the publication of ‘Huckleberry Finn’ and more money can go toward that celebration.”

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The energy-efficient measures have been so successful at the Museum Center that the organization is seeking other ways to save energy by investigating the requirements of attaining LEED gold certification, installing solar photovoltaic panels, looking into the ENERGY STAR® benchmarking program, and evaluating the HVAC system in the Twain House.

Philippon hopes other museums and historic buildings will consider the SBEA program. For her, it means more focus on the collection, less on maintenance costs. "If people see that we can do it, then other people can do it as well," she said. Her advice to others considering energy audits: "You have to keep an eye on the fact that it's a

long-term investment, not just a one-time expenditure. You keep reaping the benefits. You have to look at not what you spend, but what you'll save."

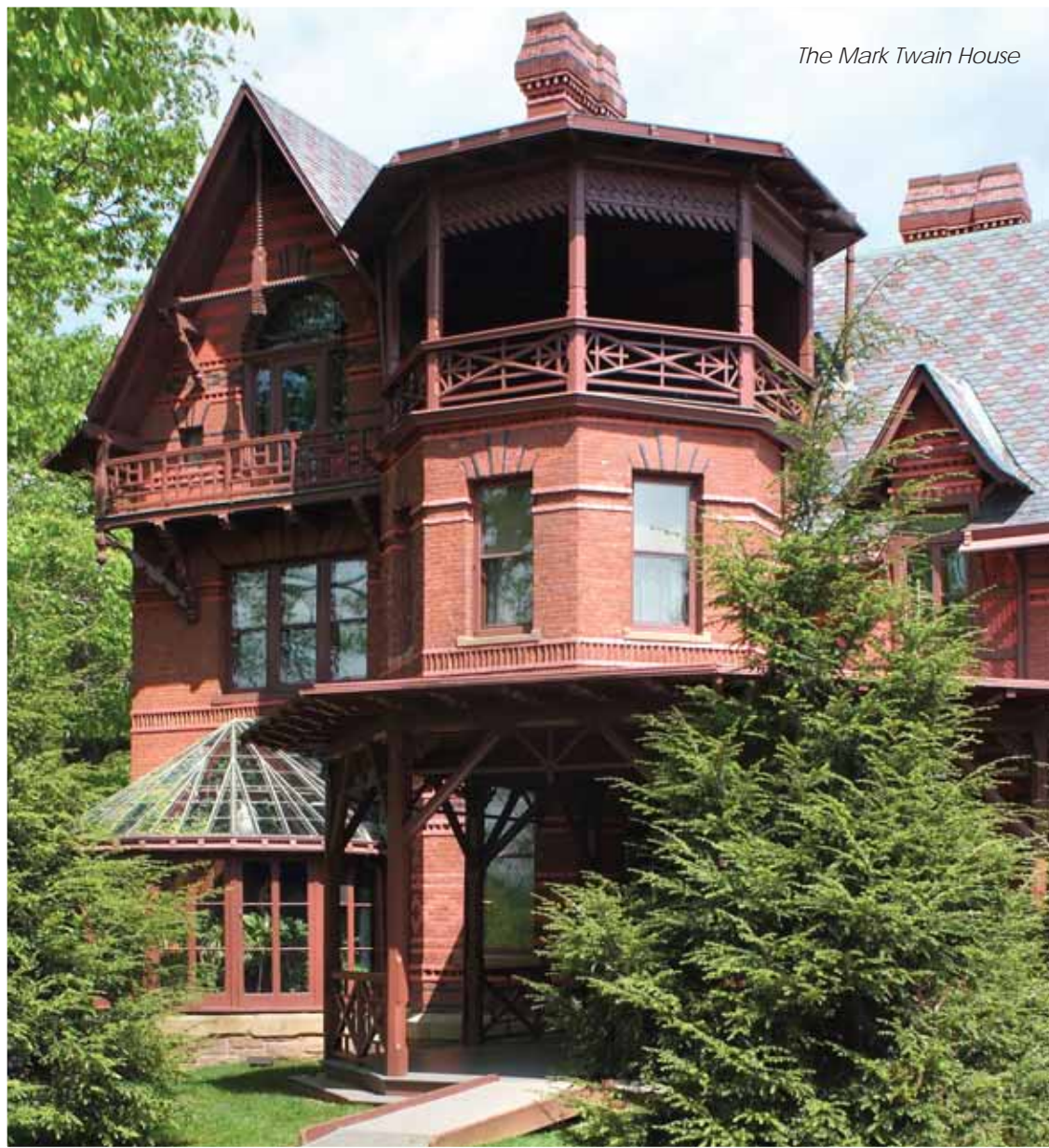
"I think you really have to give credit to The Mark Twain House & Museum for keeping an open mind despite already being a green building," said Paul Nowak of Con Serv, Inc. "They thought, 'What else can we do?' It just goes to show how you think you have no other opportunities, but you never know."

"It's the right thing to do, to be more energy-efficient," said Vagnini. "From a cost perspective, it makes sense to look at the ways to upgrade your efficiency."



New LED ceiling lights in the Museum Center gift shop create an inviting and comfortable environment for visitors to peruse the items easily.

For more information about the SBEA and other CEEF programs and incentives, visit www.CTEnergyInfo.com, www.cl-p.com or call 1-877-WISE-USE (1-877-947-3873) and find out if your business is eligible.



The Mark Twain House

[The Bottom Line

Annual estimated electric savings
in kilowatt-hours 125,231

Lifetime energy savings
in kilowatt-hours 1,592,622

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