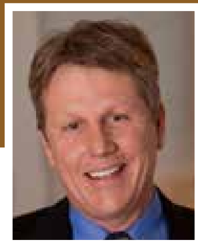
Novogradac
Journal of Tax Credits
News, Analysis and Commentary On Affordable Housing, Community Development and Renewable Energy Tax Credits

Novogradac 2014 • Volume V • Issue XI

Published by Novogradac & Company LLP

JOHN TESS COLUMN



Energy-Efficiency Upgrades and Historic Buildings

JOHN TESS

HERITAGE CONSULTING GROUP

This month's Toolbox features insight about incorporating energy efficiency on historic buildings based on expertise from Heritage staff member and window expert Sam Wharton. Wharton is a recent graduate from the Frank Lloyd Wright School of Architecture. Over the past three decades, he has promoted strategies that increase the thermal performance of windows, and has extensive knowledge of green building technology and methodology.

In the Tax Reform Act of 1976, Congress asserted that "… the rehabilitation and preservation of historic structures … is an important national goal." In a concurrent series of events precipitated by successive Arab oil embargoes, the nation was introduced to the notion that it was experiencing an energy crisis. These areas of seemingly uncommon concern invaded the national conscience and inadvertently clashed very early in their existence.

In 1977, President Jimmy Carter installed solar panels on the White House, one of this country's significant historic structures. Seven years later, in conjunction with roof repairs, Carter's successor had the panels removed and dismissed them as "unsightly and unnecessary." In what may be regarded as an unintended clash of symbols, the stage was set for a relationship that has been needlessly contentious.

Over time, it became clear that the Tax Reform Act was working well. In 2002 the Internal Revenue Service reported that "… completed (Tax Reform Act) projects have brought renewed life to deteriorated business and residential districts, created new jobs and new housing units, increased local and state revenues, and helped ensure the long-term preservation of irreplaceable cultural resources."

By the end of President Ronald Reagan's first term, the energy crisis was dampened by artificially low oil prices and seemed to have been stowed away with the White House solar panels. By the turn of the 21st century, amid growing concern about the state of the environment and rapidly mounting evidence of the cause-and-effect relationship between fossil-fuel consumption and global warming, the energy crisis reemerged and attention focused on historic structures.

According to Environmental Protection Agency statistical research, buildings have a huge effect on the environment. Nationally, they account for 40 percent of total energy

continued on page 2

continued from page 1

consumption and 72 percent of electricity consumption. On the effluent side, buildings are responsible for 39 percent of the carbon dioxide released into the atmosphere and 30 percent of greenhouse gas emissions. In addition, it is estimated by the National Oceanic and Atmospheric Administration that building roofs account for 35 percent of the 32,000 square miles of impervious surface coverage that contributes to stormwater runoff and to the ecological degradation of lakes and rivers.

In an address to the Boston Preservation Alliance, Henry Moss, an architect and a principal at Bruner/Cott in Cambridge, Mass., made the point that "sustainability has taken the moral high ground from preservation." The disturbing underpinning of such a notion is that one of these well-grounded concerns could or should supplant the other. There seem to be so many ways in which the realms of sustainability and preservation are and should be regarded as complementary and, more so, an imperative that they should be.

In a post on www2.buildinggreen.com, Tristan Roberts expands on Moss's suggestion when he asserts that, "Although plenty of middle ground has been staked out over the years, environmentalists have tended to focus on energy efficiency even at some cost to historic fabric, while preservationists insist that the 'greenest building is the one that's already built.' Both sides have a point, but each needs to learn from the other."

Indeed, historic structures are very often inherently energy efficient. The U.S. Energy Information Administration calculates that buildings erected before 1920 have an average energy consumption of 80,127 BTUs per square foot. This compares favorably to "more efficient" buildings built since 2000 which consume 79,703 BTUs per square foot.

Based upon this data, preservationists might be tempted to ask, "What's the problem?" The answer is that this state of near equilibrium may not be enough. If energy-efficient strategies and technologies are currently available and new technologies are on the horizon, why not embrace them and enhance structures with strong environmental pedigree?

A key question is: how can a building's thermal performance be unobtrusively improved?

In masonry structures such as mill buildings, the problem is tricky. In those applications the careless insulation of interior walls could compromise and permanently alter

continued on page 3

Photo: Courtesy of Heritage Consulting Group
An unobtrusive installation of solar panels on the roof of the Vestas Building, formerly the Meier and Frank Depot, in Portland, Ore.

Photo: Courtesy of Robert Clarke
Reinstallation of upgraded sash in Empire State Building.

continued from page 2

historic fabric and, worse, lead to moisture and mold problems. The best solution in masonry structures would be to ensure that water is kept out of the masonry. A roof system and wall assembly that is well-flashed and designed to duct water away from the building surfaces may be the optimal approach.

When windows constitute a very high percentage of the building's exterior surface area, attention should be paid to the pros and cons of repair, re-glazing and storm window or replacement options. The windows and the glazing can have a significant impact on the overall performance of the renovated architecture. Air infiltration and the influence of solar gain can enhance or diminish thermal behavior, and have a dramatic impact on the performance of new or existing mechanical systems.

The Empire State Building, for example, illustrates an effective upgrade to a historic building's glazing envelope. That structure is punctured by 6,514 double hung windows that comprise 39 percent of the building's skin. In 1992, the original R-1 single-glazed steel windows were replaced by dual-glazed R-2 aluminum windows. The glass in these windows was clear, non-Low-E. At the time, the glass choice was influenced by the fact that most early high-performance glazing was too reflective of visible light and not clear in appearance. With recent technological advances, clear, non-reflective low emissivity glazing is available.

The Empire State Building used one such product. In conjunction with demand-control ventilation systems, an electrical retrofit, improved lighting designs, and upgraded plug load occupancy sensors, new insulating glass was retrofitted into the 1992 replacement windows. The glazing was tuned to respond to the points on the compass. Glass that allowed more visible light was installed at the north and east. Glass that controlled solar gain was installed at the south and west. The thermal performance was elevated to R-5 and R-8. According to the Rocky Mountain Institute, the collective bottom line for this project includes the following data: the overall building energy consumption will lower by 38 percent, which translates to annual savings of $4.4 million. Carbon dioxide emissions will be reduced by 105,000 tons over the next 15 years and savings costs will pay back implementation costs in approximately three years.

In addition to this type of visually inconspicuous energy upgrade, other strategies that are invisible or nearly so can be employed on historic properties.

Some of these can have a significant impact on a building's thermal capability. It may be possible to upgrade heating

continued on page 4

continued from page 3

and cooling capacity by installing basement underground geothermal heat pumps. Such an approach would preclude the installation of exposed or roof-mounted absorptive chillers and condensing boilers. Additionally, such systems may be 50 percent more efficient on the heating side and 30 percent more efficient at cooling.

A green roof with low-lying vegetation is invisible from ground level, and as the planting reduces the volume, speed and temperature of runoff water, it improves outdoor air quality, reduces the building's "heat island effect," provides insulation, and lasts twice as long as a conventional roof.

With these considerations in mind, it seems appropriate to return to the idea of roof-mounted solar panels. Today's solar arrays with some sacrifice of efficiency could lie flat, or if the building's orientation permitted, they might be installed on the slope of a traditional roof monitor.

The devices installed on the White House in 1977 were a primitive system when compared to today's photovoltaics. They were were designed to heat hot water, and in deference to landmark considerations, the delivered dark frames were painted white. President Carter predicted that the panels might become "a museum piece" or "a small part of one of the greatest and most exciting adventures ever undertaken by the American people." He was correct. A panel is in the Smithsonian, one is at the Carter Library and another at the Solar and Science and Technology Museum in China. The remaining panels are installed on the library at Unity College in Maine where they are used to heat water. Interestingly, during both President George W. Bush's and President Barack Obama's administrations, solar panels were installed on the White House.

For historic tax credit projects, it is imperative that all energy-efficiency technology upgrades be submitted for review and approval, even if the systems are not visible. In determining whether proposed technology upgrades are approvable, the State Historic Preservation Offices

continued on page 5

Photo: Courtesy of Jimmy Carter Library
President Jimmy Carter inspecting a solar heating panel installed on the roof of the White House.

continued from page 4

and the National Park Service will assess not only the visibility of new features, but will examine any the impact on historic fabric.

Conclusion

Retrofitting historic buildings for energy efficiency while meeting the Secretary of Interior's Standards remains challenging, but not impossible. The historic rehabilitation community has seen many examples of how both goals can be achieved through early and careful planning. Considerable advancements in the area of green and historic preservation have been made in recent years and will continue to be made in the future. It nonetheless remains important that the historic preservation community continue to take the lead in finding technologies that are affordable, effective and sympathetic to our physical and built environments.

John M. Tess is president and founder of Heritage Consulting Group, a national firm that assists property owners seeking local, state and federal historic tax incentives for the rehabilitation of historic properties. Since 1982, Heritage Consulting Group has represented historic projects totaling more than $1 billion in tax credits. He can be reached at 503-228-0272 or jmtess@heritage-consulting.com.

This article first appeared in the November 2014 issue of the Novogradac Journal of Tax Credits.

Novogradac
Journal of Tax Credits

CONTACT

CORRESPONDENCE AND EDITORIAL SUBMISSIONS
Alex Ruiz
alex.ruiz@novoco.com
415.356.8088

ADVERTISING INQUIRIES
Tyler Perrotta
tyler.perrotta@novoco.com
415.356.8062

ISSN 2152-646X