# Energy Conservation in Historic Buildings

**Legacy Project # CR-15-777**

## Background:

Currently, over 30% of the Department of Defense's (DoD) buildings are more than 50 years old. By 2025, DoD real property that is more than 50 years old will increase to nearly 70% and will become eligible for National Register of Historic Places (NRHP) evaluation. However, the energy efficiency measures (EEMs) commonly taken to make required energy efficiency improvements in buildings are often difficult to implement on historic buildings because they involve making changes to the buildings that may violate the requirements of the National Historic Preservation Act (NHPA). For example, installation of solar panels on a roof commonly alters the building's historic appearance. In such cases, energy efficiency studies must meet dual (and sometimes conflicting) requirements, to enable historic buildings to conserve energy while preserving their historic and cultural nature and appearance.

## Objective:

The objective of this work was to help military installations meet energy efficiency and NHPA requirements in onsite historic buildings by: (1) assessing all factors affecting energy use in historic buildings, (2) analyzing the effects of EEMs on energy use, and (3) prioritizing and optimizing the use of combinations of EEMs in typical building types in various climate zones across the United States.

## Summary of Approach:

This work reviewed the DoD stock of buildings listed or determined eligible for listing in the NRHP. To generate findings applicable to this large number of many types of historic (or potentially historical) buildings, this analysis selected a representative set of similar historic buildings. Computer models of the selected buildings were developed using the eQUEST building energy simulation software tool. Selected EEMs were evaluated for their potential to yield energy and cost savings, while maintaining compliance with the NHPA. The results of these analyses were then extrapolated to similar buildings in other climate zones, and then summarized to provide a guide on the use of various EEMs (or combinations of EEMs) typically applicable to various historic building types in different U.S. climate zones.

## Benefit:

The results of this work enable energy auditors and cultural resources personnel, to specify projects that will improve the energy performance of historic buildings while accommodating their unique aspects and requirements. This is an important issue since there will be an increasing need for measures to meet various energy goals and requirements in these historically significant structures. The results will also aid in development of more renewable energy projects in historic buildings that will meet many Federal directives, orders, and goals. The results will also assist in defining adaptable reuse of historical buildings by providing various alternatives for renovations to energy systems that are acceptable in historic buildings. This is expected to result in more projects being performed on historic structures. In turn, this will result in more comfortable, more habitable, and better-preserved facilities that will better support the Nation's military readiness.

## Accomplishments:

This work reviewed the DoD stock of buildings listed or determined eligible for listing on the NRHP. Six buildings at Fort Sill, OK, which represent commonly found building types, were selected for study of potential EEMs. Computer models of the buildings' energy use were developed and used to estimate the potential energy savings of the various EEMs. Costs for the EEMs were estimated, simple paybacks calculated, and the results were further extrapolated to the 15 U.S. climate zones and summarized. The results were used to develop a guide to suggest EEMs appropriate for use with historical buildings, and a general guide to the energy implications of using those EEMs in various climates.

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