



Lessons learned: ASHRAE's approach in the refurbishment of historic and existing buildings



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ABSTRACT

Energy efficiency in existing buildings, including historic buildings, is perhaps our greatest opportunity for a sustainable future. Energy efficiency retrofits in all existing structures must consider both long-term use and conservation. This paper focuses on ASHRAE's work in this area.

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1. Introduction (Compulsory)

During his presidential year, 2012–2013, ASHRAE President Tom Watson called for the Society to provide guidance for a variety of building applications, including historic buildings. He observed that historic buildings were a personal of interest of his, noting “we can't simply give up on using historic buildings. They are too valuable and leave too large an environmental footprint to be neglected or abandoned” [1]. His called echoed that of another past ASHRAE President, Gordon Holness, who observed “energy efficiency in existing buildings is our great opportunity for a sustainable future.” As a result, ASHRAE is working to provide guidance on historic buildings while striving to improve its existing information and materials related to existing buildings. These efforts include proposed Guideline 34P, *Energy Guideline for Historical Buildings and Structures*; Standard 100, *Energy Conservation in Existing Buildings*; Guideline 0.2P, *The Commissioning Process for Existing Systems and Assemblies*; Guideline 1.2P, *The Commissioning Process for Existing HVAC&R Systems*; Advanced Energy Design Guide series; HPB magazine; “Energy Efficiency Guide for Existing Commercial Buildings: The Business Case for Building Owners and Managers;” and “Energy Efficiency Guide for Existing Commercial Buildings: Technical Implementation;” “Performance Measurement Procedures for Commercial Buildings: Best Practices Guide;” bEQ – Building Energy Quotient labeling program.

2. Key facts

According to the United Nations Intergovernmental Panel on Climate Change (IPCC), the energy sector contributes as much as 90 percent of carbon dioxide and 70 percent of greenhouse gases to the atmosphere. Carbon dioxide typically accounts for 95 percent of energy sector emissions with methane and nitrous oxide responsible for the balance. Stationary combustion is responsible for about 70 percent of greenhouse gas emissions from the energy sector, and about half of these emissions are associated with combustion in energy industries, mainly power plants and refineries.

2.1. Additional facts

As ASHRAE President, Gordon Holness shared these facts regarding energy use in existing buildings. We should recognize that only 2 percent of construction projects are new construction. Ninety-eight percent of construction dollars goes into existing buildings [2].

Even more importantly we should remember this: 75–85 percent of buildings that will exist in urban areas in 2030, already exist today. At our very successful net-zero-energy conference earlier this year, the statement was made that “if every single new building from this day forward was designed as net-zero, we would still only impact 15 percent of the marketplace by the year 2030” [3].

2.2. Solutions for existing buildings

At the 49th AiCARR International Conference, Historical and Existing Buildings: Designing and Retrofit, February 26–28, 2014,

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ASHRAE member David Arnold is presenting a paper on Energy Sustainability and HVAC Solutions for Existing Major Buildings in USA [4]. In his paper, Arnold will share ways to improve energy use in historic buildings:

- Adaptive re-use (retro-fitting and changing the use of the building);
- Re-building (stripping the building back to its skeleton structure and re-building to achieve sustainability);
- Retro-fitting (improving thermal properties where possible and replacing electrical and mechanical systems);
- Energy saving measures applied to mechanical and electrical systems.

3. Challenge

At the 2014 ASHRAE Winter Conference held last month in New York, a seminar session in the Technical Program focused on *Making Historic Buildings Sustainable*. Speaker Tor Brostrom shared his thoughts on energy efficiency in historic buildings. His challenge: “How can energy efficiency interventions facilitate a sustainable use and management of a building, taking into account both long-term use and preservation?” [5].

4. ASHRAE efforts

4.1. Guideline 34P

ASHRAE currently is writing its first guidance related to historic buildings. Guideline 34P, *Energy Guideline for Historical Buildings and Structures*. The purpose of the guideline is to recommend minimum provisions to design and operate energy efficient rehabilitated buildings and structures, and it includes procedures for energy efficient operation and maintenance and increasing efficiency of energy-using building systems and equipment [6].

The guideline provides guidance to rehabilitate and restore historic buildings/structures to achieve energy efficiency without compromising historical preservation, including:

- advice about needs for envelope rehabilitation and restoration to control heat and light transfer and limit air infiltration;
- advice about the need for HVAC system energy efficiency while providing acceptable indoor environmental quality;
- advice about the need for lighting systems that provide energy efficient solutions while maintaining historic qualities.

The scope of the guideline applies to those structures which qualify for inclusion on the National Register of Historic Places, or which are defined as historic buildings by applicable law in the jurisdiction where building is located. It includes portions of historic buildings and complexes and additions to historic buildings

including all systems. It also applies to both restored and unrestored historic buildings and structures.

4.2. Other ASHRAE tools

The *HVAC Applications* volume of the ASHRAE Handbook also contains information related to historic buildings. Guidance focuses on relative humidity, temperature, and air pollution. It describes various systems that are applicable for the special needs of collection spaces in museums, galleries, archives and libraries.

ASHRAE and allied organizations have also developed other publications to advance the cause of energy efficiency in existing and historic buildings. These include:

- Standard 100, *Energy Conservation in Existing Buildings*;
- Guideline 0.2P, *The Commissioning Process for Existing Systems and Assemblies*;
- Guideline 1.2P, *The Commissioning Process for Existing HVAC&R Systems*;
- Advanced Energy Design Guide series;
- HPB magazine;
- “Energy Efficiency Guide for Existing Commercial Buildings: The Business Case for Building Owners and Managers;” and “Energy Efficiency Guide for Existing Commercial Buildings: Technical Implementation”;
- Performance Measurement Procedures for Commercial Buildings: Best Practices Guide;
- bEQ – Building Energy Quotient, ASHRAE’s building energy labeling program.

5. Conclusions

Given that the great majority of the world’s building stock for the next 20 years already exist, improving energy efficiency in these existing buildings, including historic buildings, is perhaps our greatest opportunity for a sustainable future. Energy efficiency retrofits must consider both long-term use and conservation in order to preserve the past and protect our future resources.

References

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