

**INTRODUCTION TO
ASHRAE GUIDELINE 34-2019
ENERGY GUIDELINE FOR
HISTORIC BUILDINGS**

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Acknowledgements

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Mission: To serve humanity by advancing the arts and sciences of heating, ventilation, air conditioning, refrigeration and their allied fields.

Vision: A healthy and sustainable built environment for all.

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*Presenter was an active and voting member of the committee which wrote Guideline 34-2019.
All photos were taken by the presenter except where otherwise indicated.*

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Learning Objectives

1. Explain the **unique considerations** for energy retrofits in historic buildings, including the status quo and future outlook for regulatory exemptions.
2. Describe the **key principles** and **recommendations** in existing guidance documents on energy efficiency in historic buildings.
3. List the types of **intended users** of the guideline, recognizing that it isn't just for engineers and that it is written and intended to be used internationally.
4. Describe **energy efficiency measures** with high benefit and low risk applicable to historic buildings.
5. Explain how **micro-climates** can be created for sensitive artifacts, e.g., in museums.

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Presentation Outline

- I. Introduction
- II. Purpose, Scope and Glossary
- III. Background and Planning
- IV. Building Envelope Considerations
- V. Building Equipment Considerations
- VI. References and Appendices
- VII. Concluding Remarks

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I. Introduction

WHY is it important to address the **energy efficiency** of existing buildings—even in **historic structures**?

ENERGY DEMAND BY SECTOR 2022

Sector	Share
Buildings	66%
Transport	21%
Industry	9%
Buildings construction	4%
Other	4%

EMISSIONS BY SECTOR 2022

Sector	Share
Buildings	63%
Transport	11%
Industry	8%
Buildings construction	7%
Other	7%
Bricks and glass	2%

34% of the global final energy
37% of the global GHG emissions
27% of CO₂ and under 10% for GHG emissions from building construction

Source: United Nations Environment Programme (2024). Global Status Report for Buildings and Construction: Beyond foundations. Mainstreaming sustainable solutions to cut emissions from the buildings sector. Nairobi. <https://doi.org/10.59137/26-009-1182/24-0024>, accessed 08/05/2024

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I. Introduction

WHY **else** is it important to address the **energy efficiency** of existing buildings—even in **historic structures**?

- Nearly 74% of global buildings which existed in 2015 will still be in use in 2030*.
- * Note that this is 83.6% for industrial nations and only 70.4% for emerging/developing nations.

<http://www.statista.com/statistics/1414826/global-buildings-floor-area/> accessed 07/15/2024

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I. Introduction

"The greenest building is the one already built."



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I. Introduction

The 2030 Challenge goal :

"All new buildings, developments, and major renovations shall be carbon-neutral, use half as much water and emit half as much transportation emissions by 2030 ..."

We must ALSO improve existing buildings and add renewable energy sources to reach carbon neutral.

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I. Introduction

Where can you get guidance to achieve energy/environmental goals for **historic buildings**?

**ASHRAE Guideline 34 – 2019
Energy Guideline for Historic Buildings**

Why not just apply modern methods?

Energy Efficient Measures (EEMs) for modern buildings may not work for historic buildings.

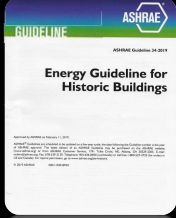



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I. Introduction

Who is served by this guideline?


Historical Preservationists
Architectural Engineers
Commissioning Experts
Envelope Experts
Architects
Architecture Professors
Energy Engineers
Acoustic Experts
Mechanical Engineers
Energy Researchers
Museum Curators

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I. Introduction

Guideline 34 Table of Contents



1. Purpose	7. Environmental Control and Energy Systems
2. Scope	8. HVAC System Selection
3. Definitions and Acronyms	9. Lighting
4. Background	10. References
5. Planning Phase	Informative Appendices A-E
6. Building Envelopes	


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II. Purpose, Scope and Glossary

1.0 - Purpose:

"to provide sound advice on the practices, processes, and workflows that should be followed when performing energy efficiency and energy conservation improvement projects and programs involving historic buildings, while minimizing disturbance to the historic character, characteristics, and materials (significance, value, and qualities) of the building."



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II. Purpose, Scope and Glossary

2.0 - Scope:

“...applies to those buildings that are listed as historic buildings or which are eligible to be so listed by applicable law in the jurisdiction where the building is located.

...applies to projects that are intended to improve ...

...energy efficiency ...[and]...energy performance of the building's envelope...[including] envelope modification and upgrades to control heat and moisture transfer and limit air infiltration...”

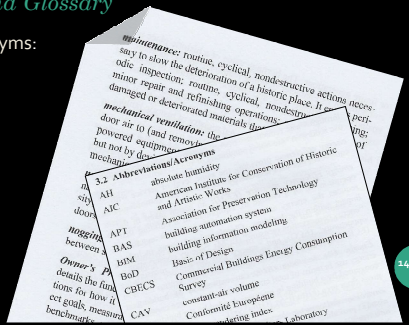
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II. Purpose, Scope and Glossary

3.0 - Definitions and Acronyms:

- ASHRAE terminology
- Preservation terms
- Construction language
- Applicable Acronyms



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III. Background and Planning

4.0 - Background:

- goals of preservation
- related existing guidance




US Sec. of the Interior Sources
Canadian Sources
UK Sources
European Sources

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III. Background and Planning

4.0 - Background (cont):

- historic buildings, their significance, and character defining features

Degree of Significance determines approach:

- ✓ PRESERVATION
- ✓ RESTORATION
- ✓ REHABILITATION
- ✓ RECONSTRUCTION



Neoclassic columns, porticoes & domes
Thomas Jefferson's Monticello
Charlottesville, Virginia USA

INCLUDES:

RECOMMENDATIONS
for **PROTECTING BUILDING CHARACTER**
and **RETAINING REVERSIBILITY**


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III. Background and Planning

4.0 - Background (cont):

- understanding past use
 - ✓ existing envelopes and systems
 - ✓ historic use and occupancy
 - ✓ historic environmental management including energy costs



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III. Background and Planning

4.0 - Background (cont):

- Example of why it is important to understand past use—for potential reinstating



Cool air from under the house rises and exits via clerestory windows around the corner in the kitchen




Frank Lloyd Wright Affeck House
Bloomfield Hills, Michigan, USA

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III. Background and Planning

4.0 – Background (cont):

- impacts of Energy Efficiency Measures (EEMs) on historic buildings

TABLE 4.1

BENEFICIAL	DETRIMENTAL
BENIGN	STUDY NEEDED

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III. Background and Planning

4.0 – Background (cont):

Example EEM from Table 4.1 from "Thermal Performance" Category

Install wall insulation on the interior of masonry buildings.

Potential Impact:		Refer to Section:		
✓ Beneficial	✓ Detrimental	5.4.3	6.2.1	6.2.3
✓ Benign	✓ Study Needed	5.6.2	6.2.2	6.2.4

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III. Background and Planning

5.0 – Planning Phase:

"...is intended to provide project teams with a **step-by-step process** to understanding the current energy use of a building and planning possible energy efficiency improvements to their historic property..."

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III. Background and Planning

5.0 – Planning Phase (cont.):

- project team

<ul style="list-style-type: none"> ✓ Owner or Owner's representative ✓ Architect ✓ Interior architect ✓ Engineers (Mechanical, Electrical & Structural) ✓ Lighting designer ✓ Telecommunication/information technology specialist 	<ul style="list-style-type: none"> ✓ Facilities manager ✓ Landscape architect ✓ Preservation specialist ✓ Curator ✓ Materials scientist ✓ Contractor & specialty subcontractors ✓ Commissioning authority (CxA) ✓ Other specialists
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III. Background and Planning

5.0 – Planning Phase (cont):

- pre-design planning phase

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III. Background and Planning

5.0 – Planning Phase (cont.):

- building research, investigation and documentation

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III. Background and Planning

5.0 – Planning Phase (cont):

- Include the history and evolution of passive systems.




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III. Background and Planning

5.0 – Planning Phase (cont):

- preliminary energy use analysis



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III. Background and Planning

5.0 – Planning Phase (cont):

- field investigations and condition assessment

RECOMMENDATIONS for:

- ENVIRONMENTAL MONITORING
- and ENERGY/EQUIPMENT ASSESSMENTS



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III. Background and Planning

5.0 – Planning Phase (cont):

- considerations for envelope improvements are detailed

INCLUDING:

- ENVELOPE TIGHTNESS
- INSULATION LEVELS
- WATER ISSUES



Photo credit:
<http://concretepro.ca/wp-content/uploads/2017/02/wet-basement.jpg> accessed 09/24/19

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III. Background and Planning

5.0 – Planning Phase (cont):

- ...AND considerations for energy systems design



ROOM CLIMATE CONTROL



ARTIFACT CLIMATE CONTROL

Da Vinci's Madonna & Child in conditioned glass container for close monitoring of temperature & humidity at Hermitage Museum, St. Petersburg, Russia (UNESCO World Heritage Site)



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III. Background and Planning

5.0 – Planning Phase (cont):

- analyze historic lighting design



Sunlight provided by oculus in Thomas Jefferson's Rotunda, University of Virginia, Virginia, USA (UNESCO World Heritage Site & a Registered National Historic Building)

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III. Background and Planning

5.0 – Planning Phase (cont):

- occupancy and operations phase

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IV. Building Envelope Considerations

6.0 – Building Envelopes:

WHAT to WATCH for WHEN IMPROVING ENVELOPES for ENERGY EFFICIENCY

- roof assemblies
- wall assemblies
- foundations
- glazing & doors

Sites 4 Important Factors to consider prior to adding insulation to the interior.

How to prevent condensation if using storm windows.

Includes a discussion on the concerns of insulating where joist pockets are in masonry.

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IV. Building Envelope Considerations

6.0 – Building Envelopes (cont.)

Examples of **character assassination** and more concerns

Original plaster and mortar covered in Portland Cement

Trinity Episcopal Church, Abbeville, South Carolina

Adding interior insulation allows exterior to be colder (wetter) and possible deterioration

Only place for insulation may be the floor or roof.

18th Century San Fernando Cathedral, San Antonio, Texas

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V. Building Equipment Considerations

7.0 – Environmental Control & Energy Systems:

Steps to follow and considerations for energy-using systems for greater energy efficiency without compromising historic fabric or building features.

- discussion of historic environmental control systems
- field investigation

18th Century Fireplace/Stove, Seurasaari Open Air Museum in Helsinki, Finland, Europe

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V. Building Equipment Considerations

7.0 – Environmental Control & Energy Systems (cont.):

- extent of intervention
- example of retrofitting existing systems

ENHANCE or REPLACE?

Original vertical terminal unit left in place and cloth ducts added close to ceiling for hot air distribution. The Henry Ford, Dearborn, Michigan, USA (Registered National Historic Building)

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V. Building Equipment Considerations

8.0 – HVAC System Selection:

- considerations for adding mechanical air conditioning

Hiding HVAC air outlets in a bench and duct work in closets (not shown) FLW Meyer May House Grand Rapids, Michigan, USA

- Design criteria (temperatures, humidity levels)?
- Add cooling equipment?
- Retrofit old equipment?
- Type of systems?
- Add duct work or install a ductless system?
- How can newer HVAC systems be accommodated and hidden?
- Potential equipment noise? +++

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v. Building Equipment Considerations

8.o – HVAC System Selection (cont):

- electrical considerations




Photo credit:
<https://torontodomanhome.wordpress.com/>
accessed 08/13/24

Original wiring without grounding mounted within a routed groove in wood within the walls.
Frank Lloyd Wright's Affleck House, Bloomfield Hills, MI USA (Registered National Historic Building)

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v. Building Equipment Considerations

9.o – Lighting:

- general considerations are detailed including emulating the historic appearance with lighting and performing a lighting survey

Example: Match 'new' lamp color rendering to historical lighting




Photo credit:
https://www.homelectrical.com/sites/default/files/styles/original_image/public/images/product/blg/blg-colortemperature.jpg accessed 09/21/19

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v. Building Equipment Considerations

9.o – Lighting (cont):

- design approaches are detailed

PRESERVE/RESTORE
REPLICATE
REHABILITATE
NEW LIGHTING



Wall Sconce in FLW Meyer May House Grand Rapids, Michigan, USA (Registered Historic Building)

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v. Building Equipment Considerations

9.o – Lighting (cont):

- exterior lighting selection and placement are discussed for both energy efficiency (lighting efficacy) and appearance



Exterior Lighting of Historic Building in Antalya, Turkey

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v. Building Equipment Considerations

9.o – Lighting (cont):

- use of dimming and lighting controls to increase efficiency

ADVANCED LIGHTING CONTROLS = ↑ ENERGY SAVINGS




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VI. References and Appendices

10.o – References



79 INTERNATIONAL REFERENCES

Informative Appendices:



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VIII. Concluding Remarks

- ❑ An overview of ASHRAE Guideline 34-2019 – Energy Guideline for Historic Buildings was given...and a few tidbits from the guideline were shared.
- ❑ Guideline 34-2019 is purposely international.
- ❑ Guideline 34-2019 is intended for addressing energy efficiency for listed historic buildings but offers guidance also for other historic buildings.
- ❑ Guideline 34-2019 is available from www.ASHRAE.org/bookstore


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Questions?

Thank you
for your
attention!



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