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BUILDING ENERGY MODELING STEP-BY-STEP PROCEDURES FOR LEED CERTIFICATION

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BUILDING ENERGY MODELING : STEP-BY-STEP PROCEDURES FOR LEED CERTIFICATION

ASHRAE Standard 90.1-2022 is a critical benchmark for energy efficiency in commercial buildings, aiming to promote energy conservation, reduce greenhouse gas emissions, and minimize environmental impact. It covers topics such as building envelope, HVAC systems, lighting, and water heating. The standard outlines minimum requirements for energy-efficient design, promoting energy conservation, reducing greenhouse gas emissions, and minimizing environmental impact.

Learning Objectives

- Introduction and Course Outline

- Building Energy Modeling Checklists

- Scaling an imported drawing from AutoCAD

- ASHRAE Standard 90.1-2022

- BEM software inputs for the project section, facade, systems, and zones

- Setup and Running the Building Energy Modeling Simulation

- Review BEM Software Output Reports.

- Sample Energy Modeling Report

- Summary and Resources

- BEMP Practice Test V.4.1

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INTRODUCTION

- Aims to promote energy conservation, reduce greenhouse gas emissions, and minimize environmental impact.

- Covers topics like building envelope, HVAC systems, lighting, and water heating.

- Key components include building envelope, HVAC systems, lighting, and water heating.

- Energy modeling is a critical component, simulating a building's energy use based on design specifications and operational characteristics.

- Adherence to ASHRAE Standards is vital for professionals in the field, ensuring new constructions are designed with energy efficiency as a foundational element.

OVERVIEW OF ASHRAE STANDARD 90.1-2022

- ASHRAE Standard 90.1-2022, titled "Energy Standard for Buildings Except Low-Rise Residential Buildings," provides minimum requirements for energy-efficient design of buildings.
- The standard covers topics like building envelope, HVAC systems, lighting, and water heating

KEY COMPONENTS OF ASHRAE STANDARD 90.1-2022

- Building Envelope: Defines the thermal performance of the building's exterior components.
- HVAC Systems: Outlines efficiency requirements for heating, ventilation, and air conditioning systems.
- Lighting: Addresses lighting power density, promoting the use of energy-efficient lighting technologies.
- Water Heating: Emphasizes the use of high-efficiency equipment and technologies to reduce energy consumption in hot water applications.
- Energy Modeling: Requires simulating a building's energy use based on design specifications and operational characteristics

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ENERGY MODELING IN THE CONTEXT OF ASHRAE STANDARD 90.1-2022

- Energy modeling serves as a predictive tool for evaluating a building's energy performance before construction.

- Modeling Requirements: Baseline vs. Proposed Design: Compares a baseline building with a proposed design that incorporates advanced energy-saving features.

- Input Data: Specifies the types of data that must be included.

- Performance Metrics: Reports performance metrics in terms of energy consumption, peak demand, and greenhouse gas emissions.

Case 2. ASHRAE 90.1-2022 (4 – 7 points)

- Comply with the provisions of ASHRAE 90.1-2022, Sections 5 through 11.Implement incremental ASHRAE 90.1 2022, Section 11 credits, above the minimum required from the list of eligible measures below.

  Eligible measures from ASHRAE 90.1-2022 section 11.5.2 for LEED points:

  - HVAC measures (H01 to H07)
  - Service Water Heating measures (W01 to W09)
  - Lighting measures (L01 to L06)
  - G07 Building Mass / Night Flush

Table 1. Points for ASHRAE 90.1-2022 Section 11 credits

Points	Case 1. ASHRAE 90.1-2019	Case 2. ASHRAE 90.1-2022
1	25 Credits	
2	50 Credits	NA
3	75 Credits	
4	100 Credits	Min required by 90.1-2022
5	125 Credits	Min required by 90.1-2022 plus 25 credits
6	N/A	Min required by 90.1-2022 plus 50 credits
7	N/A	Min required by 90.1-2022 plus 75 credits

Option 2. Energy Simulation (1 – 10 points)

Demonstrate an improvement in future source energy calculated per ASHRAE Standard 90.1 Normative Appendix G "Performance Rating Method" with the following additional provisions:

- Use the ASHRAE 90.1 version applied for *EAp: Minimum Energy Efficiency*
- Replace ASHRAE 90.1-2019 or 90.1-2022 Table 4.2.1.1 Building Performance Factors (BPF) with Table 6 below. For major renovation building area, multiply the BPF by 1.05.
- Replace all references to "cost" with "future source energy." Use an electric site-to-source energy conversion factor of 2.0 based on future projections for the U.S. A lower national average value may be used as applicable for projects outside of the U.S.
- Model energy efficiency measures for plug and process loads using Section G2.5 Exceptional Calculation Method or approved calculations in the LEED reference guidance.
- Calculate the Performance Index and percentage improvement with and without the plug and process savings.
- Calculate the Performance Index and Performance Index Target as follows:
  - $PI_{nre} = PBP_{nre} / BBP$
  - $PI = PBP / BBP$

  - $PI_t = [BBUE - (BPF \times BBRE)] / BBP$

  - Where

    - PI_{nre} = Performance index for future source energy excluding on-site renewable contribution
    - PI = Performance index for future source energy including on-site renewable contribution
    - PI_t = Performance index target for future source energy use
    - BBP = baseline building performance for baseline building future source energy use
    - $BBUE$ = baseline building unregulated future source energy use
    - $BBRE$ = baseline building regulated future source energy use
    - PBP_{nre} = *proposed building performance* without any credit for reduced annual future source energy from *on-site renewable energy* generation *systems*
    - PBP = *proposed building performance*, including the reduced annual future source energy associated with all *on-site renewable energy* generation *systems*

Points are awarded according to Table 5, using either Path 1 or Path 2.

CONCLUSION

ASHRAE Standard 90.1-2022 is a cornerstone of energy efficiency in building design, aiding in reducing operational costs and contributing to broader environmental goals.

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