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BUILDING ENERGY MODELING PROFESSIONAL - BEMP OVERVIEW

ONLINE PROFESSIONAL COURSES LED BY THE
WORLD'S TOP SPECIALISTS

ONLINE TRAINING BY KRISHNAJI PAWAR

LEED AP(BD+C), GSAS CGP, GCP, ISO 14001

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MODULE
7

Professional energy modeling specialist certification

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LEED AP(BD+C), GSAS CGP, GCP, ISO 14001

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BUILDING ENERGY MODELING PROFESSIONAL BEMP OVERVIEW

ASHRAE, an international organization, promotes the advancement of heating, ventilation, air conditioning, and refrigeration, with the Building Energy Modeling Professional certification program validating job competency in recognized technical information.

Learning Objectives

- Introduction
- Getting Started with BEM
- Establishing the Model Scope
- Building Energy Modeling Tools
- LEED, Commissioning, & Energy Conservation
- Benefits of Building Energy Modeling
- **Certification for energy modeling specialists**
- Summary and Resources
- Building Energy Modeling Professional - BEMP Practice Test V.4.1



INTRODUCTION

- The ANSI-Accredited Personnel Certification Program (#1139) BEMP certification verifies that you are capable of utilizing various types of physics to model both new and existing buildings and systems.
- Energy modeling software outputs are evaluated, selected, used, calibrated, and understood in connection to building and system economics and energy performance.
- Building energy modeling is essential for retrofit design, code compliance, and real-time building control in commercial and institutional buildings.
- Modelers can combine building analysis, climate, construction materials, architectural design, and HVAC systems.

WHY ENERGY MODELING PROFESSIONALS PURSUE THE ASHRAE BEMP

- Advance your career prospects and enhance your reputation. View survey results.
- Exhibit a high level of proficiency in essential building energy modeling competencies and skills. Identify the BEMPs.
- The digital insignia issued by BEMP ensures improved recognition.
- ISO/IEC 17024 (ID #1139)-accredited personnel certification program of the ANSI National Accreditation Board (ANAB), ensuring validity and impartiality
- International membership society for advancement of heating, ventilation, air conditioning, and refrigeration.
- Validates job competency in internationally recognized technical information.
- Reflects industry best practices.



WHY ENERGY MODELING PROFESSIONALS PURSUE THE ASHRAE BEMP

- Career prospects and standing should be enhanced. Refer to the survey results.
- Exhibit a high level of proficiency in essential components of building energy modeling. Determine who is BEMP.
- Improved recognition is ensured by the BEMP digital emblem.
- IEC 17024 (ID #1139)-accredited ANSI National Accreditation Board (ANAB) personnel certification program, which guarantees validity and impartiality.





BEMP EXAM KNOWLADGE DOMAIN

Build knowledge and skills across the four (4) Domains of the BEMP exam, which are:



Domain I: Establishing the Modeling Scope

Domain II: Components of Building and Energy Systems

Domain III: Applications of Energy Models for Buildings

Domain IV: Interpretations of Energy Model Results

I. ESTABLISHING THE MODELING SCOPE	
A. Modeling Objectives	
1.	Define the purpose of the modeling study.
2.	Interpret the design intent of the building project.
3.	Evaluate the suitability of available design and operational information.
4.	Link required project deliverables to goals of the modeling study.
B. Analysis Methodologies	
1.	Differentiate among calculation methods within available software and tools (e.g.):
a.	time-neutral (e.g.):
	- bin method. - degree day.
b.	time-sequencing (e.g.):
	- heat balance. - thermal network. - weighting factor. - parametric.
2.	Evaluate mathematical modeling methods for building components (e.g.):
	- empirical. - first-principle.
3.	Translate a building project into an energy model:
a.	simplify building physics to a mathematical model.
b.	anticipate the impact of simplification and model deficiencies.
c.	translate BIM data into an energy model
C. Software and Tool Selection	
1.	Evaluate the appropriateness of the methodology by characteristics of the project (e.g.):
	- project phase. - climate - building type.
2.	Select the optimal software and tools to meet output data needs of the project (e.g.):
	- life-cycle cost analysis. - individual component - energy use and demand. - performance.
D. Project Scheduling and Budget Considerations	
1.	Tailor the modeling strategy to the design phase (e.g.):
	- conceptual. - design benchmarking. - mid-design.
2.	Recognize budget implications of and on modeling methodology.
3.	Make approximations targeted toward specific model limitations





II. COMPONENTS OF BUILDING AND ENERGY SYSTEMS		
A. Location and Climate Definition		
1. Use commonly available data about the local climate (e.g.):		
- temperature. - humidity. - precipitation.	- solar. - elevation. - wind.	
2. Choose the best source of weather data for a project (e.g.):		
- long-term representative. - constructed.	- geographically equivalent. - historical for a time period.	
3. Identify site characteristics (e.g.):		
- microclimates. - orientation.	- adjacent buildings. - shading.	- reflectance. - vegetation effects.
B. Building Envelope and Partitions		
1. Model exterior and interior opaque surface performance (e.g.):		
- geometry. - boundary conditions.	thermal transmission and capacitance.	
2. Model ground-coupled surface performance		
3. Model fenestrations (e.g.):		
- solar heat gain. - shading. - reflectance.	- glazing. - framing. - spectral.	
4. Model building airflow (e.g.):		
- psychrometrics. - air-tightness.	driving forces of infiltration.	
C. Building HVAC Systems		
1. Model terminal equipment in each zone (e.g.):		
- perimeter heating. - fan coil units.	- heated / chilled radiant slabs. - VAV / CAV boxes.	
2. Model secondary distribution systems (e.g.):		
- air. - water.	refrigerant.	
3. Model primary energy systems (e.g.):		
- chillers. - boilers. - heat rejection.	- thermal storage. - combined heat and power.	
4. Model packaged systems (e.g.):		
- split. - roof-top.	packaged terminal air-conditioner.	
5. Model ventilation (e.g.):		
mechanical	natural	
D. Lighting Systems		
1. Model artificial lighting power.		
2. Model daylighting (e.g.):		
glare	illuminance	
3. Distribute lighting heat gain among room, return, and plenum.		

E. Other Internal and Process Loads	
1. Differentiate between space loads and building loads.	
2. Model loads as sensible, latent, or radiant fractions and thermal distribution (e.g.):	
- occupants. - water heating. - plug loads.	- appliances. - vertical transportation. - commercial refrigeration.
- external lighting. - special processes.	
F. District Energy Systems	
1. Model purchased energy.	
2. Model shared energy systems.	
G. Renewable Energy Systems	
1. Model solar thermal systems.	
2. Model onsite power generation (e.g.):	
photovoltaic.	wind.
3. Evaluate financing options for renewable energy (e.g., power purchase agreements, solar leases).	
H. Controls	
1. Model HVAC controls:	
a. temperature.	
b. humidification and de-humidification.	
c. supply air variation e.g.,	
- supply pressure variation. - supply temperature variation.	supply pressure and temperature coordination.
d. outside air ventilation e.g.,	
- quantity. - quality. - humidity.	- temperature. - demand-control.
e. supply and return flow (e.g.):	
- economizers. - exhaust.	- maximum and minimum. - capacity control.
2. Model lighting controls (e.g.):	
- illuminance. - occupancy. - time-based.	- glare considerations. - dimming.
3. Model controls for miscellaneous equipment (e.g.):	
- service hot water. - process equipment.	vertical transportation.
4. Describe basic control sequences (e.g.):	
2-position. - scheduled.	proportional integral derivative.
5. Sequence equipment to manage loads (e.g.):	
- pumps. - fans.	large plant equipment.

III. APPLICATIONS OF ENERGY MODELS FOR BUILDINGS

A. Simulation Comparisons

1. Compare alternative simulation results (e.g.):
 - code compliance
 - parametric studies
 - performance relative to standards
 - equipment and component selection
2. Compare a simulation to measured data.
 - a. statistical models.
 - b. calibrated building-specific data (e.g.):
 - forensics
 - measurement and verification
 - utility bills

B. Modeling Energy Performance

1. Choose whole-building metrics (e.g.):
 - cost
 - source energy consumption
 - emissions
 - site energy consumption
 - demand
 - PCI, EUI
2. Choose component metrics (e.g.):
 - equipment usage
 - component performance
 - equipment sizes
3. Choose metrics for indoor environmental performance (e.g.):
 - temperature
 - ventilation rate
 - humidity
 - daylighting

C. Evolution of Simulation Techniques to Meet Project Methods and Objectives

1. Adapt simulations to the project phase.
2. Customize simulations for changes in building use.

D. Baseline Building Models

1. Distinguish between regulated and non-regulated energy use.
2. Define model inputs that are the same for both the baseline and proposed design models (neutral independent and neutral dependent) and those that can be different.





IV. INTERPRETATIONS OF ENERGY MODEL RESULTS	
A. Verification and Troubleshooting of Simulation Results	
1. Perform reality check (e.g.):	▪ hand calculations ▪ mass and energy balance values ▪ conformance with expected
2. Perform software check (e.g.):	▪ metering ▪ input files ▪ hourly reports
3. Perform parametric bracketing to verify model sensitivity.	
4. Review data for anomalies.	
5. Reconcile anomalies using single time-step reports.	
6. Resolve loads not met and hours outside of control range.	
B. Analyzing and Comparing Modeling Results	
1. Analyze simulation outputs (e.g.):	▪ component metrics ▪ energy use intensity ▪ whole building metric
2. Compare outputs to targets (e.g.):	▪ rating programs ▪ codes ▪ building labelling programs
C. Economic Analyses	
1. Determine effects of utility rate structures and regulations on costs.	
2. Calculate financial metrics (e.g.):	▪ life-cycle costing ▪ effects of incentives ▪ investment performance
D. Sensitivity Analyses	
1. Perform a sensitivity analysis on modeling assumptions.	
2. Identify critical synergistic interactions of building components.	
E. Project Deliverable	
1. Communicate results.	
2. Communicate methodology and assumptions on which results are based.	
3. Submit documentation that affirms the accuracy and completeness of results.	

BEMP EXAM PREPARATION RESOURCES

- Standards: ANSI/ASHRAE Standard 55-2020, ANSI/ASHRAE Standard 62.1-2019, ANSI/ASHRAE Standard 90.1-2019 (SI), ANSI/ASHRAE Standard 189.1-2020, ASHRAE Standard 209-2018, ASHRAE Standard 211-2018, 2021ASHRAE Handbook—Fundamentals, 2020 ASHRAE Handbook—HVAC Systems & Equipment, 2019 ASHRAE Handbook—HVAC Applications Guidelines, ASHRAE Guideline 14-2014, ASHRAE Guideline 36-2021
- ASHRAE Learning Institute (ALI) and eLearning Center Courses: archived online courses, professional development seminars, short courses on ASHRAE Standards and Guidelines.
- Other Organizations Resources: Heat and Mass Transfer in Building Services Design, IESNA Lighting Handbook, Mechanical and Electrical Equipment for Buildings, Solar Radiation and Daylight Models.





CERTIFIED BUILDING ENERGY SIMULATION ANALYST

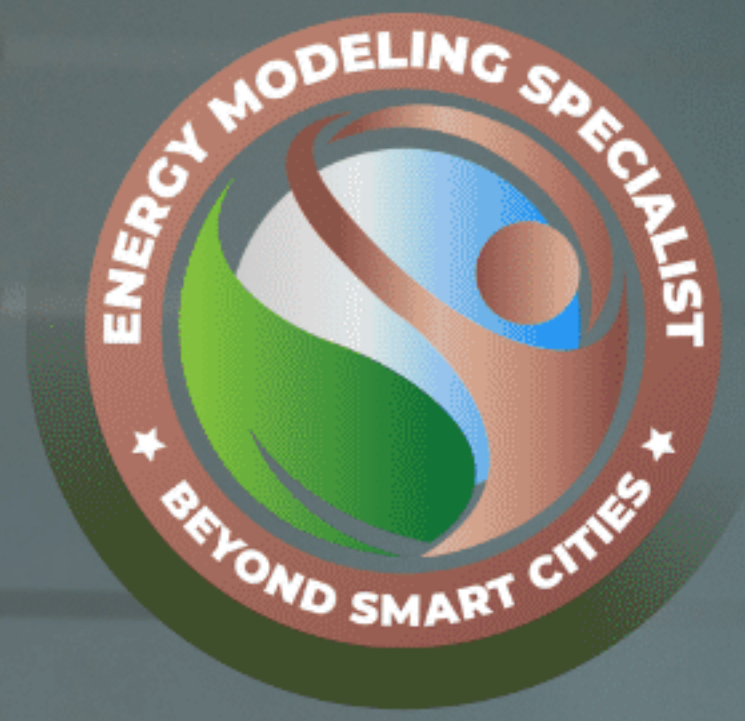
The AEE's Building Energy Simulation Analyst (BESA) professional certification aims to acknowledge persons who possess exceptional knowledge and practical experience in applying building energy simulation software to evaluate the energy efficiency of a facility.

Objectives:

- to raise the professional standards of those engaged in energy simulation.
- To improve the practice of energy simulators by encouraging energy simulation in a continuing education program for professional development.
- To identify persons with acceptable knowledge of the principles and practices of energy simulation through completing an examination and fulfilling prescribed standards of performance and conduct.
- to award special recognition to those energy simulation professionals who have demonstrated a high level of competence and ethical fitness in energy simulation.



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THANK YOU

