Instructions

for Participating in
ASHRAE's

Building Energy Modeling Professional (BEMP)

Certification
Program

Effective date: 02/01/2010

Related Resources

Resources available to help prepare for the BEMP examination include, but are not limited to, the following:

- ANSI/ASHRAE Standard 55-2004: Thermal Environmental Conditions for Human Occupancy
- ANSI/ASHRAE Standard 62.1-2004 and 2007 update: Ventilation for Acceptable Indoor Air Quality
- ANSI/ASHRAE/IESNA Standard 90.1-2004 and 2007 update: Energy Standard for Buildings Except Low-Rise Residential Buildings
- ANSI/ASHRAE/IESNA Standard 100-2006: Energy Conservation in Existing Buildings
- ANSI/ASHRAE Standard 140-2007: Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs
- ASHRAE Guideline 14-2002: Measurement of Energy and Demand Savings
- User's Manual for ANSI/ASHRAE/IESNA Standard 90.1
- 2009 ASHRAE Handbook—Fundamentals
- CIBSE Applications Manual AM11: 1998, Building energy and environmental modelling IESNA Lighting Handbook, 9th Edition
- Solar Radiation and Daylight Models by T. Muneer
- Heat and Mass Transfer in Building Services Design by Keith J. Moss
- Mechanical and Electrical Equipment for Buildings by Benjamin Stein, John S. Reynolds
- Complying with Standard 62.1-2007 – ASHRAE Learning Institute instructor-led seminar
- Complying with Standard 90.1-2007 – ASHRAE Learning Institute instructor-led seminar
- Standard 90.1 – ASHRAE eLearning course
- Standard 62.1 – ASHRAE eLearning course
- Fundamentals of HVAC Systems – ASHRAE eLearning course
- Fundamentals of Sustainable Buildings – ASHRAE eLearning course

ASHRAE does not warrant that participation in or use of any of the above resources will guarantee successful completion of the examination. Nor does ASHRAE warrant that all information presented in all of the above resources is non-contradictory. However, ASHRAE will do its best to avoid testing contradictory, out-of-date, or inaccurate information.

Effective Date: 12-1-2009

American Society of Heating, Refrigerating and Air-Conditioning Engineers

Building Energy Modeling Professional Examination Detailed Content Outline*

Open cells show an examination could include items from indicated cognitive levels.
Shaded cells prevent appearance of items on examinations.

	Items: Cognitive Level – Recall	Application	Analysis	Totals
I. ESTABLISHING THE MODELING SCOPE	**3**	**7**	**7**	**17**
A. Modeling Objectives	**0**	**1**	**2**	**3**
1. Define the purpose of the modeling study				
2. Interpret the design intent of the building project				
3. Evaluate the completeness of the design and operation information				
4. Link required project deliverables to goals of the modeling study				
B. Analysis Methodologies	**2**	**3**	**3**	**8**
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 of thermodynamics • regression				
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. Software and Tool Selection	**1**	**2**	**1**	**4**
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 performance • energy use and demand				

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D. Project Scheduling and Budget Considerations	**0**	**1**	**1**	**2**
1. Tailor the modeling strategy to the design phase e.g., • conceptual • mid-design • design benchmarking	(shaded)			(shaded)
2. Recognize budget implications of and on modeling methodology	(shaded)			(shaded)
3. Make approximations targeted toward specific model limitations	(shaded)			(shaded)
II. COMPONENTS OF BUILDING AND ENERGY SYSTEMS	**14**	**18**	**16**	**48**
A. Location and Climate Definition	**2**	**1**	**1**	**4**
1. Use commonly available data about the local climate e.g., • temperature • humidity • precipitation • solar • elevation • wind			(shaded)	(shaded)
2. Choose the best source of weather data for a project e.g., • long-term representative • constructed • geographically equivalent • historical for a time period				(shaded)
3. Identify site characteristics e.g., • microclimates • orientation • adjacent buildings • shading • reflectance • vegetation effects • local wind • solar effects				(shaded)
B. Building Envelope and Partitions	**1**	**3**	**2**	**6**
1. Model exterior and interior opaque surface performance e.g., • geometry • boundary conditions • thermal transmission and capacitance				(shaded)
2. Model ground-coupled surface performance				(shaded)
3. Model fenestrations e.g., • solar heat gain • shading • reflectance • glazing • framing • spectral				(shaded)
4. Model building airflow e.g., • psychrometrics • air-tightness • driving forces of infiltration				(shaded)

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	Recall	Application	Analysis	Totals
C. Building HVAC Systems	**3**	**3**	**3**	**9**
1. Model terminal equipment in each zone e.g., • perimeter heating • fan coil units • heated / chilled radiant slabs • VAV / CAV boxes				(shaded)
2. Model secondary distribution systems e.g., • air • water • refrigerant				(shaded)
3. Model primary energy systems e.g., • chillers • boilers • heat rejection • thermal storage • combined heat and power				(shaded)
4. Model packaged systems e.g., • split • roof-top • packaged terminal air-conditioner			(shaded)	(shaded)
5. Model ventilation e.g., • mechanical • natural				(shaded)
D. Lighting Systems	**1**	**1**	**1**	**3**
1. Model artificial lighting power			(shaded)	(shaded)
2. Model daylighting e.g., • glare • illuminance				(shaded)
3. Distribute lighting heat gain among room, return, and plenum				(shaded)
E. Other Internal and Process Loads	**2**	**2**	**3**	**7**
1. Differentiate between space loads and building loads		(shaded)	(shaded)	(shaded)
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				(shaded)
F. District Energy Systems	**0**	**1**	**1**	**2**
1. Model purchased energy	(shaded)		(shaded)	(shaded)
2. Model shared energy systems	(shaded)			(shaded)

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	Items			
	Cognitive Level			
	Recall	**Application**	**Analysis**	**Totals**
G. Renewable Energy Systems	**1**	**1**	**1**	**3**
1. Model solar thermal systems				
2. Model onsite power generation e.g., • photovoltaic • wind • micro-hydro				
H. Controls	**4**	**6**	**4**	**14**
1. Model HVAC controls				
a. temperature				
b. humidification and de-humidification				
c. pressure				
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 • energy-rate 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				

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	Recall	**Application**	**Analysis**	**Totals**
III. APPLICATIONS OF ENERGY MODELS FOR BUILDINGS	**3**	**6**	**3**	**12**
A. Simulation Comparisons	**1**	**2**	**1**	**4**
1. Compare alternative simulation results e.g., • code compliance • performance relative to standards • parametric studies • equipment and component selection				
2. Compare a simulation to measured data				
a. statistical models				
b. calibrated building-specific data e.g., • forensics • utility bills • measurement and verification				
B. Modeling Energy Performance	**2**	**3**	**1**	**6**
1. Choose whole-building metrics e.g., • cost • emissions • demand • source energy consumption • site energy consumption				
2. Choose component metrics e.g., • equipment usage • equipment sizes • component performance				
3. Choose metrics for indoor environmental performance e.g., • temperature • humidity • ventilation rate • daylighting				
C. Evolution of Simulation Techniques to Meet Project Methods and Objectives	**0**	**1**	**1**	**2**
1. Adapt simulations to the project phase				
2. Customize simulations for changes in building use				

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IV. INTERPRETATIONS OF ENERGY MODEL RESULTS	**5**	**10**	**8**	**23**
A. Verification and Troubleshooting of Simulation Results	**1**	**3**	**3**	**7**
1. Perform reality check e.g., • hand calculations • mass and energy balance • conformance with expected values				(shaded)
2. Perform software check e.g., • metering • input files • hourly reports				(shaded)
3. Perform parametric bracketing to verify model sensitivity				(shaded)
4. Review data for anomalies				(shaded)
5. Reconcile anomalies using single time-step reports				(shaded)
6. Resolve loads not met and hours outside of control range				(shaded)
B. Analyzing and Comparing Modeling Results	**2**	**4**	**2**	**8**
1. Analyze simulation outputs e.g., • component metrics • energy use intensity • whole building metric				(shaded)
2. Compare outputs to targets e.g., • rating programs • codes • building labelling programs			(shaded)	(shaded)
C. Economic Analyses	**1**	**1**	**1**	**3**
1. Determine effects of utility rate structures and regulations on costs				(shaded)
2. Calculate financial metrics e.g., • life-cycle costing • cash flow • investment performance • client financing needs			(shaded)	(shaded)
3. Estimate the effects of incentives				(shaded)
D. Sensitivity Analyses	**0**	**1**	**1**	**2**
1. Perform a sensitivity analysis on modeling assumptions	(shaded)			(shaded)
2. Identify critical synergistic interactions of building components	(shaded)			(shaded)

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	Recall	Application	Analysis	Totals
E. Project Deliverable	**1**	**1**	**1**	**3**
1. Communicate results				
2. Communicate methodology and assumptions on which results are based				
3. Submit documentation that affirms the accuracy and completeness of results				
4. Recommend actions				
Totals	**25**	**41**	**34**	**100**

* Each new test form will include two 15-item pretests (e.g., 1A, 1B).

Renewal Requirements for ASHRAE Certification Programs

Each Certificant is required to renew his/her certification every three years. The renewal process includes submittal of a renewal fee ($125 for members, $195 for non-members) and evidence of earning 45 ASHRAE Continuing Education (ACE) units during each three-year renewal period.*

The three-year renewal period starts on December 31 of the year in which the Certificant earns the certification. For example, a Certificant who earns the certification anytime in 2008 will have a renewal deadline of December 31, 2011.

Individuals who fail to submit renewal fees and evidence of the required ACEs by the December 31 deadline will be considered as "non-renewing," notified accordingly, and advised to cease using the specific certification designation after their names. The names of non-renewing Certificants will be removed from the list of Certificants on ASHRAE's website.

To be reinstated, non-renewing Certificants must submit the renewal fee, a reinstatement fee ($60), and evidence of the required ACEs by December 31 of the year following their active status. After that date, non-renewing Certificants must follow the same process as that for the initial application. Extenuating circumstances will be reviewed on a case-by-case basis by the Committee.

Acceptable Methods of Obtaining ACE credits

Type	**Credits**
Successful completion of a course in a related field from an accredited institution of higher learning Note: To qualify for this credit, a course must be offered regularly and must conclude with a test that sets a passing grade.	15 ACEs per credit hour (semester system) OR 10 ACEs (quarter system)
Patent Note: Credit can be claimed after a patent is issued and the inventor submits details to the board. The invention must be related to engineering.	10 ACEs
Publication of article/paper/book in recognized peer reviewed journal in relevant field (max. 3 per year). Note: A "news" article in a technical or professional bulletin is not considered a published paper.	10 ACEs per published item
Active participation in a professional or technical society relevant to the field Note: The certificant must serve as an officer and/or must actively participate in a committee of the organization. PDH credits are earned at the end of each year of service.	2 ACEs per year per organization
Writing ASHRAE certification exam items in relevant field	5 ACEs per exam
Accreditation Visit Evaluator (or ASHRAE approved equivalent)	3 ACEs per year
Professional awards	2 ACEs per award
Teaching of approved courses and workshops in relevant field Note: Teaching credit is valid for teaching a course or seminar for the first time only. It does not apply to faculty performing regular duties.	ACEs are determined by multiplying by two (2) the total number of course hours (for preparation time).
Attendance at meetings and conferences (e.g. National, Annual, Regional) or special conferences relevant to the field	Qualifying seminars and workshops will be based on one ACE unit for each hour of attendance.
Attendance and completion of approved short courses and other continued education activities in relevant field	Qualifying seminars and workshops will be based on one ACE unit for each hour of attendance.

*Certificants are not required to submit a report of Professional Development activities as part of certification renewal. A percentage of Certificants are randomly chosen for audit each year. If audited, a report of continuing professional development with documentation must be submitted to the Certification Coordinator for review.

Activities that qualify for ASHRAE's Continuing Education units **might** also qualify for continuing education credits (e.g., PDHs, CEUs, or LUs) from other credentialing bodies or organizations. The individual is responsible for contacting the relevant governing body to determine whether an activity qualifies for that body's continuing education credit.

For questions about any of the information about ASHRAE's certification renewal requirements, including clarification of acceptable and reportable qualifying activities, please contact ASHRAE's Certification Coordinator at certification@ASHRAE.org.