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Commercial Workforce Credentialing Council

Building Energy Manager
Educational/Training Outline

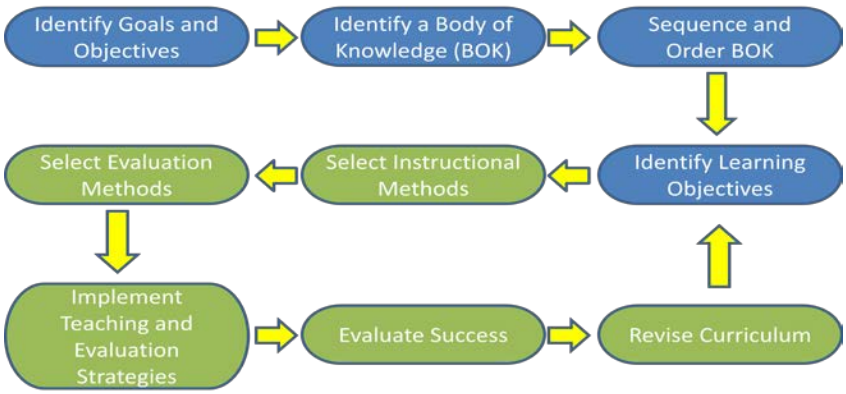
Introduction

A Building Energy Manager is responsible for managing and continually improving energy performance in commercial buildings by establishing and maintaining an energy program management system that supports the mission and goals of the organization. The major tasks of a Building Energy Manager are to:

- Plan Effective Energy Management
- Manage Energy Information
- Implement an Energy Management Program
- Manage Budgets and Finances
- Implement Energy Efficiency Projects
- Manage Energy Communications

Curriculum Design

The process used to define the components to be included in an educational/training program for Building Energy Manager includes the stages as depicted in the following graphic:



The goals and objectives of an educational/training program must first be defined. For purposes of this program, the goals and objectives of the educational/training program are as follows:

- To prepare an individual to work as an entry level Building Energy Manager

- To provide building energy management foundational knowledge to allow an individual to function sufficient to obtain the experience required to meet eligibility requirements for obtaining a professional credential as a Building Energy Manager.

Then a body of knowledge must be identified. In the case of Building Energy Manager the body of knowledge was identified through a job/task analysis. The body of knowledge was then sequenced and ordered to facilitate instruction of the content.

Curriculum

Following is a proposed curriculum. This curriculum is designed to cover all content for which a Building Energy Manager should be proficient. However not all content may be taught in a single course. For example some of the content may be part of other building construction programs. To use the course outline, community colleges and vocational institutions are recommended to review existing courses to identify content that may already be incorporated in existing courses. Then a course should be developed only to cover the remaining content not covered in existing courses. Instructional design experts and instructional staff would then select the learning activities to ensure the student learns the content including:

- Selection of textbooks and other appropriate course materials
- Creation of learning activities (lectures, handouts, performance activities, etc.)
- Creation of assessment and evaluation activities to verify learning
- Creation of curriculum evaluation activities

Course Outline

I. Building Systems

a. Air compressor and distribution systems
b. Air distribution systems
c. Building automation systems
d. Building control systems
e. Building envelope
f. Chilled water systems
g. Combined heat and power systems
h. Cooling tower systems
i. Electrical power systems
j. Energy metering and monitoring systems
k. Energy recovery systems
l. Heating hot water systems
m. Hot water systems
n. HVAC control systems
o. HVAC systems
p. Lighting control systems
q. Lighting systems

r. Potable cold water systems
s. Pumps and pumping systems
t. Renewable energy systems
u. Steam and hot water systems
v. Steam distribution systems
w. Variable drive systems

II. Building Sciences
a. Glare Control
b. Heat transfer
c. IAQ
d. Orientation/daylighting
e. Photometrics
f. Psychrometrics
g. Thermal comfort
h. Thermodynamics (1st and 2nd)

III. Basic Energy Concepts and Principles
a. Energy unit conversion
b. Power vs. energy
c. 1^{st} Law
d. 2^{nd} Law

IV. Energy Usage and Baselines
a. Energy data (utility bills, historical weather data, occupancy data, etc.)
b. Calculating energy performance metrics (EUI, EnPI, etc.)
c. Benchmarking energy usage
d. Setting up trend histories (BAS, EMS, etc.)
e. Forecasting energy usage
f. Energy Reports (internal and external to the facilities)
g. Auditing utility invoices and bills

V. Energy Management Program
a. Energy management initiatives
b. Energy management policies and procedures
c. Energy auditing
d. Energy saving opportunities
e. Prioritizing energy opportunities
f. Analyzing energy management data

VI. Budgeting and Finances
a. Prepare energy budgets
b. Cost effective energy sources
c. Capital improvement planning
d. Financial analysis methods (life cycle cost analysis, ROI, simple payback, etc.)
e. Forecasting energy costs

VII. Commissioning
- a. Facility energy performance
- b. Operational controls
- c. O&M deficiencies
- d. Corrective and preventative actions
- e. Documentation

VIII. Energy Efficiency (capital improvement) Projects
- a. Project planning and construction documentation
- b. Construction management
- c. Project close-out activities
- d. Monitoring project performance

IX. Energy Communications
- a. Advocating for energy conservation
- b. Communicating energy information to others
- c. Coordinating with external parties

X. Health and Safety
- a. Construction safety
- b. Electrical safety
- c. Indoor air quality
- d. Outdoor air quality
- e. Worker safety
- f. PPE

XI. Energy Tools, Equipment and Resources
- a. AFDD (Automated Fault Detection and Diagnostics)
- b. ANSI standards pertaining to Energy
- c. ASHRAE guidelines and standards
- d. ASHRAE procedures for commercial buildings energy audits
- e. ASHRAE standards (62, 55, 90.1, etc.)
- f. Building codes
- g. Building operation plan
- h. CMMS
- i. Computer
- j. Construction documents
- k. Contract documents
- l. EISs
- m. EMCS/BAS
- n. EMCSs
- o. Energy codes
- p. Energy forecast tables (EIA, NIST)
- q. HR policies and procedures (job descriptions, etc.)
- r. IESNA
- s. Interval data
- t. ISO 50001

u. Latest journals and other references
v. M&V Protocols
w. Measurement & Verification Standards
x. Metering tools
y. Modeling software
z. National benchmarking data (e.g., EIA, Energy STAR, CBECS)
aa. Nationally recognized energy benchmarking standards (e.g., ENERGY STAR)
bb. Printer
cc. Real time access to utility account
dd. Scheduling software
ee. Sequence of operation plan
ff. Software
gg. Specialized training
hh. Utility accounting software
ii. Utility rate schedules

XII. Energy Testing Instruments
a. Air balance hood
b. Anemometer
c. Combustion analyzer
d. Data loggers (temperature, RH, current, light, etc.)
e. Electric press gauge (manometer)
f. I.A.Q Meter (CO2, CO, RH, temperature)
g. Infrared camera
h. Infrared temperature gun
i. Light meter
j. Multimeter (air data)
k. Multimeter (electric)
l. Power analyzer/meter
m. Psychrometer
n. Tachometer
o. Thermometer (air, water, type-K)
p. Velocity grid (Vel-Grid)
q. Vibration analyzer
r. Water manometer (D.P.)

Learning Objectives

The following learning objectives are identified as the desired outcome of instruction. These objectives should be reviewed and sequenced according to like objectives by subject matter experts familiar with the content.

1. Upon completion of the course, the student will be able to identify an energy management scope
2. Upon completion of the course, the student will be able to identify regulatory requirements associated with energy management scopes

3. Upon completion of the course, the student will be able to review budgets associated with energy management projects
4. Upon completion of the course, the student will be able to define utilities that are being managed
5. Upon completion of the course, the student will be able to identify stakeholders to an energy management program
6. Upon completion of the course, the student will demonstrate knowledge of basic energy concepts and principles
7. Upon completion of the course, the student will demonstrate knowledge of best practices for energy efficiency
8. Upon completion of the course, the student will demonstrate knowledge of building sciences
9. Upon completion of the course, the student will demonstrate knowledge of building systems
10. Upon completion of the course, the student will demonstrate knowledge of energy efficient measures (EEM) and economics of EEMs
11. Upon completion of the course, the student will demonstrate knowledge of various facility processes and operations
12. Upon completion of the course, the student will be able to develop energy management policies and objectives
13. Upon completion of the course, the student will be able to review policies, commitments, and regulations associated with energy management projects
14. Upon completion of the course, the student will be able to establish energy management strategies
15. Upon completion of the course, the student will be able to identify responsibility for utility expenditures
16. Upon completion of the course, the student will be able to describe how to obtain buy-in from stakeholders
17. Upon completion of the course, the student will demonstrate knowledge of energy unit calculations
18. Upon completion of the course, the student will demonstrate knowledge of energy industry terminology, jargon and acronyms
19. Upon completion of the course, the student will be able to assess energy usage
20. Upon completion of the course, the student will be able to gather historical utility bill data
21. Upon completion of the course, the student will be able to identify energy sources
22. Upon completion of the course, the student will be able to identify what is controllable and what is not in a facility
23. Upon completion of the course, the student will be able to perform an energy balance
24. Upon completion of the course, the student will be able to identify and document significant uses of energy in a facility
25. Upon completion of the course, the student will be able to obtain interval energy data
26. Upon completion of the course, the student will be able to compile energy usage data

27. Upon completion of the course, the student will be able to determine energy indices that should be tracked
28. Upon completion of the course, the student will be able to review energy contracts
29. Upon completion of the course, the student will be able to identify historical weather data
30. Upon completion of the course, the student will be able to identify other relevant variables (occupancy data, etc.) affecting energy use
31. Upon completion of the course, the student will be able to analyze energy performance (load profile, correlation, utility consumptions, long term trend analyses, etc.)
32. Upon completion of the course, the student will be able to verify accuracy of energy data
33. Upon completion of the course, the student will be able to calculate performance metrics (EUI, EnPI, etc.)
34. Upon completion of the course, the student will demonstrate knowledge of basic statistics
35. Upon completion of the course, the student will demonstrate knowledge of energy calculations
36. Upon completion of the course, the student will demonstrate knowledge of energy source pricing structures
37. Upon completion of the course, the student will demonstrate knowledge of how to interpret interval data
38. Upon completion of the course, the student will demonstrate knowledge of how to interpret weather data
39. Upon completion of the course, the student will demonstrate knowledge of normalization
40. Upon completion of the course, the student will demonstrate knowledge of how to verify energy data
41. Upon completion of the course, the student will demonstrate knowledge of utility rate structures and schedules
42. Upon completion of the course, the student will be able to identify energy performance baselines
43. Upon completion of the course, the student will be able to determine historical timeframes (3 years, 5 years, etc.)
44. Upon completion of the course, the student will be able to establish baseline metrics (average, base-year, etc.)
45. Upon completion of the course, the student will be able to review standards/codes for baselines
46. Upon completion of the course, the student will be able to determine benchmarks to compare to (Energy STAR PM, etc.)
47. Upon completion of the course, the student will be able to forecast energy usage baseline
48. Upon completion of the course, the student will be able to conduct benchmarking
49. Upon completion of the course, the student will be able to plan energy audits
50. Upon completion of the course, the student will be able to identify energy audit scopes
51. Upon completion of the course, the student will be able to review previous energy audits
52. Upon completion of the course, the student will be able to establish energy audit methodologies
53. Upon completion of the course, the student will be able to develop an RFP for an energy audit
54. Upon completion of the course, the student will be able to identify utility and interval data

55. Upon completion of the course, the student will be able to identify building documentation
56. Upon completion of the course, the student will be able to coordinate access and scheduling
57. Upon completion of the course, the student will be able to conduct/supervise energy audits
58. Upon completion of the course, the student will be able to review and share preliminary energy audit results with other stakeholders
59. Upon completion of the course, the student will be able to analyze audit reports
60. Upon completion of the course, the student will demonstrate knowledge of best practices in measurement and verification methodology
61. Upon completion of the course, the student will demonstrate knowledge of energy auditing equipment
62. Upon completion of the course, the student will demonstrate knowledge of specialized facility types (labs, clean rooms, hospitals, etc.)
63. Upon completion of the course, the student will be able to identify energy opportunities
64. Upon completion of the course, the student will be able to identify and forecast energy opportunities
65. Upon completion of the course, the student will be able to survey facility staff and occupants
66. Upon completion of the course, the student will be able to analyze maintenance logs
67. Upon completion of the course, the student will be able to identify energy data gaps
68. Upon completion of the course, the student will be able to prioritize energy opportunities
69. Upon completion of the course, the student will be able to establish financial analysis methods (life cycle costs analysis, ROI, simple payback, etc.)
70. Upon completion of the course, the student will be able to align prioritized opportunities with organizational mission, goals and capital plans
71. Upon completion of the course, the student will be able to identify non-energy benefits (e.g. IEQ, productivity, reliability)
72. Upon completion of the course, the student will be able to identify sources for external funding
73. Upon completion of the course, the student will be able to establish criteria for energy opportunity prioritization
74. Upon completion of the course, the student will demonstrate knowledge of financial analysis methodologies and thresholds (e.g. life cycle cost analysis, ROI)
75. Upon completion of the course, the student will demonstrate knowledge of indoor environmental quality standards (lighting, temperature, etc.)
76. Upon completion of the course, the student will demonstrate knowledge of project delivery methods (ESCO, PPA, etc.)
77. Upon completion of the course, the student will demonstrate knowledge of utility and tax incentives
78. Upon completion of the course, the student will be able to consult on capital (non-energy) projects
79. Upon completion of the course, the student will be able to review construction documents for energy efficiency

80. Upon completion of the course, the student will be able to review construction documents to ensure that metrics previously defined are adhered to
81. Upon completion of the course, the student will be able to review construction documents to ensure they are aligned with energy program mission and goals
82. Upon completion of the course, the student will be able to advocate for energy efficiency measures
83. Upon completion of the course, the student will be able to ensure proper equipment is specified
84. Upon completion of the course, the student will be able to propose energy efficient and cost effective alternatives
85. Upon completion of the course, the student will be able to advocate for commissioning
86. Upon completion of the course, the student will be able to create structure for coordination (energy committee, etc.)
87. Upon completion of the course, the student will be able to gather energy management data (utility, weather, etc.)
88. Upon completion of the course, the student will be able to develop a monitoring methodology
89. Upon completion of the course, the student will be able to define data collection infrastructure and methods
90. Upon completion of the course, the student will be able to assign responsibilities for data (obtaining, entering, etc.)
91. Upon completion of the course, the student will be able to set up trend histories (BAS, EMS, etc.)
92. Upon completion of the course, the student will be able to determine information reliability
93. Upon completion of the course, the student will be able to correct data gaps
94. Upon completion of the course, the student will be able to implement facility metering and sub-metering
95. Upon completion of the course, the student will be able to implement data collection (EDI, etc.)
96. Upon completion of the course, the student will be able to define recordkeeping and reporting requirements
97. Upon completion of the course, the student will demonstrate knowledge of energy information systems (EISs)
98. Upon completion of the course, the student will demonstrate knowledge of energy management control systems (EMCSs)
99. Upon completion of the course, the student will be able to analyze energy management data
100. Upon completion of the course, the student will be able to calculate energy performance metrics
101. Upon completion of the course, the student will be able to identify sources of data for metrics desired
102. Upon completion of the course, the student will be able to calculate metrics on an ongoing basis
103. Upon completion of the course, the student will be able to compare results to baselines and benchmarks

104. Upon completion of the course, the student will be able to define level of deviation to be labeled "significant"
105. Upon completion of the course, the student will be able to identify cost implications
106. Upon completion of the course, the student will demonstrate knowledge of typical ranges of energy performance metrics
107. Upon completion of the course, the student will demonstrate knowledge of weather effects on energy use
108. Upon completion of the course, the student will be able to complete reports (internal and external)
109. Upon completion of the course, the student will be able to identify reporting needs
110. Upon completion of the course, the student will be able to identify audiences for reports
111. Upon completion of the course, the student will be able to complete recurring reports
112. Upon completion of the course, the student will be able to complete exception reports
113. Upon completion of the course, the student will be able to complete project reports
114. Upon completion of the course, the student will be able to implement the energy program managerial initiatives (training, procurement, communication, and design standards)
115. Upon completion of the course, the student will be able to identify energy management initiatives
116. Upon completion of the course, the student will be able to design the energy management initiatives in accordance with planned policies and objectives
117. Upon completion of the course, the student will be able to identify resources required to implement energy management initiatives
118. Upon completion of the course, the student will be able to implement energy management initiatives
119. Upon completion of the course, the student will be able to develop awareness programs for stakeholders (behavioral, etc.)
120. Upon completion of the course, the student will be able to describe how to coordinate team resources
121. Upon completion of the course, the student will be able to manage staff
122. Upon completion of the course, the student will be able to assign roles and responsibilities
123. Upon completion of the course, the student will be able to describe how to obtain and retain external expertise
124. Upon completion of the course, the student will be able to maintain professional requirements
125. Upon completion of the course, the student will be able to describe how to obtain buy-in of stakeholders
126. Upon completion of the course, the student will be able to describe how to obtain authorization/approval for energy management activities
127. Upon completion of the course, the student will be able to evaluate results of managerial initiatives (training, procurement, communication, and design)
128. Upon completion of the course, the student will be able to evaluate the energy management initiatives (training, behavioral and capital)

129. Upon completion of the course, the student will be able to implement improvements for energy management initiatives
130. Upon completion of the course, the student will be able to communicate findings to appropriate parties
131. Upon completion of the course, the student will demonstrate knowledge of energy initiative evaluation methodologies
132. Upon completion of the course, the student will be able to manage ongoing commissioning
133. Upon completion of the course, the student will be able to evaluate facility energy performance
134. Upon completion of the course, the student will be able to maintain operational controls
135. Upon completion of the course, the student will be able to analyze trend data
136. Upon completion of the course, the student will be able to identify operations and maintenance (O&M) deficiencies
137. Upon completion of the course, the student will be able to implement corrections, preventative actions or corrective actions
138. Upon completion of the course, the student will be able to conduct building systems re-training
139. Upon completion of the course, the student will be able to verify outcome of corrections, preventative actions or corrective actions
140. Upon completion of the course, the student will be able to manage user behaviors
141. Upon completion of the course, the student will be able to document system and procedural changes
142. Upon completion of the course, the student will demonstrate knowledge of building operations planning and design loads
143. Upon completion of the course, the student will demonstrate knowledge of commissioning processes
144. Upon completion of the course, the student will demonstrate knowledge of sequence of operations
145. Upon completion of the course, the student will be able to audit utility invoices
146. Upon completion of the course, the student will be able to gather rate and contract information (e.g., schedules, etc.)
147. Upon completion of the course, the student will be able to validate bills with meter data (monthly and interval)
148. Upon completion of the course, the student will be able to conduct component analysis (KW, KWH, KVAR, taxes, transportation costs, water and sewage credits, etc.)
149. Upon completion of the course, the student will be able to compare utility data with historical and benchmark trends for abnormalities and opportunities
150. Upon completion of the course, the student will be able to review and approve invoices
151. Upon completion of the course, the student will demonstrate knowledge of utility meter types
152. Upon completion of the course, the student will demonstrate knowledge of utility rates, tariffs, and contracts
153. Upon completion of the course, the student will be able to forecast energy costs

154. Upon completion of the course, the student will be able to plan for capital and operational changes
155. Upon completion of the course, the student will be able to check for utility rate increases
156. Upon completion of the course, the student will be able to apply corrections to baseline forecasts
157. Upon completion of the course, the student will be able to report forecasted energy cost
158. Upon completion of the course, the student will be able to procure cost effective energy sources
159. Upon completion of the course, the student will be able to evaluate alternative energy supply options (dynamic pricing, renewable, deregulated purchasing, etc.)
160. Upon completion of the course, the student will be able to evaluate rate plan options
161. Upon completion of the course, the student will be able to investigate demand response programs
162. Upon completion of the course, the student will be able to review impact on charge backs (tenants)
163. Upon completion of the course, the student will be able to make energy source recommendations to procurement
164. Upon completion of the course, the student will be able to implement procurement changes
165. Upon completion of the course, the student will demonstrate knowledge of basic energy engineering calculations
166. Upon completion of the course, the student will demonstrate knowledge of procurement processes
167. Upon completion of the course, the student will be able to prepare budgets
168. Upon completion of the course, the student will be able to review operations and capital master plans
169. Upon completion of the course, the student will be able to budget for utilities
170. Upon completion of the course, the student will be able to budget for energy program costs (including initiatives and projects)
171. Upon completion of the course, the student will be able to plan project implementations
172. Upon completion of the course, the student will be able to create baselines and set up M&Vs
173. Upon completion of the course, the student will be able to create scopes of work
174. Upon completion of the course, the student will be able to determine best procurement path (bid, internal, etc.)
175. Upon completion of the course, the student will be able to develop project specifications and guidelines
176. Upon completion of the course, the student will be able to review project specifications for code compliance
177. Upon completion of the course, the student will be able to coordinate work with stakeholders and user groups
178. Upon completion of the course, the student will be able to create the project plan
179. Upon completion of the course, the student will demonstrate knowledge of energy accounting
180. Upon completion of the course, the student will demonstrate knowledge of risk assessment

181. Upon completion of the course, the student will be able to implement energy projects
182. Upon completion of the course, the student will be able to manage project contractors
183. Upon completion of the course, the student will be able to conduct construction management activities (change orders, submittals, RFIs, contractor invoices, etc.)
184. Upon completion of the course, the student will be able to monitor project progress
185. Upon completion of the course, the student will be able to report on project progress
186. Upon completion of the course, the student will be able to conduct commissioning activities
187. Upon completion of the course, the student will be able to initiate M&V activities
188. Upon completion of the course, the student will demonstrate knowledge of construction management
189. Upon completion of the course, the student will demonstrate knowledge of industry accepted codes, standards and regulations
190. Upon completion of the course, the student will be able to conduct project close-out activities
191. Upon completion of the course, the student will be able to conduct final inspections and testing
192. Define maintenance requirements
193. Obtain close-out documentation (As-Builts, sequence of operations, warranties, etc.)
194. Upon completion of the course, the student will be able to conduct training
195. Upon completion of the course, the student will be able to review lessons learned
196. Upon completion of the course, the student will be able to obtain incentives
197. Upon completion of the course, the student will be able to conduct financial close-out activities
198. Upon completion of the course, the student will be able to prepare final reports (executive summaries, white papers, etc.)
199. Upon completion of the course, the student will demonstrate knowledge of incentive programs
200. Upon completion of the course, the student will demonstrate knowledge of best practices in maintenance programs
201. Upon completion of the course, the student will be able to monitor project performance
202. Upon completion of the course, the student will be able to conduct M&V activities
203. Upon completion of the course, the student will be able to conduct ongoing monitoring activities
204. Upon completion of the course, the student will be able to report on project monitoring
205. Upon completion of the course, the student will be able to verify maintenance is performed
206. Upon completion of the course, the student will be able to take corrective actions as required
207. Upon completion of the course, the student will demonstrate knowledge of M&V methodologies
208. Upon completion of the course, the student will be able to advocate for energy conservation
209. Upon completion of the course, the student will be able to communicate the benefits of energy efficiency (climate change effects, air quality, savings, non-energy benefits, etc.)
210. Upon completion of the course, the student will be able to educate stakeholders about why energy is important
211. Upon completion of the course, the student will be able to evaluate effectiveness of communications efforts

212. Upon completion of the course, the student will be able to communicate progress towards energy goals and objectives
213. Upon completion of the course, the student will be able to support organization (PR) in communications to media/press and/or stakeholders
214. Upon completion of the course, the student will be able to communicate energy information to senior management
215. Upon completion of the course, the student will be able to create progress report
216. Upon completion of the course, the student will be able to tailor data for audience
217. Upon completion of the course, the student will be able to offer suggestions for improvement
218. Upon completion of the course, the student will be able to prepare standard and ad-hoc reports (legal compliance, regulatory agencies, etc.)
219. Upon completion of the course, the student will be able to coordinate energy program with external parties
220. Upon completion of the course, the student will be able to interface with regulatory bodies (e.g. PUCs, municipalities)
221. Upon completion of the course, the student will be able to interface utility companies and other supplies
222. Upon completion of the course, the student will be able to interface with certification groups (Energy Star, USGBC, Green Globes, ISO, etc.)