



Western Technical College

10481114 Energy Management Capstone

Course Outcome Summary

Course Information

Description	This will be a cumulative application of the concepts of all technical skills and general knowledge obtained throughout the curriculum to a sponsored project. These projects will be either industry, community or municipality sponsored and will range from industrial, commercial or residential in nature. Students will perform complete design, analysis, specification, and commissioning of a variety of energy management systems, thermal systems, or other renewable and energy efficiency systems. A final project report will be presented to the sponsor, community forum and the advisory board.
Career Cluster	Architecture and Construction
Instructional Level	Associate Degree Courses
Total Credits	4
Total Hours	108

Pre/Corequisites

Prerequisite	10481107 High Performance Buildings
Prerequisite	10481108 Energy Modeling 2

Textbooks

No textbook required.

Success Abilities

1. Cultivate Passion: Enhance Personal Connections
2. Cultivate Passion: Expand a Growth-Mindset
3. Cultivate Passion: Increase Self-Awareness
4. Live Responsibly: Develop Resilience
5. Live Responsibly: Embrace Sustainability

6. Live Responsibly: Foster Accountability
7. Refine Professionalism: Act Ethically
8. Refine Professionalism: Improve Critical Thinking
9. Refine Professionalism: Participate Collaboratively
10. Refine Professionalism: Practice Effective Communication

Experiential Learning

1. Community Based Learning Project: a key learning outcome of this course is to connect academic learning and civic development while simultaneously addressing a community partner's needs, interests, or problems.

Course Competencies

1. Evaluate building envelope.

Assessment Strategies

- 1.1. Report

Criteria

You will know you are successful when

- 1.1. you calculate SA and volume of building envelope for your project.
- 1.2. you document the condition of the envelope.
- 1.3. you perform a blower door test as needed.
- 1.4. you document air leakage areas.
- 1.5. you document energy performance of the windows and doors.

Learning Objectives

- 1.a. Calculate the SA and volume of the building envelope.
- 1.b. Evaluate air tightness of building envelope.
- 1.c. Determine material components of the building envelope.
- 1.d. Identify the condition of the building envelope.

2. Evaluate building durability.

Assessment Strategies

- 2.1. Report

Criteria

You will know you are successful when

- 2.1. you select appropriate method for conducting analysis (i.e. software or hand calculations).
- 2.2. you conduct a hygrothermal analysis of the building assemblies.
- 2.3. you conduct a thermal bridging analysis of building assemblies.
- 2.4. you apply industry standard assemblies as appropriate.

Learning Objectives

- 2.a. Determine moisture interactions with building envelope
- 2.b. Determine heat flows through the building envelope
- 2.c. Perform a hygrothermal analysis.
- 2.d. Perform a thermal bridge analysis.
- 2.e. Research industry recognized durable assemblies.

3. Evaluate heating, cooling and ventilation systems.

Assessment Strategies

- 3.1. Report

Criteria

You will know you are successful when

- 3.1. you document the type, size, and efficiency of the heating system.
- 3.2. you document the type, size, and efficiency of the cooling system.
- 3.3. you document the type, size, and efficiency of the ventilation system.
- 3.4. you document the controls of the systems.

Learning Objectives

- 3.a. Locate heating, cooling, and ventilation equipment in the building.
- 3.b. Identify the type and size of heating system.
- 3.c. Identify the type and size of cooling system.
- 3.d. Identify the type and size of the ventilation system.
- 3.e. Identify the energy efficiencies of the systems.
- 3.f. Identify the controls for the systems.

4. Evaluate lighting systems.

Assessment Strategies

- 4.1. Report

Criteria

You will know you are successful when

- 4.1. you document usage patterns for the lighting.
- 4.2. you document the purpose for the lighting
- 4.3. you document the lighting controls.
- 4.4. you document the type of lighting systems used.
- 4.5. you document the wattage of the lighting systems.

Learning Objectives

- 4.a. Identify the type of lighting system.
- 4.b. Identify wattage of the lighting system.
- 4.c. Identify the controls of the lighting system.
- 4.d. Analyze how indoor lighting systems affect the energy balance.

5. Evaluate plug/appliance loads.

Assessment Strategies

- 5.1. Report

Criteria

You will know you are successful when

- 5.1. you document plug/appliances with digital images and/or written descriptions
- 5.2. you document usage patterns for plug/appliances
- 5.3. you document energy consumption associated with plug/appliances
- 5.4. you document phantom loads associated with plug/appliances

Learning Objectives

- 5.a. Locate plug/appliances that contribute to building loads
- 5.b. Identify plug/appliances that contribute to building loads
- 5.c. Identify loads associated with plug/appliance
- 5.d. Identify controls for plug/appliances
- 5.e. Identify the energy efficiency of plug/appliances

6. Determine building energy consumption.

Assessment Strategies

- 6.1. Report
- 6.2. Demonstration

Criteria

You will know you are successful when

- 6.1. you provide a written description and digital image for documentation.
- 6.2. you collect utility bills.

- 6.3. you analyze collected utility bills.
- 6.4. you separate heating, cooling, and base loads.
- 6.5. you document renewable energy systems productions.
- 6.6. you use energy modeling software to determine building loads as needed.
- 6.7. you identify the building occupancy.

Learning Objectives

- 6.a. Explore methods of documentation (pictures, manuals/model numbers, internet sources, etc.)
- 6.b. Audit building energy consumption
- 6.c. Analyze building utility bills through time dependent analysis, linear regression, and CUSUM.
- 6.d. Determine building energy loads using software.
- 6.e. Analyze how building occupancy effects energy consumption.

7. Evaluate financial impacts of project.

Assessment Strategies

- 7.1. Report

Criteria

You will know you are successful when

- 7.1. you calculate the savings associated with energy conservation measures
- 7.2. you calculate the costs associated with energy conservation measures
- 7.3. you calculate the simple payback with energy conservation measures
- 7.4. you calculate the net present value of energy conservation measures
- 7.5. you calculate the internal rate of return of energy conservation measures
- 7.6. you compare the cost effectiveness of the energy conservation measures with doing nothing

Learning Objectives

- 7.a. Estimate energy savings associated with energy conservation measures
- 7.b. Estimate the costs associated with energy conservation measures.
- 7.c. Estimate cost effectiveness of energy conservation measures.
- 7.d. Summarize available financial incentive programs

8. Recommend energy conservation measures.

Assessment Strategies

- 8.1. Report
- 8.2. Demonstration

Criteria

You will know you are successful when

- 8.1. you meet with client / customer to discuss energy conservation measures.
- 8.2. you recommend measure to clients.
- 8.3. you rank suggested measures based on cost effectiveness and client need.
- 8.4. you work with client to select the final measures and determine next steps.

Learning Objectives

- 8.a. Identify customer/client goals.
- 8.b. Identify different energy conservation measures that might meet customers goals.
- 8.c. Present findings to customer/client.
- 8.d. Select the final conservation measures to be included in project.

9. Recommend renewable energy systems.

Assessment Strategies

- 9.1. Report
- 9.2. Demonstration

Criteria

You will know you are successful when

- 9.1. you meet with client / customer to discuss renewable energy systems.
- 9.2. you recommend systems to clients.
- 9.3. you discuss the cost effectiveness of each suggested system.

- 9.4. you work with client to select the final systems and determine next steps.

Learning Objectives

- 9.a. Verify if site is appropriate for renewable energy.
- 9.b. Determine potential renewable energy measures that could be included.
- 9.c. Present findings to customer/client.
- 9.d. Share cost benefits/incentives with customers/clients.
- 9.e. Incorporate selected measures into final plan.

10. Advise client on industry best practices.

Assessment Strategies

- 10.1. Report
- 10.2. Demonstration

Criteria

You will know you are successful when

- 10.1. you discuss code compliance needs with client.
- 10.2. you determine durability concerns of project.
- 10.3. you explain concerns to client.
- 10.4. you recommend energy efficient appliances, lighting, HVAC, and other measures.
- 10.5. you advocate for clients' goals with other contractors.

Learning Objectives

- 10.a. Identify code compliance needs.
- 10.b. Examine potential durability concerns of project.
- 10.c. Suggest energy efficient appliances, lighting, HVAC systems, etc.
- 10.d. Coach clients to work with other contractors on the projects.
- 10.e. Justify recommendations to client.