

Prepared by the Department of Natural Sciences & Life Fitness

Date of Departmental Approval: February 15, 2017

Date Approved by Curriculum and Programs: March 1, 2017

Effective: Fall 2017

1. Course Number: ENV171

Course Title: Energy Efficiency and Conservation Methods

2. Description: This course provides students with the information to identify and explain all of the energy efficiency/conservation methods available for energy use reduction. Energy-consuming facilities, both domestic and commercial, are analyzed by the students for energy efficiency opportunities. The students calculate energy savings and environmental impacts for most energy efficiency methods in order to identify and assess energy conservation opportunities. In addition, the students demonstrate the appropriate usage of energy monitoring and measuring equipment commonly used by energy specialists and energy auditors.

3. Student Learning Outcomes (instructional objectives; intellectual skills):

Upon successful completion of this course, students are able to do the following

- Explain all of the energy efficiency/conservation methods available for energy use reduction.
- Demonstrate energy savings and environmental impacts for most energy efficiency methods in order to identify and assess energy conservation opportunities.
- Demonstrate the appropriate usage of energy monitoring and measuring equipment commonly used by energy specialists and energy auditors.

4. Credits: Three credits

5. Satisfies General Education Requirement: No

6. Prerequisites: MAT020 (Prealgebra) or MAT025 (Pre-Algebra) and ENL108 (Critical Reading & Thinking) or satisfactory basic skills assessment scores

7. Semester Offered: Fall

8. Suggested General Guidelines for Evaluation: Research paper, notebook/journal, exams

9. General Topical Outline:

- I. Basic Areas for Energy Efficiency and Conservation Measures
 - A. Low Cost/No Cost Energy Conservation Methods (ECMs)
 - B. Weatherization ECMs
 - C. Replacement vs. Retrofits of Equipment
- II. Data Acquisition, Monitoring, Auditing, and System Balancing Equipment for Energy Analysis, including: data loggers, universal data recorder, flue gas analyzer, thermometer, utility meters, combustion analyzers, infrared thermography, airflow velocity meters, relative humidity measures, electrical meters, refrigeration measures, light meters, and sling psychrometer
- III. Energy Bill Analysis, including power factor correction, peak demand limiting, rate structure and comparison to alternative rate opportunities, including green power
- IV. HVAC Energy Conservation Measures (ECMs)
 - A. HVAC tuning and operation ECMs, including equipment sizing, selection and maintenance, heating combustion efficiency, system efficiency, steam traps, chiller optimization, Coefficient of Performance and Energy Efficient Rating, stratified air consideration, psychrometric charts, economizer cycles, waste heat recovery, operating and maintenance considerations, cogeneration and micro-turbines, and thermal storage
- V. Other Building Equipment ECMs (kitchen, laundry, office equipment)
 - A. Energy Star and other Energy Efficiency Ratings
 - B. Domestic Water Heating ECMs
 - C. Compressed Air ECMs
- VI. Building Envelope ECMs

- A. Conduction and infiltration heat loss/gain, including vapor barriers, insulation levels, radiant heat gain/loss, solar shading, infiltration, building ventilation, and thermal mass of building
- VII. Review renewable energy assessments and analysis (green power), green building, sustainable design
- VIII. Electrical ECMs – Lighting Systems Review, Pumps, fans, and motors review, including efficiencies, belt drives, variable speed/frequency drives, load factors, fan laws, pump curves
- IX. Energy Suppliers and Fuel Acquisition
- XII. Prioritization of ECMs based on Cost Effectiveness and Environmental Impacts
- XIII. Case Study: Analyses and prioritization of ECMs for a given facility