

CE 51500 Building Energy Audits

Sem. 1, Lecture 3, Cr. 3.

Restrictions: Senior status in the College of Engineering or Graduate-level standing;

Concurrent pre-requisites: CE 41400 Building Mechanical and Electrical System Design and CE 41300 Building Envelope Design and Thermal Loads, or permission from instructor.

Description: This course is designed to provide students with the necessary skills to perform an energy audit on commercial and residential buildings. Energy accounting procedures for all major building subsystems are covered in detail, along with operational cost analysis of these systems. Students learn fundamental techniques for auditing the building envelope; electrical and lighting systems; heating, ventilation, and air conditioning systems; internal thermal loads; and building maintenance and operation procedures. Students also learn to analyze electric and natural gas utility tariffs and rate structures and apply their findings to the energy auditing process.

Course Instructor: Travis Horton

Level: Undergraduate/Graduate Level

Course Outline:

- **Introduction and Overview.** Introduction to the course plan and objectives; Define the scope and levels of effort of an energy audit; Overview of general auditing procedures; Example of a complete energy audit. [1 Week]
- **Understanding Utility Billing Practices and Analyzing Rate Tariffs.** Introduction to regulated and de-regulated utilities; Analyzing electric utility rate structures; Analyzing natural gas utility rate structures; Linking rate tariffs to potential energy conservation measures. Assessing rate change opportunities. [2 weeks]
- **Inverse Building Modeling.** Defining appropriate energy usage indices; Correlating building energy usage to weather-related factors; Cumulative sum of errors and statistical change-point analysis. [1 week]
- **Auditing Major Building Sub-Systems.** Electrical and lighting audit; Building envelope audit; Internal loads, HVAC&R audit, Operations and maintenance audit; Instrumentation for energy auditing. [4 weeks]
- **Energy Estimating Techniques.** Weather bin modeling; Single variable regression analysis; HVAC energy estimating; Compressed air systems; Steam systems. [3 weeks]
- **Advanced Technology Opportunity Assessment.** Automated building energy management systems; Thermal energy storage systems; Combined heat and power systems. [3 weeks]
- **Continuous Building Monitoring and Improvement.** Total building commissioning; Financial analysis of energy conservation opportunities. [1 week]