Course Number and Title: NRG 111 Residential/Light Commercial Energy Analysis

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2018-51

Prerequisite:
MAT 020, NRG 101, SSC 100 or concurrent

Co-Requisites:
None

Course Credits and Hours:
3.00 credits
2.00 lecture hours/week
2.00 lab hours/week

Course Description:
This course explores how a building's design affects its energy use. Topics include building shell analysis and auditing, building services and utilities, air leak testing, the study and auditing of residential and light commercial energy use, lighting, and the use of diagnostic equipment to conduct detailed energy assessments following Building Performance Institute (BPI) standards. Home Energy Rating System (HERS) Index and Energy Star audit standards are used as resource material.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
Scientific calculator (preferably TI-83+ or TI-84+), Notebook

Schedule Type:
Classroom Course
Hybrid Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Engage in professional behavior. (CCC 1, 3, 4, 5)
2. Conduct energy audits in residential and light commercial buildings to include values and characteristics of standard and advanced construction design as they relate to energy efficiency. (CCC 1, 2, 4, 6; PGC NRG 1, 2, 3, 4, 5, 6, 7; PGC SOL 1, 2, 3, 4, 5)
3. Examine data related to construction materials that make up thermal and vapor barriers and their proper alignment in existing residential and light commercial buildings with consideration given to indoor air quality. (CCC 2, 5, 6; PGC NRG 1, 2, 3, 4, 5, 6, 7; PGC SOL 1, 2, 3, 4, 5)
4. Employ tools required by Building Performance Institute (BPI) (blower door, duct-blaster, IR camera, manometer, pressure pans, humidistat, psychrometer, and utility meters) for gathering and diagnosing information in the completion of an energy audit. (CCC 2, 3, 5, 6; PGC NRG 1, 2, 4, 5; PGC SOL 1, 2, 3, 4, 5)
5. Identify combustion zones, combustion equipment (combustion test kits, CO monitors, and gas leak detectors), and the safe and efficient operation of fossil fueled heating equipment and appliances.(CCC 2, 4, 5, 6; PGC NRG 1, 2, 3, 4; PGC SOL 1, 2, 3)
6. Investigate differences among BPI, Energy Star, and HERS audit programs. (CCC 2, 3, 5, 6, 7; PGC NRG 1, 2, 3, 4, 6; PGC SOL 1, 2, 3, 4, 5)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Engage in professional behavior.
    1. Demonstrate punctuality when attending class, participating in off-site projects, and submitting assignments.
    2. Communicate using industry-appropriate language in presentations, reports, and homework.
    3. Demonstrate appropriate professional behavior when working with others.
2. Conduct energy audits in residential and light commercial buildings to include values and characteristics of standard and advanced construction design as they relate to energy efficiency.
    1. Conduct several mini energy audits specific to insulation, infiltration, combustible appliance zones, and energy consumption.
    2. Distinguish between proper and improper approaches to lighting, insulation, infiltration, air sealing, stack effect, combustible appliance zones, and energy efficient design.
    3. Apply knowledge of an energy audit's purpose.
    4. Demonstrate accurate interpretation of utility bills.
    5. Recommend behavioral and technological modifications necessary to improve energy efficiency.
    6. Employ basic electrical, plumbing, and mechanical skill sets as they apply to energy use and savings in buildings.
    7. Relate principles of psychrometrics to comfort and energy efficient practices and design in existing residential and light commercial buildings.
    8. Analyze appliance efficiencies, including washer, dryer, refrigerator, heater/furnace, and air conditioning equipment.
3. Examine data related to construction materials that make up thermal and vapor barriers (and their proper alignment) in existing residential and light commercial buildings with consideration given to indoor air quality.
    1. Compare air and thermal barrier systems found in existing residential and light commercial buildings, and explain their relationship to energy consumption.
    2. Identify sources of indoor air contaminants in existing residential and light commercial buildings.
    3. Recommend appropriate measures for improving air quality in existing residential and light commercial buildings.
    4. Relate construction methods to how those methods affect a building's cost effectiveness.
    5. Compare the interrelation of U-factors and R-factors (insulation, wall and floor materials, windows, and doors), and explain what effect changing either of these values has on a building's overall energy performance.
    6. Demonstrate the importance of proper knee wall insulation.
    7. Identify and compare various materials used for insulation and their appropriate applications.
4. Employ tools required by Building Performance Institute (BPI) (blower door, duct-blaster, IR camera, manometer, pressure pans, humidistat, psychrometer, and utility meters) for gathering and diagnosing information in the completion of an energy audit.
    1. Demonstrate the proper use of all tools required by the BPI.
    2. Employ safe operation methods during audits.
    3. Identify proper tool calibration processes.
    4. Analyze data (infrared [IR] imagery, carbon monoxide [CO] measurements, pressure readings, humidity readings, gas levels, and meter information) gathered from building auditing tool.
5. Identify combustion zones, combustion equipment (combustion test kits, CO monitors, and gas leak detectors), and the safe and efficient operation of fossil fueled heating equipment and appliances.
    1. Define *combustion zone*.
    2. Describe appropriate methods of setting up combustion zones for testing.
    3. Implement proper testing of combustion appliances through the use of combustion efficiency test kits.
    4. Describe levels of response required in the event of unsafe findings during the testing process.
    5. Identify different types of combustion appliances, the potential hazards that may be encountered, and the proper method of testing each type of device.
    6. Demonstrate appropriate methods of setting up combustion zones for testing.
6. Investigate differences among BPI, Energy Star, and HERS audit programs.
    1. Identify common requirements and/or procedures for conducting audits.
    2. Describe the benefits of each audit program.
    3. Analyze data collection techniques that differ among each audit program.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	**–**	**100**	**=**	**A**
83	**–**	**91**	**=**	**B**
75	**–**	**82**	**=**	**C**
0	**–**	**74**	**=**	**F**

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):
Energy Management

1. Utilize building system and energy technology hardware and software to gather data on building lighting systems operation and energy consumption.
2. Utilize building system and energy technology hardware and software to gather data on heating, ventilation, and air conditioning (HVAC) systems operation and energy consumption.
3. Calculate, analyze, and verify the energy use of buildings based upon the interaction of energy consuming building systems.
4. Evaluate residential buildings and make recommendations for optimized building performance and occupant comfort.
5. Evaluate commercial buildings and make recommendations for optimized building performance and occupant comfort.
6. Prepare and present technical errors.
7. Analyze the economic, environmental, and business implications of potential energy measures.

Renewable Energy Solar

1. Utilize building system and energy technology hardware and software to gather data on building lighting systems operation and energy consumption.
2. Calculate, analyze, and verify the energy use of buildings based upon the interaction of energy consuming building systems.
3. Evaluate residential buildings and make recommendations for optimized building performance and occupant comfort.
4. Prepare and present technical reports.
5. Analyze the economic, environmental, and business implications of potential energy measures.
6. Perform preliminary and in depth site and customer suitability evaluation of potential applications for solar use.
7. Design and calculate the output of an optimal site-specific array by deriving panel configuration and specifying components.

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.