Subject:	SUST
Course Number:	221
Descriptive Title:	Energy and Carbon Reduction in Buildings
Division:	Industry and Technology
Department:	Environmental Technology
Course Disciplines:	Environmental Technology
Catalog Description:	This course will cover the role of energy consumption in the built environment and introduce concepts that reduce our dependence on energy derived from fossil fuels. From resource extraction and material production to building assembly and systems operation, students will learn how to analyze upfront and operational carbon to develop strategies that achieve carbon neutrality. Through case studies, the course will expose students to the processes of auditing and determining the amount of carbon emissions for the purposes of identifying alternative materials and methods.
Prerequisite:	
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	3
Hours Laboratory (per week):	0
Outside Study Hours:	6
Total Course Hours:	54
Course Units:	3
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	
Transfer UC:	No
Effective Date:	
General Education ECC:	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	
Term:	

Other:	
Student Learning Outcomes:	**SLO #1 Energy and Buildings** Given lecture information about energy consumption associated with the built environment, students will demonstrate their knowledge of quantitative and qualitative methods to determine carbon emissions. **SLO #2 Analytical Skills** Students will be able to use methodologies to compare and contrast various building materials and methods to engage in strategies that reduce carbon emissions. **SLO #3 Project Assessment** Successful students tracking for graduation, transfer and employment in design or planning fields will be able to evaluate trade-offs related to costs and benefits of emission reduction and offset procurement strategies.
Course Objectives:	1. Use of critical thinking to understand the linkages between socioeconomic and ecological processes. 2. Provide knowledge on the role of economics, supply chains, and performance of sustainable materials. 3. Demonstrate the ability to discern and explain cost-benefit analysis and project trade-offs. 4. Synthesize carbon emissions data with reduction strategies to achieve carbon neutral solutions. 5. Develop methodologies that analyze quantitative and qualitative methods for determining emissions.
Major Topics:	**I. Carbon Literacy within the Built Environment (3 hours, lecture)** A. The Big Carbon Picture B. The role of energy in the building C. How did we get here? **II. Upfront and Embodied Carbon (6 hours, lecture)** A. Defining carbon emissions B. Conventional materials and methods C. Material production and embodied carbon D. The “Concrete Factor” **III. Operational Carbon (3 hours, lecture)** A. Flipping the switch: energy performance B. Systems operations and maintenance C. The carbon costs of replacement **IV. Carbon Emissions (12 hours, lecture)** A. Measuring environmental impacts B. Cradle-to-Grave vs. Cradle-to-Cradle principles

	C. Life cycle inventory analysis and impact assessment D. E3 tool and other carbon calculators E. Interpreting Environmental Product Declarations F. Interpreting and communicating the findings G. The “uncertainty factor” **V. The Product Life Cycle (6 hours, lecture)** A. Resource extraction and conservation B. Manufacturing and Processing C. Material and product transportation D. Usage and decommissioning E. Waste disposal and recycling **VI. Zero Carbon and Reduction Strategies (6 hours, lecture)** A. The role of building design B. Low carbon and sustainable materials C. On-site vs. off-site construction methods D. Responsive design and other performative systems **VII. Carbon Economy and Offsets (3 hours, lecture)** A. Decarbonization and net-negative carbon B. Understanding the circular carbon economy C. The effectiveness of carbon markets and channeling resources **VIII. Factors for Carbon Reduction (6 hours, lecture)** A. Carbon Capture and Sequestration B. Naturally occurring carbon storage C. Capture and storage technologies D. Project scale and potential impacts of storage E. Carbon costs and limitations of reduction strategies **IX. Sustainable Energy Systems and Applications (3 hours, lecture)** A. Energy Star and other efficiency ratings B. Energy positive and green technologies C. Thermal bridges and energy recovery techniques **X. Cost-benefit Analysis (6 hours, lecture)** A. Setting project parameters and criteria B. Obstacles to alternative methods and materials C. Assessment to determine whole project outcomes D. Identifying trade-offs and workarounds
Total Lecture Hours:	54
Total Laboratory Hours:	0

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Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	In a two- to three-page written and visual report using tables, graphs and charts, demonstrate the life cycle of various materials and products, determine the amount of carbon emissions, and develop alternative strategies for carbon reduction. Submit report to the instructor.
Critical Thinking Assignment 1:	Conduct a carbon emissions analysis via an Excel (or similar) spreadsheet that demonstrates the embodied carbon for a particular building assembly. Submit the spreadsheet via two- to three-page report to the instructor.
Critical Thinking Assignment 2:	Prepare Life Cycle feasibility study via 2-3 slides (PowerPoint or similar) that demonstrates the embodied and operational carbon, and reduction measures to achieve carbon neutrality for the construction of an ADU or 'tiny house'. Submit the analysis via slides to the instructor.
Other Evaluation Methods:	Class Performance, Completion, Presentation, Quizzes, Term or Other Papers
If Other:	
Instructional Methods:	Demonstration, Discussion, Lab, Lecture, Multimedia presentations
If other:	
Work Outside of Class:	Skill practice, Problem solving activity, Written work (such as essay/composition/report/analysis/research)
If Other:	
Up-To-Date Representative Texts:	Simon Sturgis, *Targeting Zero: Whole Life and Embodied Carbon Explained*, 1st edition, RIBA Publishing, 2019. (Discipline Standard)
Alternative Texts:	
Required Supplementary Readings:	
Other Required Materials:	
Requisite	
Category	
Requisite course:	
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite Skill:	
Requisite Skill and Matching skill(s): Bold the requisite skill(s). if applicable	
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Requisite and Matching skill(s): Bold	

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Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Marc Yeber
Date:	11/20/2023
Original Board Approval Date:	03/21/2024
Effective Term:	FALL 2024