Living Building Renovations through Energy Mmgt.

Course is designed as a Year 2 credit course for Community College or as a Continuing Education for Professionals Course for the Cascadia CC Environmental Technology & Sustainable Practices program, Edmonds CC Energy Management program, or Shoreline CC Clean Energy Technology Program. The course would also be suitable for a certificate program or bachelor's degree in Sustainable Human Habitat Design.

Suggested Course structure: Two in-class sessions per week @ 4.6 hours per week, plus independent student lab time as individuals and in "design teams" @ 3 hours per week

COURSE DESCRIPTION:

The Living Building Challenge, developed in the Cascadia region, is an international performance standard and a tool for designing, constructing, retrofitting, and operating buildings. It is also a philosophy, and an advocacy tool for achieving urban human communities that sustain people and life of our planet. The course will explore how energy management can be used to achieve the standard's imperatives. Net Zero Energy, biomimicry building system design, biophilic community planning, and car free living will is highlighted. Students will gain critical skills in both commercial building analysis and energy retrofit project planning.

PREREQUISITES:

Required: One of the following or equivalent

- ENERGY 105: Introduction to Sustainability
- ETSP 101: Introduction to Environmental Technology & Sustainable Practices
- NRG 110: Introduction to Energy in the Built Environment

Recommended:

- 1 design course (ENERGY 120: Energy Efficiency Design, Construction, & Retrofit / ETSP 120/130/140/170 or NRG 200: Net Zero Energy Design)
- 1 energy management course (ENERGY 130: Energy Assessment & Analysis, or ETSP 190: Documenting & Reporting Energy Use, or NRG 121: Energy Audit 1)

REQUIRED RESOURCES & TEXTBOOKS TO BE USED BY STUDENTS

- The Integrative Design Guide to Green Building by Bill Reed
- Zugunruhe- The Inner Migration to Profound Environmental Change by Jason McLennan
- Access and utilization of online resources at the International Living Building Institute website
- Living Building Challenge – latest version in printed form
- Community member status for class shared by students – access online user guide, dialog section, and other sources

REQUIRED INSTRUCTIONAL RESOURSES & SUPPLIES:

- Classroom with seating up to 24 students
- Minimum of 6 Hardwired Computer Workstations for teams to use during class
- Instructors Computer Work station

- A/V system capable of showing educational videos, and computer generated multi-media productions by students
- Pre-coordinated commercial /institutional buildings with Living Building elements for class field trips / independent visits by student design teams
- Pre-coordinated guest speaker presentations by design professionals

GENERAL COURSE GOAL:

Students gain knowledge in how energy management retrofit work can reduce building carbon footprint, increase building occupant health, and take concrete steps in design teams toward achieving goals of the Living Building Challenge

COURSE OUTCOMES:

At the conclusion of this course, students will be able to:

- Interpret appropriate application of the Living Building Challenge to different energy management scenarios
- Articulate the energy saving benefits of individual petals within the LBC
- Develop metrics for a baseline scenario versus application of the Living Building Challenge Articulate for specific imperatives within the standard

METHODS OF ASSESSMENT:

- In class participation
- Online quizzes
- Out-of-class “lab “assignments
- Group project
- Mid-term & final exam

METHODS OF INSTRUCTION MAY INCLUDE:

- Lectures
- Guest Presenters
- Group exercises
- Building walk-thru “field trips”
- Assignment of online videos
- Student presentations

COURSE DETAILS

Unit 1: Overview of the Living Building Challenge & Energy Management

Introduction: The Living Building Challenge defines the most advanced measure of sustainability in the built environment possible today. This philosophy, advocacy tool and certification program covers all building at all scales and is a unified tool for transformative design, allowing us to envision a future that is *Socially Just, Culturally Rich and Ecologically Restorative.*

Learning Objective - At the end of this unit, student will be able to:

- Describe the purpose and intention of the LBC
- Identify elements of the LBC that can be achieved with energy management strategies

Topics Covered:

- Imagination and creativity as design tools
- Sustainable design standards history
- Core philosophy of the Living Building Challenge
- Integrative design teams – who, what, & why
- 7 performance areas = petals or processes
- 4 project typologies – defining scope of the project
- 6 Living Transects based on new urbanism categorization concepts
- Overview of energy management goals found in the LBC
- 20 LBC imperatives: direct and indirect energy management opportunities

Major Activities:
Day 1:
Lecture topic: Philosophy and Building Blocks of the LBC
Exercise: Students complete survey on sustainability concepts
Discussion topic: How can sustainable design lead to restoration of the natural environment?
Reading Assignment: Living Building Challenge V2.1 (48 pgs) or latest version
Handouts: Syllabus and Design Project Overview

Day 2:
Lecture topic: Energy Management components of the LBC – petals and imperatives
Exercise: Matching energy management strategies with LBC imperatives
Discussion topic: What are the best strategies for achieving Net Zero Energy projects?
Reading Assignment: Chapters 1 & 2 of "Integrative Design Guide to Green Buildings"
Lab Assignment: Angel Online posting & dialog about the Integrative Design process

Skill Codes: PM-C3, PM –C7, BA-A8, PM-A17, BA-C4

NOTE: Exercises, discussion topics, reading assignments, lab assignments, and handouts for the Unit 1 are just an example. It is left to the discretion of the instructor on what these will be for subsequent units..

Unit 2: LBC Project Development

*Introduction: C*ommercial building sector presents an enormous opportunity for revitalization through renovation. Integrative Design Teams are key to achieving carbon neutrality potential of the LBC.

Learning Objective - At the end of this unit, student will be able to:

- Identify benefits of an Integrative Design Team approach vs. traditional approaches
- Define an LBC project by the LBC Typology & Living Transect characterization systems

Topics Covered:

- Types of Certification: Petal Recognition, Net Zero Energy, & full LBC certification
- Traditional Commercial Project design methodology & "siloing" of professions
- Integrative Design – definition & case studies
- Design Charette Process

Major Activities:
Day 1: Integrative Design, & Formation of Design Teams

Day 2: Typology and Living Transects – defining a project

Skill Codes: PM-G7, PM-C7, PM-E8, BA-E7, PM-H3, BA-A3

Unit 3: LBC Petals: Site, Water, & Energy

Introduction: Human survivability is now threatened by the rapid spread of sprawl development in a feedback loop of ecosystem destruction. Compact-Connected Communities, net Zero Water & Net Zero Energy are strategies that can reverse this trend.

Learning Objective - At the end of this unit, student will be able to:

- Identify role site can play in energy management choices
- Describe ways on-site water can reduce community-scale energy usage
- Define current solar income and explain its relationship to net-zero energy buildings
- Identify strategies for achieving net zero energy buildings

Topics Covered:

- Site: limits to growth, urban agriculture, & car-free living
- Water: optimizing use & reuse of potable water, energy conservation through onsite systems
- Energy: Current Solar Income, Minimizing load, & on-site renewable energy
- Energy: Net Zero Energy certification program

Major Activities:
Day 1: Petals overview: Site & Water – EM of Urban Agriculture & Car Free Living
Day 2: Petals overview: Energy – EM of Net Zero Energy & Civilized Environment

Skill Codes: PM-H5, PM-H12

Unit 4: LBC Petals continued: Health, Materials, Equity, & Beauty

Introduction: Industrialization and development practices of the last 200 years have resulted in "fouling of our nests". We can now renovate buildings that have healthy indoor environments, non-toxic replenishable materials, are accessible to all people, that elevates our spirit - - while minimizing embodied and operational energy consumption.

Learning Objective - At the end of this unit, student will be able to:

- Describe how material selection impacts indoor environmental quality
- Identify strategies for "breathable buildings"
- Define the role a building height plays in adjacent building's access to sunlight
- Define how building materials can be re-used / re-purposed

Topics Covered:

- What Old is New again – proven low & no energy strategies for ventilation & cooling
- Cradle-to-Cradle & Replenishable materials
- Estimating total embodied carbon
- Precautionary Principle applied to materials selection
- Human Scale and Humane Places
- Rights to Nature & Access to Sunlight
- Projects as inspiration & educational

Major Activities:
Day 1: Petals overview: Health & Materials- EM of Healthy Air & Embodied Carbon Footprint
Day 2: Petals overview: Equity & Beauty – EM of Humane Places & Rights to Nature

Skill Codes: PM-E4, BA-A5, BA-B13, PM-C7,

Unit 5: LBC Renovations: successes and team proposals

Introduction: Net Zero Energy certification, Petal Recognition, & Scale Jumping provide 3 pathways for achieving key elements of the LBC in a commercial building renovation project. Reducing energy demand through energy retrofits is key.

Learning Objectives - At the end of this unit, student will be able to:

- Identify strategies employed to achieve net zero energy on renovation case studies
- Describe an example of scale jumping for building renovation project
- Demonstrate group creativity and decision making through project proposal

Topics Covered:

- Scale Jumping – a strategy for renovation projects
- Recognizing the possible: Net Zero Energy certification & Petal Recognition
- Elements of an integrative design team – expertise, roles, & responsibilities
- Case Study 1: Painters Hall converted into Pringle Creek Community Center, OR
- Case Study 2: Bertshi School science wing conversion from gas station, Seattle, WA
- Student teams present preliminary project goals and objectives in class and with documentation

Major Activities:
Day 1: Applying the LBC to an existing building: concepts & case studies
Day 2: Review of design team proposals

Skill Codes: PM-H12, BA-A10, PM-G3, PM-C14, PM-C8, BA-F4, BA-A6

Unit 6: Quantifying Energy in LBC Imperatives

Introduction:
An ability to estimate building's annual energy loads and onsite renewable energy potential is required to make good design decisions. Understanding how spreadsheet calculators and building energy model software contribute to this process can enable net zero energy outcomes.

Learning Objectives - At the end of this unit, student will be able to:

- Identify strategies to minimize onsite energy demand
- Demonstrate ability to estimate EUI and onsite renewable energy potential
- Describe how building energy model can answer energy system design questions

Topics Covered:

- State-of-the-art low energy HVAC & Lighting technologies
- State –of-the-art onsite renewable energy technologies
- Location specific renewable energy – region, locality
- Building design strategies for lowering energy demand
- Energy Utilization Intensity estimating
- Renewable Energy annual power production projections

- Estimating energy saving in the associated imperatives
- Building Energy Modeling – data needed, methods, results
- Advance Spreadsheets as building energy analysis tools

Major Activities:
Day 1: Mid-term exam
Day 2: Quantify Energy associated with different LBC imperatives – part 1
Day 3: Quantify Energy associated with different LBC imperatives – part 2

Skill Codes: PM-G1, PM-E5, PM-H5, PM-C11, PM-E7, BA-D7, PM-E13, PM-F3, BA-C4, BA-C10

Unit 7: Biomimicry & Biophilia: emulating nature and bringing building to life
Introduction:
Nature is a 3.8 billion year laboratory of how life sustains itself. This is a storehouse of models which can be applied to a building design challenge. Human have evolved over tens of thousands of years in a bio-centric world. The ability to integrate form, place-based elements, and other biophilic design strategies can lead to healthier, more productive indoor environments.

Learning Objectives - At the end of this unit, student will be able to:
- Utilize life's principles to shape design concepts in a building retrofit
- Identify biophilic elements of an existing building
- Describe benefits of incorporating biophilia into building renovation strategies

Topics Covered:
- Scientific Literacy
- Life's Principles as a design tool
- Conservation of Energy & Thermodynamics
- Functional Biology
- Biomimicry as a system design tool for buildings
- Biophilia as a measurement of healthy buildings
- Urban living: human habit vs. built environment
- Biophilia of building energy systems

Major Activities:
Day 1: Biomimicry: nature as a model, mentor, and measure for sustainable design
Day 2: Biophilia: overview of the theory, science, and practice of bringing buildings to life

Skill Codes: PM-C7, PM-C11, BA-D8

Unit 8: Energy Management in Urban redevelopment
Introduction: Sprawl development combined with single occupancy combustion fuels have led to an enormous increase in the energy consumption and carbon footprint of North Americans over the last 6 decades. It will take a mix of strategies achieve community-scale energy efficiency and carbon neutrality

Learning Objectives - At the end of this unit, student will be able to:

- Describe the benefits of complete, compact & connected communities
- Identify building redevelopment strategies that reduce community energy usage

Topics Covered:

- New Urbanism
- Smart Growth
- Complete, Compact, & Connected Communities
- Post –construction documentations for LBC & Net Zero Energy

Major Activities:
Day 1: Smart Growth: energy management opportunities in urbanizing re-development
Day 2: Net Zero Energy Certification process

Skill Codes: PM-A14, PM-A17, BA-A9, PM-B11, PM-C3, BA-C7, BA-C2

Unit 9: Creating a Community of Practitioner

Introduction: Place-based CBL Collaboratives offer a path for building the human infrastructure for scaling up the application of the LBC.

Learning Objectives - At the end of this unit, student will be able to:

- Describe how local collaborative of practitioners support implementation of the LBC
- Identify strategies for engaging Energy Management professionals in a LBC Collaborative

Topics Covered:

- Power of Collaboration
- Leadership
- Restorative & Regenerative Design

Major Activities:
Day 1: Living Building Collaboratives: a process for paradigm shift

Skill Codes: PM-G8, PM-H6, BA-G6, BA-G7

Unit 10: Design Project Presentations

Introduction: A transformative design performance standard like the Living Building Challenge needs to be applied to real world challenges to ascertain skill necessary to affect real change as energy professional.

Learning Objectives - At the end of this unit, student will be able to:

- *Demonstrate competency working in a design team*
- *Demonstrate presentation capabilities for retrofit energy management applications*
- *Identify key decision making steps in their design process*

Topics Covered:

- *Project Scope*
- *Project Goals*
- *Design Strategies*
- *Comparative analysis of existing vs. proposed retrofit*

Major Activities:
Day 1: Project Team Presentations & class review
Day 2: Project Team Presentations & class review

Skill Codes: PM-D11, PM-A8, BA-F5

Unit 11: Course Wrap Up
Day 1: Course review session PM-D3, BA-D7
Day 2: Final Exam PM-D12, BA-G1, BA-C4

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