

University of Florida
ME Rinker Sr. School of Building Construction

BCN 6585 Sustainable Construction

Syllabus

This course addresses the application of the sustainable development paradigm to the built environment. Sustainable development includes reducing the impacts of human activities on natural ecosystems and understanding the role these ecosystems have in the economy and on human welfare. It involves understanding the lessons that human society can learn from natural systems and how these lessons can help provide a good quality of life for the planet's population. This course will cover the fundamental concepts of sustainable development in the built environment; the environmental / resources issues and industrial / construction metabolism with examples. It also discusses environmental ethics and environmental justice; ecological / environmental economics including Life Cycle Costing; building assessment (frameworks) and ecolabels. Additionally, this course develops basic knowledge about energy systems, exergy, entropy, energy conservation and renewable energy; Life Cycle Assessment, embodied energy, energy, and materials. Concepts such as New Urbanism, bioclimatic design principles, ecological concepts, passive design strategies will be discussed. This course will use a mix of class lectures, guest lectures, videos, additional reading materials, and other approaches for instruction.

Course Objectives

- Understand the concept of sustainable development or sustainability in the built environment.
- Learn about the different sustainability frameworks used worldwide, their strengths and weaknesses.
- Learn about the fundamental resources issues related to the built environment.
- Understand concepts such as New Urbanism, passive design strategies, technologies, ecological principles, and energy conservation measures for efficient buildings.



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Method. Class lectures, guest lectures, videos, quizzes, exams, course papers and group project.

Course Website. Sakai: <http://lss.at.ufl.edu>

Class Attendance. Attendance at all class meetings is mandatory. Unexcused absences will result in a half letter grade reduction.

Late Assignments. Assignments are due to the instructor by the start of class on the due date. A 40% deduction will be imposed for assignments up to 24 hours late. Assignments more than 24 hours late will receive no credit.

Disruptive Behavior Policy. Students engaging in disruptive behavior will be asked to leave the classroom. Use of cell phones and computers without permission of the instructor is considered disruptive behavior.

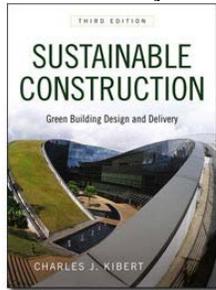
Honor Policy. It is Rinker School policy that any incidence of cheating, copying, signing rosters for others, or other attempts to deceive will be penalized by course failure.

Instructor

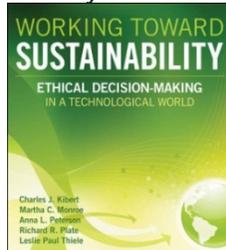
Charles J. Kibert
Weekly office hours at RNK 341
MWF noon – 2:00 PM or by appointment
Email: ckibert@ufl.edu

Textbooks

1. *Sustainable Construction: Green Building Design and Delivery*. Third Edition, Charles J. Kibert, New York: John Wiley & Sons, 2012.



2. *Working Toward Sustainability: Ethical Decision Making in a Technological World*, CJ Kibert et al, New York: John Wiley & Sons, 2011.



3. *Environmental Building News (EBN)*
Available online and accessible in several ways:
 - o If you have a Gatorlink account and are logged in on campus, simply go to the Building Green website <http://www.buildinggreen.com> and you will be automatically connected to Environmental Building News.
 - o If you have a Gatorlink account and are off-campus, log in using the VPN and then go to the Building Green website.

REQUIREMENTS

Course papers (3 x 100 pts each)	300 points
Course problems (3 x 50 pts each)	150 points
Blogposts and responses	100 points
Oral presentation (1 paper)	25 points
Group Project	100 points
Oral presentation (project)	25 points
Quizzes (max 10 x 10 points each)	100 points (max)
Total Points (max)	800 points

Course Papers (3 papers, 100 points each)

- o Should be 1500 words in length.
- o Should have a minimum of 10 citations, at least 7 must be from journal articles. Turnitin will scan papers.

Course Problems (3 problems, 50 points each)

1. Life Cycle Costing (LCC) Model
2. Life Cycle Assessment (LCA) Model
3. Building Water Model

Blogpost and Responses (100 points)

Start a blog at www.blogpost.com and respond to each other's posts. Requirement is two posts on even numbered weeks, 500 words per post. Share your site with the class and instructor

Group Project (1 project, 100 points each)

- o Team will consist of three or four students.
- o Group Project overview will be discussed by the instructor in class.
- o Group Project Report should be 1500 words min. *Course Papers, Problems, and Group Project Reports must be your (or group's) original work and must not have been submitted to other courses in any other educational institution.*

Format for course papers: Follow the American Psychological Association (APA format) available at <http://apastyle.org>

Quizzes (10 numbers, 10 points each)

At the start of class, students may be quizzed on the reading materials assigned for that class. The only materials the student can use in taking the quiz are their personal handwritten notes on the readings.

Extra Credit (50 points max), refer Lecture 1 for details.

Grading Method

Grading will be based foremost on the quality of the submissions by the students. All references must be fully specified at the end of each assignment and keyed into the written text by author, year, and page number(s) if the citation is a book or journal. Spelling and grammar are also subject to evaluation. Presentations will be graded based on the quality of the student's oral presentation, the quality of the graphics and written material supporting the presentation, and quality of integration of the team presentation.

Grading based on points earned as a percentage of total points. A: 95 and up, A-: 92-94 B+:88-91, B: 83-87, B-: 80-82, C+: 77-79, C: 73-76, C-: 70-72, D+: 67-69, D: 63-66, D-: 60-62, E: 59 or below.

BCN 6585 Lectures + Assignments

- 1 Introduction: Sustainability in the Built Environment
- 2 Environmental / Resources Issues & Industrial / Construction Metabolism
- 3 Ethics of Sustainability and Environmental Justice
- 4 Ecological / Environmental Economics and Life Cycle Costing (LCC)
Course Paper #1 Due + Course Problem #1 assigned (Life Cycle Costing Model)
- 5 Building Assessment and Ecolabels
Course Problem #1 Due (Life Cycle Costing Model)
- 6 Sustainability Frameworks
- 7 Sustainable Communities and Sustainability Indicators
Group Project Assignment
- 8 Energy Systems, Exergy, Entropy, Energy Conservation and Renewable Energy
- 9 Life Cycle Assessment (LCA), Embodied Energy, Energy and Materials
Course Paper #2 Due + Course Problem #2 Assigned (LCA)
- 10 Water Resources, Wastewater and Stormwater
Course Problem #3 assigned (Building Water Model) + Course Problem #2 Due (LCA)
- 11 Urban Planning, Land Development, New Urbanism and Landscaping
Course Problem #3 Due (Building Water Model)
- 12 Design for the Environment, Ecological Principles, Passive Design and Climatic Design
- 13 Construction Operations, Advanced Construction Waste Management and Deconstruction
Course Paper #3 Due
- 14 Building Health, Building Commissioning and Facility Management
- 15 Industrial Ecology and Construction Ecology
Group Project Report Due + Oral Presentation

The syllabus will be followed to the best of the instructor's ability, but the instructor reserves the right to adjust the syllabus as required.

Lecture Objectives, Assignment & Outcomes

SC – Sustainable Construction: Green Building Design & Delivery, 2nd Edition, Charles J. Kibert, New York: John Wiley & Sons, 2008.

Ethics – Working Toward Sustainability: Ethical Decision Making in a Technological World, CJ Kibert et al., New York: John Wiley & Sons. 2011.

EBN – Environmental Building News, Building Green Inc.

Note: When the assignment is to **“READ”** the reference, it is intended that you gain a thorough understanding of the book, paper, or other material. **“SCAN”** means to obtain a cursory understanding or familiarity with the subject matter of the assignment. **“VIEW”** means that the student should page through the lecture. For **“VISITING INTERNET SITE”** assignments, you must obviously be connected to the internet. You are responsible for becoming generally familiar with the issues and current activities of the organizations at these sites.

Lecture 1. Introduction: Sustainability in the Built Environment

Learning Objectives:

- Various definitions of Sustainable Development and Sustainable Construction.
- “Strong” versus “Weak” Sustainability.
- Sustainable Development relative to the interconnection of ecological, economic, and social conditions.
- Sustainable Construction as the implementation of Sustainable Development in the economic sector known as the Built Environment.
- General current thinking about Sustainable Development and Sustainable Construction.
- Worldwide efforts in Sustainable Development and Sustainable Construction.
- International organizations involved in Sustainable Development and Sustainable Construction.
- Agenda 21, the Brundtland Commission, the President’s Council on Sustainable Development.
- The concept of high performance green buildings

a. Read:

- Chapter 1: Introduction and Overview (SC)
- Chapter 1: Context for Sustainability (Ethics)
- EBN’s “Checklist for Environmentally Responsible Design & Construction” (EBN); Vol 1(2), revised 2001.

b. Scan:

- [Sustainable Building Technical Manual](#)

c. View:

- Lecture 1
- Ted Talks video: Population growth, box by box http://www.ted.com/talks/lang/en/hans_rosling_on_global_population_growth.html
- “Home” video by Yann Arthus-Bertrand <http://www.youtube.com/watch?v=eoto5FC4gsM>

d. Visit Internet Sites:

- [Powell Center for Construction and Environment, U. of Florida](http://www.cce.ufl.edu) <http://www.cce.ufl.edu>
- [U.S. Green Building Council](http://www.usgbc.org/) <http://www.usgbc.org/>
- [The Florida Green Building Coalition](http://www.floridagreenbuilding.org) <http://www.floridagreenbuilding.org>
- http://www.architecture2030.org/2030_challenge/index.html

- e. **Module Outcomes** (*You should be able to accomplish these as a result of the assignments*):
- Understand the basic concepts behind sustainable development and sustainable construction.
 - Be conversant with the vocabulary of sustainability

Lecture 2. Environmental/Resources Issues & Industrial/Construction Metabolism

Learning Objectives:

- The global environmental issues motivating Sustainable Development.
- The impacts of human activities on the environment.
- The range of resource depletion issues forcing reconsideration of economic assumptions and the industrial system of production.
- The rate of resource consumption by both industry in general and construction industry in particular.

a. Read:

- Part One: Green Building Foundations (SC)
- Chapter 2: Background (SC)
- Chapters 2: The Technology Challenge (Ethics)

b. Scan:

- [BDCMag White Paper on Sustainability 2003](#)

c. View:

- Lecture 2
- [Sustainability and Resource Depletion: Survival Challenge for the 21st Century](#)

d. Visit Internet Sites:

- [The Sierra Club Global Warming site](#)
- [The World Resources Institute](#)

e. **Module Outcomes**

- Be familiar with the key environmental and resource issues motivating sustainable development.
- Understand the global strategy that must be implemented to counter global warming.

Lecture 3. Environmental Ethics and Environmental Justice

Learning Objectives:

- The moral and ethical problems posed by current production and consumption.
- The inherent rights of natural systems to exist.
- The impacts on society, especially the poor, of the present industrial system.
- Environmental ethics as an alternative to present behavior relative to nature.

a. Read:

- [Cultural and Legal Strategies for Combating Environmental Injustice](#), Nicole Kibert, 2002
- Chapter 2: Background (Read sections on Ethics) (SC)
- Chapter 3: Introduction to Ethical Concepts (Ethics)

b. View:

- Lecture 3

c. Visit Internet Sites:

- [WFEO Code of Environmental Ethics for Engineers](#)

d. Module Outcomes

- Understand the key ethical issues of sustainable development.
- Be able to define environmental justice, what it is in practicality, and its major issues.

Lecture 4. Ecological/Environmental Economics and Life Cycle Costing

Learning Objectives:

- The assumptions of present economic thinking that does not take the environment into account.
- The evolving field of Ecological Economics.
- Alternatives to GNP and GDP as measures of economic performance.
- Full Cost Accounting which factors in impacts on natural systems.
- The application of Life Cycle Costing to Built Environment decision-making.

a. Read:

- Chapters 6: Economic Dimensions of Sustainability Ethics (Ethics)

b. Scan:

- [Chapter 3, Problems and Principles of Ecological Economics in An Introduction to Ecological Economics \(Costanza et al. 2008\)](#)

c. View:

- Lecture 4

d. Module Outcomes

- Understand the role of ecological economics with respect to sustainable construction.

Lecture 5. Building Assessment and Ecolabels

Learning Objectives:

- Ecolabeling of products as a solution to assuring attention to environmental impacts in production.
- Building Assessment as a method of labeling buildings for their environmental impacts.
- The U.S. Green Building Council's LEED Standard and the Green Globes Standard.
- International Building Assessment tools and rating systems

a. Read:

- Chapter 4: Green Building Assessment (SC)
- [Building Environmental Assessment Methods: A Measure of Success \(Raymond Cole\)](#)
Note: this is a paper in the International Electronic Journal of Construction (IeJC). You need to click on Special Issues, then on the special issue, Future of Sustainable Construction, then on this paper.
- EBN articles on alternative flooring materials (EBN)

b. View:

- Lecture 5

c. Visit Internet Sites:

- [German Blue Angel Ecolabel](#)
- [LEED Rating System \(U.S. Green Building Council\)](#)
- [Green Globes on-line auditing tool](#)

d. Module Outcomes

- Be able to explain the concepts of ecolabeling and building assessment and how they are related.
- Understand the purpose of the LEED assessment system and other similar building assessment systems.
- Understand the relationship of technology to sustainability.

Lecture 6. Sustainability Frameworks

Learning Objectives:

- Proposed approaches or frameworks for achieving sustainability.
- Concepts of measuring progress based on environmental issues (EcoMetrics) and the efficient use of natural systems functions (EcoEfficiency).

a. Read:

- Chapter 7: The Green Building Design Process (SC)
- Chapter 2: The Technology Paradox (Ethics)

b. View:

- Lecture 6

c. Module Outcomes

- Be able to describe the frameworks for sustainability mentioned in the lecture materials.
- Understand how green building initiatives can or do use these frameworks.

Lecture 7. Sustainable Communities and Sustainability Indicators

Learning Objectives:

- The role of sustainable communities in achieving sustainable development.
- Case studies of specific sustainable communities.
- Local Agenda 21 and the Healthy Communities Initiative.
- Measuring progress through sustainability indicators.
- Types of sustainability indicators and their creation.

a. Read:

- Chapter 4: Social Dimensions of Sustainability Ethics (Ethics)
- [Developing Indicators of Sustainability: U.S. Experience](#) (Brad Guy and Charles J. Kibert)
- [Local Government Dialogue Paper 2001](#) (ICLEI)

b. Scan:

- [The City of Santa Monica Sustainability Report Card \(2010\)](#)

c. View:

- Lecture 7

d. Visit Internet Sites:

- [Sustainable Communities Network](http://www.sustainable.org) <http://www.sustainable.org>
- [Center of Excellence for Sustainable Development](http://www.sustainable.doe.gov/) <http://www.sustainable.doe.gov/>
- [The International Council for Local Environmental Issues](http://www.iclei.org/) <http://www.iclei.org/>
- [City of Santa Monica Sustainability](#)

e. Module Outcomes

- Be able to explain the concept of a sustainable community and the role of Local Agenda 21 in helping create a sustainable community.
- Understand what an 'indicator' is and its role in sustainable community development.

Lecture 8. Energy Systems, Exergy, Entropy, Energy Conservation, and Renewable Energy

Learning Objectives:

- Problems associated with energy use worldwide and in the U.S.
- Quantities of energy being used and forecasts for the future.
- Role of energy conservation in reducing energy demand.
- Potential for renewable energy systems to meet energy needs.
- Concepts of Exergy and Entropy.
- Design concepts for energy efficient buildings.

a. Scan:

- Chapter 9: Energy and Carbon Footprint (SC)

b. View:

- Lecture 8
- [Advanced Photovoltaic Thin Film Technology \(video\)](#)

c. Visit Internet Sites:

- [Lighting Excellence: Lawrence Berkley National Lab](http://eande.lbl.gov/CBS/LightingExcellence.html) <http://eande.lbl.gov/CBS/LightingExcellence.html>
- [The Renewable Energy Policy Project](#)
- [International Solar Energy Society](http://www.ises.org/) <http://www.ises.org/>
- [Solar Energy International](http://www.solarenergy.org/) <http://www.solarenergy.org/>
- [The Sustainable Buildings Industry Council](#)

e. Module Outcomes

- Be able to describe the basic energy strategy that should be used to produce sustainable school buildings. Be sure to include health as an important issue.

Lecture 9. Life Cycle Assessment, Embodied Energy, Energy, and Materials

Learning Objectives:

- Concept of Life Cycle Assessment.
- Embodied Energy and Energy.
- Green Building Materials.
- Assessing building materials for their environmental impacts.

a. Read:

- EBN articles on insulation (EBN)

b. Scan:

- Chapter 11: Closing Materials Loops (SC)

c. View:

- Lecture 9

d. Module Outcomes

- Be able to describe how materials can be considered sustainable or non-sustainable and give examples in construction.

Lecture 10. Water Resources, Wastewater, and Stormwater

Learning Objectives:

- Water resource issues worldwide and in the U.S.
- Strategies for water conservation, reuse, and recycling.
- Alternative wastewater handling strategies.
- Alternative stormwater handling strategies.

a. Read

b. Scan

- Chapter 10, Built Environment Hydrologic Cycle (SC)
- [The Texas Rainwater Harvesting Handbook](#)

c. View

- Lecture 10
- [Circle of Blue \(video\)](#)

d. Module Outcomes

- Understanding water issues connected to sustainable buildings.
- Be familiar with the global water crisis.

Lecture 11. Urban Planning, Land Development, New Urbanism, and Landscaping

a. Read:

- Chapter 7 Integrating the Three Legs of Sustainability (Ethics)

b. Scan:

- Chapter 6 Sustainable Sites and Landscaping (SC)
- [Turning Brownfields into Vital Community Assets](#) (C. Kibert, T. Vetica, and N. Kibert)
- [USEPA Natural Landscaping Manual](#)

c. View

- Lecture 11

d. Module Outcomes

- Understand the concept of 'brownfield' and how remediating them contributes to urban sustainability
- Be able to describe the concept of Conservation Subdivision Design.
- Explain the thrust of the USEPA Natural Landscaping Manual.

Lecture 12. Design for the Environment, Ecological Principles, Passive Design, and Climatic Design

Learning Objectives:

- Design and architecture issues relative to sustainability.
- Natural systems as the model for sustainable design.
- Passive versus active systems.
- Emerging concepts: Ecological Design, Climatic Design, Design for the Environment (DFE).

a. Read:

- [A Roadmap to Sustainable Building Design](#) (Charles J. Kibert and Pekka Huovila)
- Chapter 3: Ecological Design (SC)

b. View Internet Sites:

- [Sustainable Architecture, Building and Culture](#)
- [Solar Design Associates](#)

c. View

- Lecture 12

d. Module Outcomes

- Be able to describe how design, in the sense of architecture and engineering as applied to the built environment, is changing in the era of sustainable construction and green building.

Lecture 13. Construction Operations, Advanced Construction Waste Management, and Deconstruction

Learning Objectives:

- The impacts of construction operations on the environment.
- The extent of construction and demolition (C&D) waste.
- Reduction, reuse, and recycling of C&D waste.
- Deconstruction of buildings: technical, environmental, and economic potential.

a. Read:

- [Financial Consequences of Construction Waste](#) (Bosslink)
- [Deconstruction: Giving Old Buildings New Life](#), (Sherman)

c. Scan

- Part Three: Green Building Construction, Commissioning, Economics, Future Green Buildings (SC)
- Chapter 13 Construction Operations (SC)

c. View:

- Lecture 13

d. Visit Internet Sites:

- [Construction Waste Management](#)
- [On-Site Minimizing Construction Waste RMIT – Australia](#)

e. Module Outcomes

- Be able to describe the construction and demolition waste problem in the U.S.
- Be able to explain the concept of a construction waste management plan and how you would implement one in a construction company.

Lecture 14. Building Health, Building Commissioning and Facility Management

Learning Objectives:

- Building Health Issues and Causes.
- Indoor Environmental Quality (IEQ) Issues.
- Role of Building Commissioning in Sustainable Construction.
- Facilities Management Opportunities and Building Maintenance Issues.

a. Read:

- [Sick Building Syndrome- IAQ Insider](#) (Robert L. Scarry)

b. Scan

- Chapter 10: Indoor Environmental Quality (SC)

c. View

- Lecture 14

d. Visit Internet Sites:

- [The Green Building Guide](http://www.greenguide.com/) <http://www.greenguide.com/>
- [Sustainable Building Sources \(Austin, TX\)](http://www.greenbuilder.com/general/BuildingSources.html) <http://www.greenbuilder.com/general/BuildingSources.html>

e. Module Outcomes

- Be able to describe the problems of indoor environmental quality in buildings and how green buildings are attempting to create high quality, healthy indoor environments.
- Understand the concept of 'building commissioning' and how it is applied in green building. Be sure to review the LEED-NC 2009 rating system to determine how building commissioning is applied in current U.S. Green Buildings.

Lecture 15. Industrial Ecology and Construction Ecology

Learning Objectives:

- Definitions and objectives of Industrial Ecology and Construction Ecology.
- Pollution Prevention and Clean Technology.
- Natural systems as models for industrial systems.
- Case Studies of Industrial Ecology.

a. Read:

- Chapter 15 The Cutting Edge and Beyond (SC)
- [Supporting Pillars For Industrial Ecology](#) (Ray Cote)

b. View:

- Lecture 15

c. Visit Internet Sites:

- [Program for the Human Environment, Rockefeller University](#)
- [Indigo Development](#)

d. Module Outcomes

- Be able to explain the concept of industrial ecology and how it is connected to sustainable construction.