

Green Machine: Designing the BAC of the Future

Mondays 7:15—10:15pm

Instructor

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Green Machine: Designing the BAC of the Future introduces students to environmentally responsive design as a tool to improve the built environment. Students will study the Boston Architectural College in order to propose retrofits that will improve the environmental performance of the existing buildings and facilities of the college. The studio asks how designers can increase the environmental performance of buildings while taking a critical stance on sustainability in architecture. The proposed alterations to the existing buildings of the BAC will use conceptually rigorous design to guide the application of relevant architectural technologies. Digital media will be employed to enhance our understanding of building performance as well as evaluation of design solutions. The studio will also be an opportunity to emphasize the importance of a clear position on historical context and concepts of preservation of existing structures.

Course Rationale

This studio fulfills the B-1 design studio requirement for the Bachelor of Design Studies (BDS) program, functioning as a gateway to the BDS concentrations. The studio will build on the fundamental concepts of design introduced in the Level A studios, introducing advanced design concepts that comprise the various concentrations of Design Studies. Sustainability will be a lens through which the other four areas of concentration within the Bachelor of Design Studies curriculum are viewed. These areas of concentration include Architectural Technology, Design Computing, History, Theory, and Criticism, and Preservation.

Goals and Learning Objectives

Green Machine uses the concrete design exercise of improving the performance of our built environment to frame learning objectives that are conceptual in nature. The studio will consider three main questions over the course of the semester:

1. What is environmentally responsive design and why is it important?
2. What does the process look like when the goal is environmentally responsive design?
3. How can the success of such a design be evaluated? How can we tell whether a design that is environmentally responsive achieves its objectives?

The course intends to foster a deep understanding of the environmental performance of a building in a direct way. At the same time the course will suggest that design is a powerful tool that can be used to build awareness about environmental performance issues, and suggest solutions to them in an historic and social context. The course will permit a variety of approaches to the problem according to individual student preferences.

The goal of the studio is to develop in each student the ability to carry out a creative design process with the following attributes:

1. Environmentally responsive and applicable to our built environment in general
2. Based upon sound research and analysis
3. Capable of creating design solutions that are compelling to building occupants

Unit 1: Site Analysis

Weeks 1--4

The first unit of the semester will be devoted to understanding material and energy flows relative to the built environment. The first class will consist of an ice-breaking exercise in which students are provided with a simple kit of parts consisting of recycled cardboard, rubber bands, wood dowels, an electric motor, a fan, and an Light Emitting Diode (LED) and instructed to build a scale model of a windmill capable of lighting the LED light. Following this exercise students will study resource and energy flows to and from the BAC to build a systematic understanding of building functions from the standpoint of resource use. Students will research the building to define a specific area of their own interest. We will then map the embodied and operating energy flows of the BAC and surrounding neighborhood graphical, using software as well as hand methods to increase our understanding of resource use in the building and surrounding area. Unit 1 will provide the background understanding required for the second unit, which will propose designs responding to the resource flows.

Informal Review as class (No outside reviewers)

Unit 2: Individual Design Approaches

Weeks 5--10

During the middle segment of Big Green Machine students development proposals to improve the environmental performance of specific areas of the BAC. Concurrent with the development of the proposals we will look at case studies of environmental performance of new buildings, retrofits of existing buildings, and methods of raising awareness about environmental issues in general. Particular emphasis will be placed on the evaluation of retrofitting an existing building in an historically sensitive manner consistent with the context of its current and past environment. Students will likewise be introduced to methods of digital building performance evaluation as a means of evaluating their proposed design solutions.

Formal Review (outside reviewers evaluate individual proposals)

Unit 3: Proposal Development and Documentation

Weeks 11—16

Designers intent on creating a better future must develop effective tools to disseminate their designs and communicate to the public. During unit three the class will collaborate to produce an exhibition documenting the various proposals. The exhibit could consist of an integration of the various proposals into one master proposal, or it could simply document all of the projects in a single format. Emphasis will be placed on digital presentation methods and materials.

Formal Review of entire project (students present individual proposals as a part of whole)

Schedule

Week 1

Small Wind Generation

Course Introduction and philosophy

Individual interests

In-class design exercise: windmill kit of parts

Assignment #1:

Write personal definition of sustainability

Get a sketchbook dedicated to class

Reading:

Stewart Brand: *How Buildings Learn*

Week 2

Embodied Energy

Review Assignment 1

Lecture: Embodied Energy

Dimensions of sustainability: Light Green, Dark Green, Bright Green

Assignment #2:

Embodied Energy Analysis for one material used in construction of BAC
Readings:
American Institute of Architects: *Sustainable Architectural Practice Position Statement*
E.F. Schumacher: excerpt from *Small is Beautiful*

Week 3

Operating Energy

Lecture: Operating Energy
Presenting information in diagrams
Case Study: Cape Wind
Assignment #3:
Operating Energy Analysis for a region of BAC at 320 Newbury St.

Week 4

Site Analysis Review

Assignment #4:
Sketch Proposal for the BAC
Case Study: California Academy of Sciences
Reading:
Karen E. Steen: *Green Architecture's Grand Experiment*: Metropolis Magazine: Sept. 2008

Week 5

Designing the BAC of the Future: RFP

Identifying the problem: review sketch proposals
Assignment #5 (Due week 7):
Concept models and developmental sketches
Reading
Architecture Boston: *Reimagining City Hall--Graphic Essay: Imagine That* Sept.- Oct. 2007

Week 6

Architectural Context

In-class collaborative work session: construct physical site model

Week 7

Proposal Development

Review concept models and development sketches
Individual meetings with students
Assignment #5:
Proposal Development in response to comments

Week 8

Proposal Development

Individual meetings with students
Assignment #6:
Proposal Refinement in response to comments

Field Trip: Genzyme Building, Cambridge, MA
Behnisch, Behnisch and Partner, Stuttgart

Week 9

Proposal Development

Desk Crits and Production
Assignment #7:
Midterm Review Requirements
Preparation for Midterm Review

Week 10

Midterm Review

Week 11	Outside Reviewer TBD Midterm Review Response Desk Crits and Production Assignment #8: Midterm Review Response
Week 12	Context and Landscape Lecture: Building in Site/ Site in Building Desk Crits and Production Assignment #9: Site and Context
Week 13	Writing the Project Individual meetings with students Assignment #10: Project observation Written Description of the project Reading Francois Roche/R&SIE(N): <i>Aqua Alta and Dusty Relief Project Descriptions</i>
Week 14	Reading the Project Review written project descriptions Lecture: Techno-Utopias: Masdar City, Dongtan, Songdo, Boston Seaport? Assignment #11: Preparation for final review
Week 15	Refining the Project Individual meetings with students In-class working session Assignment #12: Preparation for final review
Week 16	Final Review Outside Reviewers TBD

Readings

Berge, Bjorn. *Ecology of Building Materials*. Architectural Press, 2001.

Brand, Stewart. *How Buildings Learn: What happens after they're built*. Basic Books, 2000. ISBN: 0465007805.

Chamberlain, Lisa. "Mayor Daley's Green Crusade" *Metropolis Magazine* July, 2004.
http://www.metropolismag.com/html/content_0704/chi/index.html

Daniels, Klaus. *Technology of Ecological Building*. Basel: Birkhauser Verlag 1997.

Daniels, Peter L., and Stephen Moore. "Approaches for Quantifying the Metabolism of Physical Economies: Part I: Methodological Overview." *Journal of Industrial Ecology* 5, no. 4 (2001): 69-93. (Material Flow Analysis)

Fernandez, John E. *Material Architecture: emergent materials for innovative buildings and ecological construction*. Architectural Press, 2005.

Fuller, Buckminster. *Utopia or Oblivion*. New York, NY: Bantam Books, 1969. ISBN: 0553028839.

Graedel, Thomas E. *Streamlined Life-cycle Assessment*. Upper Saddle River, NJ: Prentice Hall, 1998, chapters 2 and 5. ISBN: 9780136074250.

Hawken, Lovins and Lovins. *Creating the Next Industrial Revolution* Boston, MA: Little Brown & Co. 1999.

McDonough, William. *Cradle to Cradle*. North Point Press, 2002. 0865475873

Paladino Consulting. *A Primer on LCA for Sustainable Building Projects*. Seattle Public Utilities, 2000.

Papanek, Victor. *Design for the real world: human ecology and social change*. Chicago, IL: Academy Chicago, 1985. ISBN: 0897331532.

N55: 3 selections from "Manual for N55." In *N55 Book*. Odder, Denmark: Narayana Press, 2003. ISBN: 8791409055.

Reid, Esmond. *Understanding Buildings: A Multidisciplinary Approach*. Cambridge: The MIT Press, 1999.

Rogers, Everett M. 2003. *Diffusion of Innovations*. 5th Edition. Free Press: New York. 2003.

Sinclair, Cameron and Stohr, Kate. *Design Like You Give a Damn*. New York: Metropolis Books, 2006. 19330452

Steele, James. *Ecological Architecture: A Critical History*. Thames & Hudson, 2005.

Wines, James. *Green Architecture* Koln, Germany: Taschen, 2000.

ISO:14040 *Environmental management : Life Cycle Assessment : Principles and Framework*. Geneva: ISO, 1997

Whitehill, Walter Muir. *Boston: a topographic history*.

Newman, William A. and Holton, Wilfred E. *Boston's Back Bay: the story of America's greatest nineteenth-century landfill project* Northeastern University Press ; Hanover University Press of New England, c2006.

Neighborhood Association of the Back Bay. Development Committee. *Principles and guidelines for future development of the Back Bay : a report / by the Development Committee of the Neighborhood Association of the Back Bay*. Boston, MA : The Committee, 1999.

Back Bay : since 2500 B.C. [Boston] : New England Mutual Life Insurance Co., c1961.

Primary material regarding the design and construction of the Boston Architectural College's 320 Newbury Street building is available in the institutions archives.

Links:

US Dept. of Energy: <http://www.energy.gov/>

US Green Building Council: <http://www.usgbc.org/>

Rocky Mountain Institute: <http://www.rmi.org/>

Center for Maximum Potential Building Systems: <http://www.cmpbs.org>

Building Green: <http://www.buildinggreen.com/>

Online tool for exploring the energy performance of building designs: <http://designadvisor.mit.edu>