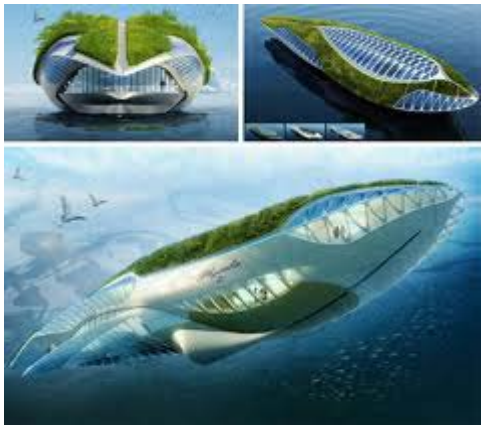
Zero+ Campus Design Project: Spring 2011; 7 Week Project Module

ARCH 5550 · Zero+ °C Design

Envisioning the Sustainable Campus

Integrating carbon, energy, and water management strategies toward zero- and net-positive design

Masdar, a zero-carbon, zero- waste city to be built in the desert near Abu Dhabi by the Laboratory for Visionary Architecture (LAVA)



The Physalia (which means "water bubble"). A self-sufficient, zero-emission, positive-energy floating garden.

Each building is a unique ecosystem within the larger ecosystems of landscape and region… Ecologically designed buildings and institutions afford a chance to make such relationships explicit, thereby becoming part of the educational process and research agenda organized around the study of local resource flows, energy use, and environmental opportunities.

David Orr, The Chronicle of Higher Education

Now there is one outstandingly important fact regarding Spaceship Earth, and that is that no instruction book came with it.

R. Buckminister Fuller, Operating Manual for Spaceship Earth (1963)

Instructor

Loren Abraham, AIA, LEED AP, Adjunct Assistant Professor
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Class Hours : Monday, Wednesday, and Friday, 1:30-5:00 p.m.
Office hours: Friday, 12:00-1:00 p.m. or by appointment, Rapson Rm 71

Additional Studio Advisor

Mary Guzowski, Associate Professor, School of Architecture
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If you cannot make these office hours please see the instructors after class to make an appointment. Office hours can be used to discuss course work, review work in-process, get additional readings, or to talk about the subject matter in relation to your special interests.

Course Description

The Zero+ Design module will offer an interdisciplinary design and study experience exploring the interrelationships of energy, waste, water and carbon emissions with the stated goal of achieving net zero emissions, energy and water use or even becoming an exporter of resources to the surrounding community.

Course Focus & Objectives

The primary goal of this course is to move beyond a compartmentalized approach to energy, water and waste management and toward the next generation of zero-energy and zero-emissions holistic design thinking. The University of Minnesota Twin City Campus provides a perfect venue in which to investigate the strategic integration of carbon, energy, and water management design for individual buildings within the landscape and regional contexts.

Key Questions: The course will explore three fundamental questions related to integrated zero-impact design:

1. What are the criteria for measuring our ecological footprint and how do we evaluate our proposed designs accordingly?
2. What are the interrelationships between energy, water and waste that if optimally exploited could move toward synergetic "zero+" performance?
3. What are the major impediments to achieving and implementing this level of performance in design and how can they be overcome?

The objectives of the course:

1. Introduce students to a theoretical and practical framework for an ecological approach to integrated living building design.
2. Provide fundamental concepts, principles, strategies, and design tools for achieving zero carbon emissions, zero energy, zero water and zero waste design goals.
3. Use hands-on fieldwork, case study analyses, and design investigations to explore and apply these concepts, principles, and skills.
4. Enable and encourage students to develop their own integrated ecological design process and methodology.

Course Framework &Desired Outcomes The course will investigate the ecological opportunities of integrated zero energy, zero water and zero waste design through a modestly-scaled and locally-based design project. The explorations will include iterative studies using computer analysis tools, and other qualitative and quantitative investigations. Exercises will be used to integrate various ecological design considerations. The course will include: 1) informal and formal design critiques, 2) brief in-class presentations of issues and exemplars, 3) discussion of readings and case studies, and 4) hands-on experience, observations, and qualitative and quantitative assessment of the use of energy, water and waste management practices in exemplary regional buildings.

Outcomes

The Zero+ Design Project Desired Outcomes will be to:

- Evaluate the zero+ design performance of buildings and landscapes through integrated carbon, energy, and water management strategies.
- Reduce energy and related greenhouse gas emissions through integrated landscape and building design.
- Reduce water and associated energy consumption as well as and waste generated
- Reduce stormwater runoff and its associated pollution, flooding, and ecological effects.
- Reduce the urban heat island and related threats to human and ecological health.
- Beautify the landscape with additional trees, green roofs, living walls and other ecologically strategic landscape and high performance building design and related amenities.

Assignments designing for a nearby site and building project with the University of Minnesota as the "client", students will investigate a set of ecological, energy and resource issues and building operation objectives. The resulting proposed project design solutions will develop incrementally over the 7 week period based on the following tentative course structure.

Course Structure ***Tentative topics and weighting:***

Precedent/Case Study Research	*10%*
Evaluating Energy and Carbon Emissions	*10%*
Calculating water, runoff and waste	*10%*
Assessing Urban Heat Island Impacts	*10%*
Establishing Linkages and creating synergies	*20%*
Getting to the next level - "zero+" performance	*10%*
Measuring success - Integrated Zero+ Design	*30%*
Total	*100%*

Due Dates Assignments will be due at the beginning of class on the assigned due date. Late projects will be lowered one grade (except under extenuating circumstances) for each day that it is late (i.e. from an A to A- if it is late on the due date; from an A- to B+ the day after the due date, etc.). All exercises must be *completed and presented* to receive a passing grade.

Meeting Times Class periods will begin promptly at 1:30 p.m. and conclude at 5:00 p.m. Please make every effort to be to class on time. This issue is important in maintaining and building community and as a means of minimizing class disruptions.

Grading Standards *University of Minnesota Grading Standards:*

A Achievement that is outstanding relative to the level necessary to meet course requirements
B Achievement that is significantly above the level necessary to meet course requirements
C Achievement that meets the course requirements in every respect
D Achievement that is worthy of credit even though it fails to meet fully the course requirements
SAchievement that is satisfactory, which is equivalent to a C- or better
F (or N) Represents failure (or no credit) and signifies that the work was either: 1) completed but at a level of achievement that is not worthy of credit or 2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an incomplete.
I (Incomplete) Assigned at the discretion of the instructor when, due to extraordinary circumstance, e.g., hospitalization, a student Is prevented from completing the work of the course on time. Requires a written agreement between instructor and student.

Academic Dishonesty Academic dishonesty in any portion of the academic work for a course shall be grounds for awarding a grade of F or N for the entire course.

Credit/Workload Expectations This 4 credit course will run for 7 weeks. The expected workload for this course, based on University standards, is an estimated total of 24-30 hours per week. This can include any combination of time in the class or outside the class. We will work with students to assess the workload and make adjustments as needed.

Schedule and Attendance The course meets on Monday, Wednesday, and Friday afternoons in a room to be announced. Attendance is required. It is critical that you fully participate and attend all class periods (lectures, reviews, and field studies). Please make every effort to be to class on time. Punctuality is important in maintaining and building community and as a means of minimizing class disruptions.

Supporting Materials ***Required Reading List***
Specific readings will be assigned with the individual course assignments in 1-2 week blocks. All readings are on *electronic reserve* through the University of Minnesota library system.

Required Software Commercial Software: Autodesk® Ecotect™ (other commercial software applications will be demonstrated as well, e.g. Energy 10, IES Environmental Simulator Plugin for Sketchup, etc.) Other Freeware, Shareware and Proprietary Software developed for this class will be distributed via the class website on *Moodle*.

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integrating carbon, energy, water and resource management strategies

toward zero- and net-positive design solutions

zero carbon · zero energy · zero water · zero waste

Tentative Course Schedule

Week 1	Introduction to ZER0+ Design		
	Mon 03 21	1:30-3:00	Studio Logistics and Review of Syllabus and Schedule
		3:15-5:00	Introductory Lecture: ZER0+ Design - Energy and Water in Buildings
	Wed 03 23	1:30-3:00	Methodology and Introduction of Projects
		3:15-5:00	Initial Meeting with "Client," Orlyn Miller & M. MacKenzie, Client Representatives
	Fri 03 25	1:30-5:00	Informal Review - Due Exercise 1: Precedent/Case Study Research
Week 2	Evaluating Energy and Carbon Emissions		
	Mon 03 28	1:30-3:00	Opportunities for Optimizing Energy and Carbon Emissions
		3:15-5:00	Innovative approach to modeling Energy and Carbon Emissions
	Wed 03 30	1:30-3:00	Living Architecture - conservation vs. renewable energy
		3:15-5:00	Work period and desk crits
	Fri 04 01	1:30-5:00	Informal Review Due Exercise 2: Energy and Carbon Emissions
Week 3	Water, runoff and waste		
	Mon 04 04	1:30-3:00	One man's treasure is another man's garbage…targeting zero waste
		3:00-5:00	Innovative approaches to modeling Water and waste
	Wed 04 06	1:30-3:00	Water: Elixir of Life, Guest Lecturer: Barry Lehrman, Research Fellow
		3:15-5:00	Work period and desk crits
	Fri 04 08	1:30-5:00	Informal Review - Due Exercise 3: Calculating water, runoff and waste
Week 4	Assessing Urban Heat Island Impacts		
	Mon 04 11	1:30-3:00	Urban Heat Island - Guest Lecturer Barry Lehrman, Research Fellow
		3:00-5:00:	Innovative approach to modeling UHI
	Wed 04 13	1:30-5:00	Field Study: Mdewankanton Sioux Community Wastewater Treatment Plant and Green Roof
	Fri 04 15	1:30-5:00	Informal Review - Due Exercise 4: Modeling UHI and measuring the cost
Week 5	Establishing Linkages and creating synergies		
	Mon 04 18	1:30-3:00	An integrated systems approach
		3:00-5:00:	Innovative approach to modeling integrated systems
	Wed 04 20	1:30-3:00	Student Presentations: More Examples of Integrated Systems
		3:00-5:00:	Work period and desk crits
	Fri 04 22	1:30-5:00	Informal Review - Due Exercise 5: Modeling Integrated ecological systems

Week 6 Getting to the next level - “zero+” performance

Mon 04 25	1:30-3:00	Field Study - TBD
	3:00-5:00	Work period and desk crits (flexible)
Wed 04 27	1:30-3:00	Work period and desk crits
	3:00-5:00:	Work period and desk crits
Fri 04 29	1:30-5:00	Work period and desk crits
	3:00-5:00:	Software Tool Troubleshooting (available in studio)

Week 7 Measuring success - Integrated Zero+ Design

Mon 05 02	1:30-3:00	Systems Integration - the synergies and trade-offs
	3:00-5:00:	Work period and desk crits
Wed 05 04	1:30-5:00:	Work period and small group pin-ups
Fri 05 06	1:30-5:00:	FORMAL REVIEW Exercise 6: Final Integrated Zero+ Design