

# ARCH 5550 • Zero+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. Buckminster Fuller, Operating Manual for Spaceship Earth (1963)*

### **Exercise 1: Precedent Study, Net-Zero Design Performance**

#### **Due Dates**

Step A: Due Wed. Mar. 23, 1:30 PM Discussion Topic for “Client “ Meeting Room 71

Step B: Due Friday Mar. 25, 1:30PM: informal presentation; Room 71

*Phase Grade weighting: 10% total grade (100 points); team grade*

#### **OBJECTIVES**

- To establish clear design objectives for your project.
- To identify the performance metrics, tools and related design targets for your project.
- To identify case examples and precedents which demonstrate exemplary integration of energy, water, runoff and waste optimization strategies .
- To begin to establish an holistic approach to integrated living building design towards net-zero and zero+ performance goals.
- To identify areas for further research relating to the design objectives of the project.

#### **Introduction**

Universities, as research institutions and as long-term owners of property, have the opportunity—and responsibility—to explore new forms of sustainable practice. This project will link several building performance metrics (e.g., energy use, water consumption, stormwater runoff and reclamation, etc.) and will seek to explore how the University of Minnesota campuses can become a model of environmental stewardship. The practice of modeling the energy performance of

buildings is well established and typically integrated into the design of new buildings, however, performance modeling of environmental factors – storm water, biodiversity, shade and ground cover, energy use in the landscape – are currently not considered or integrated into the creation of the building energy models. Combined, these environmental factors play a significant role in the actualized performance of the campus, and also contribute to the beauty of place. This exercise aims to identify and showcase recent building projects, especially higher education facilities, where site and building performance goals are well integrated resulting in net-zero or zero+ performance. In addition the exercise should identify methods of analysis and tools used to model, predict the performance of the projects as designed and evaluate the post-occupancy performance of completed projects.

### STEP A: DEVELOP AN INITIAL “CLIENT MEETING” DISCUSSION GUIDE

1. **What are the critical questions that should be asked during the initial meeting with the client?** As a team, establish a list of information you would like to obtain during your initial meeting with the client for your project. These things may include institutional values, performance criteria, operational and maintenance issues, budget and life-cycle cost parameters. Consider how you might better understand the needs of the client and the best approach for your team. You might consider:

- *Site issues including percent of site to remain open*
- *Specific strategies to include or exclude*
- *Design priorities in terms of sustainability vs. design*
- *Traffic and pedestrian Circulation patterns*
- *Life-cycle Cost Benefit Requirements*
- *Utility and Energy Costs*
- *Storm water issues and opportunities*
- *Etc.*

### STEP B: RESEARCH PRECEDENTS

2. **Integrated Energy and Water/ Building and Site Precedent study:** Assign at least 2 precedent research tasks to each individual in your team. You might consider:

- *Integrated Energy and Water Strategies*
- *Net-Zero performance Goals*
- *Integrated Building and Site design*
- *Living Walls, arbors and trellises*
- *Intelligent Skin concepts*
- *Other innovative Approaches*
- *Performance analysis methods*
- *Innovative use of modeling tools*
- *Energy and water performance data*
- *Eco-services systems approach*
- *Renewable Energy integration*

3. Graphical studies and a brief written narrative highlighting the key concepts and describing the innovative Integration:

- Annotated building wall sections at an appropriate scale
- Or include other diagrams to explain integration, e.g., exploded view diagrams, cutaway perspective or axonometric studies. Include sufficient annotation to convey design intentions clearly.
- Explanation of Energy and Water linkages evident in the design or methods used

### GRADING CRITERIA - Project Two – Phase 1: 10% total of ARCH 5516 grade (100 pts)

- Depth of precedent research and appropriateness and relevance to project
- Clarity and accuracy of quantitative analysis charts, graphs and annotated drawings
- Demonstrated understanding of the thermal analysis process being used
- Clarity and accuracy of conclusions drawn