

GSD 6404: ZED Workshop - Live / Work Prototype

Harvard Design School, Department of Architecture
Fall Semester 2009
Instructors: William Dunster, RIBA + Kenneth Martin Kao, Dr.Tech.Sci. AIA
Class Fridays 1-4 pm, Gund 510
Dunster Workshop * Thursdays 5-7 pm, Gund 510

Schedule Revised 9/8/09

- 1a. Thu* Sep. 3 ZED Case Study: Beddington Live / Work Prototype (Dunster @ GSD)**
- 1b. Fri Sep. 4 ZED Case Study: Jubilee Wharf & Recent Projects (Dunster @ GSD)**
- 2. Fri Sep 11 ZED Research: Students' Design / Research Charrette @ Studio (no lecture)**
- 3. Fri Sep 18 ZED Research – Key Concepts (class discussion, Dunster AV)**
- 4. Fri Sep 25 Sustainable Housing Development: Solar City, Linz (Schroepfer)**
- 5. Fri Oct 2 Net Zero Energy Home / Open-Source Building Systems (Benson)**
- 6. Fri Oct 9 Living Building & Eco Towns Challenge - Beyond LEED & Energy Star**
- 7a. Thu* Oct 15 ZED Charrette: Design Workshop (Dunster @ GSD)**
- 7b. Fri Oct 16 ZED Charrette: Design Workshop (Dunster @ GSD)**
- 8. Fri Oct 23 Engineering Net Zero Energy & Carbon-neutral Planning (Arup)**
- 9. Fri Oct 30 Renewable Energy: Building Integrated Systems, Micro-Grid, Off-Grid**
- 10. Fri Nov 6 Water Conservation Management & Eco-waste treatment (Todd & Todd)**
- 11. Fri Nov 13 ZED Design Workshop: (Dunster AV Link)**
- 12. Fri Nov 20 Building Prototype & Mass Customization: Toyota Green Prefab Houses**
Fri Nov 27 (Thanksgiving Recess)
- 13a. Thu* Dec 2 ZED Prototype: Presentations & Discussion (Dunster @ GSD)**
- 13b. Fri Dec 3 ZED Prototype: Presentations & Discussion (Dunster @ GSD)**

GSD 6404: ZED Workshop - Live / Work Prototype

Harvard Design School, Department of Architecture
Fall Semester 2009
Instructors: William Dunster, RIBA + Kenneth Martin Kao, Dr.Tech.Sci. AIA
Class Fridays 1-4 pm, Gund 510
Dunster Workshop * Thursdays 5-7 pm, Gund 510

Schedule Revised 9/8/09

1a. Thu* Sep. 3 ZED Case Study: Beddington Live / Work Prototype (Dunster @ GSD)

Philosophy of Zero (fossil) Energy Development;
ZED living approach; ZED design strategies & standards
Planning gains: high quality of life on a low ecological footprint;

Beddington Zero Energy Development project assessment;
Collaboration framework to creating a Live/Work prototype community;
Performance measures - Lessons learned

Readings: Bill Dunster, Craig Simmons, Bobby Gilbert, *the ZED book*, Part 1, Principles for ZED living; pp.3-55; pdf: Chris Twinn, "BedZed" The Arup Journal, 01/2003 pp.1-16; pdf: Bill Dunster Architects, from A to ZED, realizing zero (fossil) energy development. CD2006) pp. 1-84

1b. Fri Sep. 4 ZED Case Study: Jubilee Wharf & Recent Projects (Dunster @ GSD)

ZED factory: Designing, developing, and realizing ZED recent projects.
Jubilee Wharf, Cornwall; Earth Center, Duncaster; Rural ZED; Suburban ZED;
Urban ZED; project analysis; Evaluating the ZED physics model; Ecological
footprint analysis, baseline data

Readings: Bill Dunster, Craig Simmons, Bobby Gilbert, *the ZED book*, Designing & Realising ZED standards projects, pp. 85-116; Part III, Case studies, pp. 216-247; pdf: Bill Dunster Architects, from A to ZED, realizing zero (fossil) energy development. CD2006 pp. 139-169;

2. Fri Sep 11 ZED Research: Students' Design / Research Charrette @ Studio (no lecture)

Envisioning a Zero (fossil) Energy master planning development; Research bioclimatic Potential project site typologies, identify key topics and issues for sustaining ZED living. Outline master plan, spatial and building concepts of a ZED prototype; Program & design of a Live/Work prototype unit;

Readings:
Dunster, the ZED book, Part II, Building fabric and insulation, passive solar design, thermal mass, low energy systems, pp.159-206; BioRegional Solutions for Sustainability: BedZED tool kit Part I; A guide to construction materials for carbon neutral development, (Bill Dunster Architects, from A to ZED, realizing zero (fossil) energy development. CD2006) pp. 85-137)

3. Fri Sep 18 ZED Research – Key Concepts (class discussion, Dunster AV)

Development of ZED concepts, principles, and metrics; Carbon-neutral developments; Student presentation of research on: Planning gain, Bio-climatic design, Thermal, Electrical, Water, Transport, Renewable Energy; Quality of Life; The Living Building, Site and Infrastructure Challenge; Restorative Design;

Readings: Bill Dunster, Craig Simmons, Bobby Gilbert, *the ZED book*, The ZED physics model; pp.117-158; Center for the Built Environment, UC Berkeley, *Getting to Zero:How CBE Industry Partners are meeting net-zero energy goal*; Wendt, Allyson. "The Living Building Challenge: Can It Really Change the World?" *Environmental Building News*. Vol 18, No. 6, June 2009.

4. Fri Sep 25

Sustainable Housing Development: Solar City, Linz

Consultant: Thomas Schroepfer, Harvard GSD

Integrated planning, public-private partnership in sustainable planning, design and construction; optimum density – low carbon transportation; flexibility of housing types; low impact self sufficient energy generation; low energy building; water and waste management on site; preservation of river ecology and biodiversity. Thomas Herzog + Partners; Low energy building designs.

Readings:

Thomas Schroepfer, Emerging Forms of Sustainable Urban Housing; Thomas Schroepfer, Christian Werthmann, TransUrban: Charting Experiments for Cities of the Future – Case Study 02: Solar City Linz; Thomas Herzog, Solar Energy in Architecture and Urban Planning; Thomas Herzog Architecture + Technology

5. Fri Oct 2

Net Zero Energy Home / Open-Source Building Systems

Consultant: Tedd Benson, Benson Woodworks, Factory Visit.

Prototyping Green / Smart home; MIT House of the Future: House n –Initiative; Open Source Building System; Experimental Prototype collaboration Engineering & Fabrication;

Readings: Kent Larson, 2008.11.13 Open Prototype Initiative webcast; architecture.mit.edu/house_n/documents/Project_List.pdf; architecture.mit.edu/house_n/publications.html; Barry Bergdoll, Home Delivery, *Fabricating the Modern Dwelling*; pp.12-25, 40-140; momahomedelivery.org; livinghomes.com;

6. Fri Oct 9

Living Building & Eco Towns Challenge

Integrated holistic planning; Performance based design, construction, and operation; Life Cycle environmental Impacts; Real Estate Development Metric & Market Valuation; Overcoming barriers to implementation, process and strategies.

Readings: BioRegional Development Group, CABE, *What makes an Eco-Town?*; The Cascadia Living Building Challenge; National Science and Technology Council Committee on Techology: *Federal Research Agenda for Net-Zero Energy, High-Performance Green Buildings*; National Renewable Energy Laboratory, *A Handbook for Planning and Conducting Charrettes for High-Performance Projects*;

7a. Thu* Oct 15

ZED Charrette: Design Workshop (Dunster @ GSD)

Students design workshop & discussions

- 7b. Fri Oct 16 ZED Charrette: Design Workshop (Dunster @ GSD)**
Students design workshop & discussions
- 8. Fri Oct 23 Engineering Net Zero Energy & Carbon-neutral Planning**
Consultant: Mark Walsh Cooke, Director Arup – Boston
Carbon Neutral Engineering; Net-Zero Energy programming; Life / Work Style energy assessment and conservation; Dynamic load planning and reduction; Renewable energy demand planning; Case Studies: Dongtan; Treasure Island;
Readings: Fiona Cousins, Arup, *Down to Zero! Understanding zero energy and zero carbon across scales*; Treasure Island Master Plan, Sustainability report; Life Cycle Assessment: Anderson, Jane and David Shiers with Mike Sinclair. *The Green Guide to Specification. Carbon Mixer, Athena Institute, Impact Estimator for Building Software.*
- 9. Fri Oct 30 Renewable Energy: Building Integrated Systems, Micro-Grid, Off-Grid**
Consultant: Daniel M. Kammen, Distinguished Professor of Energy, University of California, Berkeley, Founding Director, Renewable and Appropriate Energy Laboratory, Lead Author, Intergovernmental Panel on Climate Change, which shared the 2007 Nobel Peace Prize
Green Energy Infrastructure layout; Renewable Energy Micro-grid Development. Building integrated systems, PV & Wind turbines; Integrated glazing and power generation cladding; High intensity PV pane, Emerging R+D
Readings: Kammen, D. M. and Pacca, S., (2004) "Assessing the costs of electricity", Annual Review of Energy and the Environment, 29, 1 – 44; Kammen, Daniel. "Community-Based Electric Micro-Grids Can Contribute to Rural Development: Evidence from Kenya". Wilson, Alex. "The Folly of Building Integrated Wind". *Environmental Building News* May 1, 2009.
- 10. Fri Nov 6 Water Conservation Management & Eco-waste treatment**
Consultant: Dr. John & Jonathan Todd, Todd Ecological Design, Inventor of Living Machine; Winner of the Buckminster Fuller Prize.
Living Machine, Eco Waste Treatment; Constructed wetlands; Water conservation, hydrology & site management; Nutrient development integrated food production; Vegetated vertical screens, air filtration and purification, Building integrated vegetation and buildings;
Readings: John Todd with Nancy Jack Todd, *From Eco-Cities to Living Machines: Principles of Ecological Design*, Nancy Jack Todd, *A Safe and Sustainable World: the promise of ecological design*; toddecological.com; Water Conservation Planning: Samuel F. Helmle, *Developing a Strategic Plan for Socially Acceptable Demand Control Programs*; Dunnett, Nigel, and Noel Kingsbury. *Planting green roofs and living walls*;

11. Fri Nov 13 ZED Design Workshop: (Dunster AV Link)

Development of select topics of the Allston project
Design / Research Consultations with key resources.

12. Fri Nov 20 Building Prototype & Mass Customization: Toyota Green Prefab Houses

Technology Transfer, design and engineering green prefabs using digital mass customization; Green housing prototype for computer aided mass production; Total Quality Management, Lean Production, and Just-in-time strategies; Development of integrated web-based mass home marketing.

Readings: D. Schodek, M. Bechthold, K. Griggs, K.M. Kao, M. Steinberg, *Digital Design and Manufacturing*; Clayton M. Christensen, *The Innovator's Dilemma*, NY: Harper Business, 2000. (Chapter 2: Value Networks and the Impetus to Innovate, pp. 33-63); 'Mass Custom-Design' Approach to Custom Homes: masscustomhome.com; Innovative tools for mass customization of vehicle: cater-ist.org;

Fri Nov 27 (Thanksgiving Recess)

13a. Thu* Dec 2 ZED Prototype: Presentations & Discussion (Dunster @ GSD)

13b. Fri Dec 3 ZED Prototype: Presentations & Discussion (Dunster @ GSD)