

**FINAL REPORT**

to

American Institute of Architects

Upjohn Research Initiative 2007-2009

# Case Studies of Carbon Neutrality

May 28, 2009

UO E-PCS: 13801  
UO INDEX: 446800

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**PROJECT ABSTRACT:** In 2006, recognizing the impact of buildings on global climate, the American Institute of Architects adopted the 2030 Challenge — an initiative to reduce the building sector’s dependence on fossil fuels and mitigate greenhouse gas emissions. The AIA also initiated a program (2001) to develop case studies of recently completed and ongoing projects. The case study initiative was intended to expose students to specific issues of professional practice, and simultaneously provide opportunities for practitioners to reflect on their design approach for their next project.

This proposal addresses both AIA initiatives, relates to domains of architectural knowledge, design, and building performance; strengthens research links between academia and practice, and addresses the goals of the 2030 Challenge.

The Case Studies of Carbon Neutrality Project will catalog the design and delivery process for carbon-neutral buildings through a series of case studies that describe design intent and actual performance. Research methodologies will include interviews with selected practitioners from architectural firms on the West Coast on the design process and strategies that delivered buildings that meet the 50% target of the 2030 Challenge. Performance outcomes will be measured by using a nationally implemented set of investigative protocols that focus on particular design strategies. By documenting the delivery process for carbon neutral buildings, the barriers to sustainable practice will be better understood — the issues faced by design teams during the design process and the role of clients, consultants, and contractors. Examining the results of post-occupancy performance will offer practice a means to “close the loop” of design lessons learned in building design.

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**Introduction:** The AIA Upjohn Award was awarded in November 2007. During this time period, we adjusted the budget to meet the needs of the project with the reduced funding from our proposal. We also began researching and reviewing suitable digital transcription equipment, costing out transcription services vs. having student assistants complete the tasks, filing a Human Subjects Protocol with the University of Oregon Office for the Protection of Human Subjects, meeting with consultant, Nicholas Rajkovich to refine interview process, and contacting four firms for the initial interviews.

Nick Rajkovich from Pacific Gas and Electric in San Francisco, was the primary consultant for the project, advised on all aspects of the narrative development, conducted interviews, developed the format for the narratives, and presented the project at several conferences.

Britni Jessup, Graduate Research Assistant from the UO Center for Housing Innovation and the principal research assistant for the project from its inception. Britni has purchased equipment, conducted interviews and followup building walk throughs, transcribed all interviews, provided exhibits, and worked on final edits. Britni graduated in March 2009 and I have hired her as a research assistant using my university research funds to finish up this project

Christopher Neilson, Graduate Research Assistant from the UO Center for Housing Innovation, came onto the project on April 1, 2009 and has assisted with the final edits, calculations, and updating case study information.

The firms invited for this project are shown on Table 1. Principals at the firms were sent a letter of invitation, asked to select a recent project that meets or exceeds the Commercial Buildings Energy Consumption Survey (CBECS) energy consumption performance standard of 50 percent of the regional average for that building type. Some firms selected buildings that were designed

early in the USGBC’s LEED process (or before) and other firms decided to select buildings that were designed more recently. Our criteria for the project were that it had to have been in operation for at least one year. One firm, SERA Architects, insisted on using the East Portland Community Center which is still under construction; we may or may not include it with the final case studies depending on the balance of information. Interviews with the mechanical/energy consultants are also included on Table 1.

Table 1: Architectural Firms and Consulting Engineers Participating in the AIA Upjohn Project

CASE NO.	BUILDING	FIRM	ARCHITECT/ENGINEER
2009-001	Chartwell School Seaside, California	EHDD	Scott Shell
		Taylor Engineering	Gwelen Pagliaga
2009-002	Tillamook Forest Center Tillamook, Oregon	Miller Hull Partnership	Bob Hull Teresa Russell
		PAE Engineers	Paul Schwer
2009-003	Orinda City Hall Orinda, California	Siegel and Strain Architects	Henry Siegel Burton Peek Edwards
		Taylor Engineering	Allan Daly
2009-004	Portland State University Stephen Epler Hall Portland, Oregon	Mithun	Ron van der Veen, Roger Gula Steve McDonald
		Interface Engineers	Mark Heizer
2009-005	The Gerding Theater Portland, Oregon	GBD Architects	Craig Mendenhall
		Glumac Engineers	Bob Schroeder
2009-006	East Portland Community Center Portland, Oregon	SERA Architects	Lisa Petterson Eric Ridenour
		Interface Engineers	Mark Heizer

**Interview Protocol:** We developed a series of questions for the interviews with the intention to draw out a discussion and conversation. The questions are organized in the categories of: team building, goal setting, technology, process, management and relationships, barriers, and future work. An Olympus digital recorder recorded the interview, during which time the interview team could focus on the interview and not be distracted or slowed down by taking notes. The interviews took place in the firm’s office, usually in a conference room. We encouraged the architects not to use any drawings or handouts, so that the story could be told verbally. Each interview takes approximately one hour. Most firms had two people sitting in for the interview: the project architect and the design architect; they were able to refresh each other’s memories and discuss the project from different perspectives. The interview protocol was also used when we contacted the engineers associated on the projects. We developed a similar protocol and set of questions for the facility managers.

- *All interviews were completed by February 2009.*
- *All transcriptions were completed by March 2009.*

**Transcriptions and Narrative Development:** The transcriptions from each hour-long interview took approximately 5 to 6 hours to transcribe. The development and editing of the narrative (from the transcription) took approximately 10 hours. Correspondence, further editing, and formatting by the architects and engineers took approximately another 15-20 hours spanning over three weeks, depending on their schedules. We severely underestimated the amount of time that it would take to get the narratives to the end product. There was also the delicate balance of the firms wanting the narratives to read as a promotional pieces (and to edit the “voice” or clarity of speech) and our intention to have their voices tell the story of the design and delivery process. Anticipating the time (see December interim report) needed to complete the narratives, we requested a no-cost extension to the end of May.

- *No-cost extension requested on April 8, 2009. Richard Hayes approved April 13, 2009.*
- *All narratives were completed by early May 2009.*

**Equipment and Supplies:** We purchased the Olympus DS-40 Digital Voice Recorder, ME30W Stereo microphones, and AS-2400 footswitch, headset, software, cases for cameras and equipment. We also had the opportunity to examine several carbon metrics and requested half sized drawing sets and specifications; this incurred unbudgeted expense. We purchased additional recording equipment, a video camera and 4 large screen monitors to facilitate the editing process.

- *All equipment purchases completed by April 2009.*

**Building Visits:** Following the interviews with the architects, interviews and building walk-throughs were scheduled with the Facility Manager. A modified interview protocol was developed for the interview with the Facility Managers about the operations of the building, covering similar topics (team building, goal setting, technology, process, management and relationships, barriers, and future operations), but focusing on building operations and maintenance. The intention is for students to take the lead in the Building Visits portion of this project and to give them first-hand experience in the protocol because it is an activity that students frequently conduct during studio. During the building walk-through, students take notes, make observations, sketches and photographs about the functioning/operation of the building: e.g. occupancy and behavior, lighting use/control, clothing, fans, positions of blinds, diffusers. Most importantly, they are asked to develop questions as they walk through the building, covering almost any issues that they find interesting and related to energy use, thermal response, thermal comfort and/or climate control, ventilation, lighting control, number of computers used, plug loads, etc. These questions may be followed up later or developed into a case study project on a building performance topic. Successful strategies are to be recorded.

- *Four of the six building walk throughs are complete by December 2008; however due to time constraints, we focused on the transcriptions and architect-engineer stories/*

**Dissemination:** On Nov. 16-19<sup>th</sup>, we presented the project at a national conference, Behavior, Energy and Climate Change, in Sacramento, California home to more than 700 participants for the second conference on behavior, energy and climate change, Nov. 16-19, 2008 at the Hyatt Regency Hotel. Convened by the California Institute for Energy & Environment (CIEE), University of California (<http://ciee.ucop.edu>), the Precourt Institute for Energy Efficiency, Stanford University (<http://ipiee.stanford.edu>) and the American Council for Energy-Efficient Economy (ACEEE) (<http://aceee.org>), this conference focused on understanding behavior and decision making of individuals and organizations and using that knowledge to accelerate the transition to an energy-efficient and low carbon future. International participants from utility organizations, policy institutes, communications and marketing companies, and academics (few architects) gathered around concurrent behavior tracks. The project levered other dissemination activities and we conducted two Zero Net Energy Design Charrettes; one in Portland, Oregon for 25 architects and 25 engineers, and one in San Francisco for architects only. Response that these presentations generated emphasized the need for more case studies and information about the design process of buildings.

- *Behavior, Energy and Climate Change, Sacramento, CA Nov. 16-19,2008*
- *Zero Net Energy Design Charrette, White Stag Building, March 21, 2009 (50 architects, engineers), Portland, Oregon*
- *Zero Net Energy Design Charrette, AIA National Convention, April 29, 2009, (50 architects), San Francisco, California*

**Summary:** As pdf documents, we hope the AIA will place these narratives on their website for further dissemination. These documents represent narratives about the design and delivery process by the firms that has a unique place in the market as an architectural resource. We plan to continue the development of these kinds of narratives in the near future.

**BUDGET:**

	proposed budget	actual budget	interim expenses <sup>8</sup>	FINAL 05/30/09
<b>Interviews on Design Process and Delivery:</b> (PI, Consultant, and 1-2 Graduate Research Fellows, travel, per diem, 1 day to Portland, San Francisco, Seattle);	\$3,450.	\$3,450.	\$2,743.	\$5,247.
<b>Instrumented Building Visits:</b> (PI, Consultant, 2-3 Graduate Research Fellows, travel, per diem, 3 days to Portland, San Francisco, Seattle)	\$8,900.	\$8,900.	\$573.	\$958.
<b>Equipment and Instrumentation:</b> Digital camera, digital transcription equipment*	\$2,400.	\$1,451.	\$770.	\$1,599.
<b>Consultants:</b> Interview development, on-site investigations, advisory technical review	\$3,600.	\$2,100.	\$300.	\$4,600.
<b>Student(s) Assistance:</b> Assist PI with project activities.		\$840.	\$961.	\$961.
<b>Peer Review Meeting:</b> (PI, Consultant, Practitioner Team)	\$2,050.	\$2,050.		n/a
<b>Dissemination</b> AIA National Convention, Conference, USGBC Greenbuild Conference (PI, practitioners, or student travel, lodging, per diem, registration)	\$2,027.	0.		\$2,001.
<b>Misc. Supplies</b> paper, disks, batteries, toolkit supplies, CDs, portable memory	\$300.	\$300.	\$1,354.	\$3,725.
<b>Direct Costs</b>			\$6,701.	\$19,901.
<b>Indirect Costs</b>	\$2,273.	\$1,909.	\$670.	\$1,909.
<b>TOTAL:</b>	\$25,000.	\$21,000.	\$7,371.	\$21,000.

**Attachments:**

- 6 Narratives:
  - 2009-01 Chartwell School
  - 2009-02 Tillamook Forest Center
  - 2009-03 Orinda City Hall
  - 2009-04 Stephen Epler Hall
  - 2009-05 The Gerding Theater
  - 2009-06 East Portland Community Center