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The Carbon Neutral Design Project

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Abstract

Never before have architectural educators and professionals faced the magintude and urgency of today's ecological challenges resulting from global warming and climate change. To meet these challenges, the Society of Building Science Educators (SBSE)[1] has initiated the **Carbon-Neutral Design (CND) Project** to create and disseminate the resources and tools needed to integrate carbon-neutral and zero-energy design into professional architecture programs and practice. This project is a direct response to the *2010 Imperative* [2] (which is a call for architectural educators to address carbon-neutral design and fossil fuel reduction in the design studio, to improve ecological literacy for design students, and to integrate related issues in the design and operations of university facilities and campuses) as well as the *Architecture 2030 Challenge* (the realization of carbon-neutral architecture by the year 2030). The paper provides an overview of the **CND Project**, including: 1) project goals and overview; 2) carbon-neutral design studio project, 3) online carbon-neutral design resource, and 4) current and future carbon-neutral design education opportunities provided *by SBSE.*

Keywords: Architectural Education, Carbon-Neutral Design, The 2010 Imperative, The Architecture 2030 Challenge

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[1] Society of Building Science Educators. www.sbse.org
[2] Architecture 2030. www.architecture2030.org

1 Introduction: Project Goals and Overview

The **Carbon Neutral Design (CND) Project** is a multi-faceted, multi-year project designed to bring together architecture's professional and academic communities around the topic of carbon neutral design. Our goal is to codify and disseminate the knowledge base that is emerging in both practice and academia on producing buildings that require no fossil fuel energy and create no greenhouse gas emissions. This means not only applying the current best practices of high performance sustainable design to design education, but also envisioning the next generation of design thinking and communicating it to both the profession and to design students.

Phase I and II: The first phase of the **CND Project** includes two existing efforts; the *Carbon Neutral Studio* initiative and the SBSE 2008 Summer Retreat focusing on carbon-neutral design education. The second phase of the project is a proposed *Carbon Neutral Design Summit* and development of an online *Carbon Neutral Design Resource* to be initiated over the coming year. SBSE is currently seeking funding to coordinate both efforts. The proposed *CND Summit* will bring together design practitioners and educators to discuss best practices and innovations in professional practice and design studios. The resulting list of design strategies, simulation tools, web resources, case studies and other educational materials will be assembled for web-based dissemination. The University of Wisconsin-Milwaukee is proposed as the venue for the *CND Summit* in August 2008. Web-ready content will be created by the end of the year.

Phases III and IV: The third and fourth phases of the **CND Project** focus on further development of the online and educational resources as well as regional and national educational efforts during the next five years. Phase III will further develop the online resources, assess and develop new computer simulation tools, and develop case studies of carbon neutral buildings. Phase IV envisions a multi-year training program based on regional partnerships between design practitioners and educators that will emphasize climatic and bioregional implications of carbon-neutral design.

The SBSE is currently seeking funding and partnerships for all phases of the project. The following discussion considers current resources and efforts.

2 Carbon Neutral Studio Initiative

The SBSE *Carbon Neutral (CN) Studio* initiative was implemented in Fall 2007 to develop carbon-neutral teaching resources and tools; to pilot those resources and tools; and to develop a means to share educational resources and the studio outcomes for carbon-neutral design education. The studio initiative includes a network of 50 participants from around the world, and thirty-one carbon-neutral

studio projects during the 2007-2008 academic year (see *Figures 1* and *2*). Fourteen studios were completed in Fall 2007and the remaining studios will be completed by the summer of 2008. Ten studios are undergraduate, graduate, or mixed-level elective studios; at least four are designed to satisfy the U.S. National Architectural Accreditation Board's "comprehensive design" requirement; and four are either capstone or thesis studios. The studio problem statements include: affordable and green housing programs; schools; nature centres and other public programs; high-volume retail environments; an office park/data center; other commercial programs; and several higher education projects including a 20–30 story mixed-use dormitory.

Geographic and Program Distribution: As illustrated in *Figure 1*, the participating institutions are geographically diverse. The studios include a range of degree programs (BSAS, B.ARCH, and M.ARCH) as well as varied curricular approaches within the different programs. One segment of architectural education not well represented is the beginning design curriculum. To address this issue, SBSE would like to partner with other groups, such as the annual Conference on the Beginning Design Student, to solicit participants from early design studios.

Participating Studio Projects by Climate and Type: As illustrated in *Figure 2*, the studio projects include a wide range of building types and climates. Predictably, small buildings are favored as modest scale projects more easily lend themselves to in-depth investigations. Also predictably, most projects are located in temperate climates. These biases will be analyzed during the evaluation and tool distillation process to insure that tools appropriate for each scale and climate type are developed. Preference will be given to the underrepresented climates and project types if a proposed second round of studio evaluations takes place in the Fall of 2008. The results of the design studios will become part of an online *Carbon Neutral Design Resource* website to share the educational resources and outcomes of the studio efforts. An "Educator's CND Workbook" is proposed to help educators apply the outcomes and lessons of the *CN Studio* and a proposed *CND Summit*. Faculty and programs throughout the world are invited to participate in the *CND Studio* initiative.

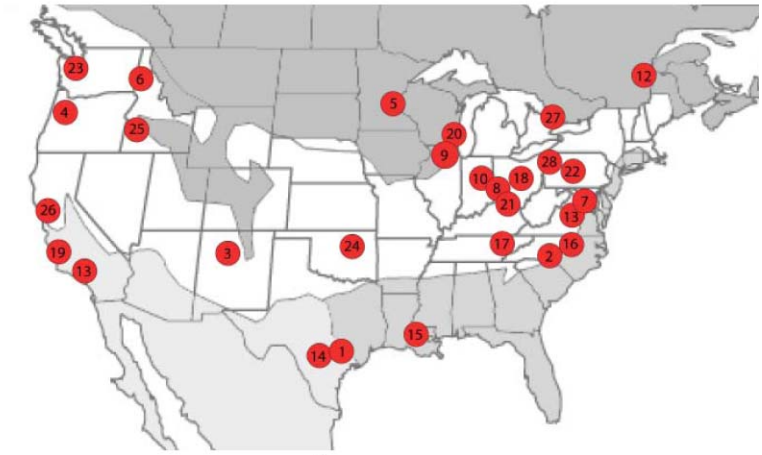

Figure 1: Carbon Neutral Design Studio Participating Institutions Mapped on the four climate zones of North America

Project/ Climate Types	**Small** *(climate dominated building design)*	**Large** *(interior load dominated building design)*	**X-Large** *(ecological land planning/ urban + nieghborhood design)*
Hot-humid	Bagneid Koester Kwok Rashed Rose Rider Theis	Rashed Rose Rider	Rashed
Hot-dry	Bagneid Koester La Roche	Wu	Elzeyadi
Temperate	Bagneid Dent Haglund Johnston Kaiser Koester Kwok Quale La Roche Shelton Peña	Elzeyadi Haglund Shelton Wu Zaretsky Mansy	Elzeyadi Haglund Johnston Kaiser Quale Iulo
Cold	Bagneid Guzowski Koester Thomson	Potvin/Demers Sharag-Eldin Wasley	Ripley

Figure 2: Carbon Neutral Design Studios by Climate and Type

3 Online Carbon Neutral Design Resource and Website

The development of the proposed CND Resource website is included in current bids for funding from several agencies. The resource is intended to extend on as well as refine current curricular materials that focus on preparedness to undertake Carbon Neutral Design; i.e. that address key areas of passive design, sustainable systems and active design, all of which are required as a point of departure for successful Carbon Neutral Design. To this resource database will be added the multitude of outcomes from the various aspects of the CND Project.

The online *CND Resource* website will provide educators and practitioners with access to guidelines, strategies, case studies, and tools, including the following design resources for educators and practitioners:

CND Processes and Strategies: Reframing the Design Problem: The *CND Resource* will provide practical design guidelines and strategies to assist carbon neutral design planning and processes. The *Resource* will include methods to frame carbon neutral design project goals, strategies to establish proposed energy and carbon profiles, and evaluation methods to assess anticipated performance. Design lessons, processes, strategies, and examples will be drawn from practitioners' projects and from the studio work of design educators participating in the *CND Summit*.

CND Case Studies: Real World Solutions: The *CND Case Studies* will document successful built projects that combine design excellence and performance goals for carbon and fossil fuel reductions, including design processes, strategies, assessment methods, and lessons. The *CND Case Studies* will include projects from practitioners participating in the *CND Summit* and the *AIA COTE Top Ten Green Projects Awards Program*.

CND Tools and Software: Evaluation and Assessment Resources: An annotated bibliography of *CND Tools and Software* will be compiled from the *CND Summit*. Phase II will include an in depth analysis of design tools, software, and performance metrics and the creation of new application specific tools.

4 Current and Future Carbon Neutral Design Education Opportunities

The SBSE annual summer retreats provide an additional opportunity for design educators to participate in the **CND Project**. In the spirit of the upcoming Oxford Conference, "Resetting the Agenda," the July 2008 *SBSE New Forest*

Retreat [3] will focus on defining new directions in building science research and architectural education. The retreat is organized around two objectives: 1) to share new and emerging best practices and 2) to chart a course for the engagement of the SBSE in global discussions on the future of research and education. Two themes will be explored: 1) "New Topics and New Approaches," focusing on sharing emerging ideas and approaches to teaching energy and other green building topics, and 2) "Resetting the Agenda," which will create position statements representing SBSE's vision for the future of building science research and education. The outcomes of the retreat will become part of the online *Resources* available through the SBSE website.

The SBSE welcomes participation in the **CND Project** from faculty, students, administrators, allied organizations, and the building industries. For more information on the related carbon-neutral design efforts please see the SBSE website at www.sbse.org/resources/index.htm.

[3] SBSE New Forest Retreat info: http://www.sbse.org/retreat2008/index.htm