

<http://www.iccsafe.org/e/prodshow.html?prodid=9551S08>

<http://www.joe.org>

<http://resnet.us>

<http://darkwing.uoregon.edu/~akwok/pdfs/ASES03.pdf>

<http://www.the-bac.edu>

Green

<http://www.usgbc.org>

<http://darkwing.uoregon.edu/~akwok/pdfs/ASES03.pdf>

Building

Educator's

Toolkit

<http://www.eng.vt.edu>

<http://www.the-bac.edu>

<http://www.nahbgreen.org>

<http://search.nrel.gov>

<http://www.housing-commercialization-tools.com>

<http://www.mnshi.umn.edu>

<http://resnet.us>

<http://www.joe.org>

<http://www.greenbuildingadvisor.com>

<http://www.eng.vt.edu>

<http://www.mngreenstar.org>

www.mnshi.umn.edu

<http://search.nrel.gov>

<http://www.mnshi.umn.edu>

<http://www.nahbgreen.org>

<http://www.greenbuildingadvisor.com>

<http://www.mngreenstar.org>

<http://www.usgbc.org>

www.mnshi.umn.edu



Prepared for the **National Housing Endowment**

Prepared by the **NAHB Research Center**

September 2010

2373_09/10-v.1

Background and Layout

The Green Building Educator's Toolkit is an annotated bibliography for two- and four-year university programs in Residential Construction Management. It represents an assessment of—and response to—these types of institutions' needs for instructional materials on sustainability and green building. It is not intended to be an exhaustive treatment of all green building resources but rather a broad sampling. The Toolkit contains the following types of items.

- Annotated bibliography of resources
- Instructional aides
- Course syllabi
- Approaches to green curriculum

The assessment of institutional needs was made by conducting four focus groups comprising 17 participants from 14 schools. The primary prompt was, "What do you most need in a Green-Curriculum Toolkit?" The response was to develop this Toolkit. The annotated bibliography within this Toolkit lists green-related materials according to the topical groupings that were mentioned most frequently during the focus groups: Curriculum, Theory, Technology, Standards, Applications, and Environmental. Specific case-study curricula are included in the appendices. Each topical grouping contains multiple entries that are listed alphabetically. Each entry has a brief description included that provides the reader a glimpse into what to expect when visiting the source's website.

The secondary prompt was, "What do you think is needed in the future in terms of a 'Next-Generation' Tool?" The focus-group discussions revealed that participants felt the peer-review process takes too long, and that there is a need for a "wiki-like" clearinghouse where junior faculty could submit material more often and sooner (e.g., articles, lesson plans). It was suggested that the clearinghouse should function by requiring users to participate as reviewers and editors of the submitted materials. Further, they must agree to use the submitted materials at their own risk. Two potential facilitators for such a clearinghouse were proposed: the NAHB Research Center and the National Consortium of Housing Research Centers.

Acknowledgements

Principal Investigator/Author: Randall A. Cantrell, PhD; NAHB Research Center

Program Manager/Reviewer: Thomas M. Kenney, PE; NAHB Research Center

Eric A. Holt; Purdue University Green Curriculum Development

Micah Kaufhold; Jefferson State Community College Green Curriculum Development

About the NAHB Research Center

Located in Upper Marlboro, Md., the NAHB Research Center promotes innovation in housing technology to improve the quality, durability, affordability, and environmental performance of homes and home building products. Created over 40 years ago as a subsidiary of the National Association of Home Builders (NAHB), the NAHB Research Center has established itself as the source for reliable, objective information and research on housing construction and development issues. Through its various testing and certification services, the Research Center seal is internationally-recognized as a mark of product quality and an assurance of product performance.

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I. Curriculum-Related Material

Agents of Change Project: Changing Perceptions of Building Performance

A three-year effort to disseminate a unique and successful approach of embedding investigations of actual buildings within architectural curricula.

http://www.nahbgreen.org/pdf/toolkit/Agents_of___Change_Project.pdf

Boston Architectural College (BAC) Course Descriptions and Required Texts

[Sustainable Design Home Page](#)

[About the Sustainable Design Program](#)

[Semester Course Schedule](#)

[The Certificate Program \(CSD, GCSD\)](#)

[What to Expect in an Online Course](#)

<http://www.the-bac.edu/x756.xml>

Comments of the RESNET Green Rater Task Force on USGBC Course Definitions

RESNET staff is in the process of revising the proposed process for the RESNET Green Rater training based upon input submitted by the task force members. An area that staff requested additional input from the task force was on defining the categories of the green rater training. The US Green Building Council (USGBC) has adopted the below definitions for their training programs. The task force was asked whether RESNET should adopt the USGBC course definitions for its green rater training.

http://www.nahbgreen.org/pdf/toolkit/RESNET_Green_____Rater_Comments_on_USGBC_Definitions.pdf

Consumer Education Program for Residential Energy Efficiency

The Consumer Education Program for Residential Energy Efficiency is an educational effort conducted in partnership with Cornell Cooperative Extension and the New York State Energy Research and Development Authority. This article describes program strategies and impacts, and features efforts county Extension educators have implemented to engage adults and youth in learning practical aspects of energy efficiency. A national approach for education on residential energy efficiency is recommended.

http://www.nahbgreen.org/pdf/toolkit/Consumer___Edu_Program_for_Residential_Energy_Efficiency.mht

A Curriculum Model for Architects and Landscape Architects

There are several possible approaches to developing a curriculum for sustainability-oriented environmental design. One is to start with existing details and work up to a whole. Another approach is to start at the largest most idealized level and work down to details. This exercise tries to do both simultaneously by sorting through the murky reality of existing conditions and, at the same time, by analyzing two past idealized curricula that were highly influential for their time and comparing them to our situation today. Since the main thrust of this paper is the idealized curriculum, analysis of existing sustainable design curricula is discussed at the end of the paper.

http://www.nahbgreen.org/pdf/toolkit/Curriculum_Model_for_Architects_and_LA_Architects.pdf

(For additional work by Margot McDonald, see:

<http://works.bepress.com/mmcdonal/>.)

ENERGY STAR Student Activity Guide to Improving Energy Performance on Campus

The ENERGY STAR Student Activity Guide provides a comprehensive overview of ENERGY STAR tools and resources available to colleges and universities that are looking to improve energy performance. It also offers ideas for hosting activities on campus that will appeal to and motivate students, faculty, staff, administrators, and the local community to learn how to protect the environment by using energy-efficient practices and products.

http://www.nahbgreen.org/pdf/toolkit/ENERGYSTAR_____Student_Activity_Guide.pdf

Green Building and Alternative Energy Curriculum Infusion

Through the use of the established associate degree program in Drafting and Design Development, a new curriculum for green construction and manufacturing is being developed by Edison State College. Students are further investigating the regional impact of green building as well as the barriers to the adoption of those building techniques through faculty-guided research experiences.

Co-Principal Investigators: Dennette Foy dfoy@edison.edu, Albert Dambrose Edison Community College
8099 College Parkway S.W.
Fort Myers, FL 33919 813/489-9300.

Green Building for Building Professionals Outline

(see Appendix A for details)

Comprehensively explains the relationship between Building Science and the disciplines of green building and remodeling.

Green Technology and Sustainability at Portland Community College (PCC)

Presentation outlining PCC's instructional leadership in the area of Green Technology and sustainability. PCC administrators, faculty and staff are proactively moving the college and community toward a more sustainable future while giving students the tools they need to obtain green-collar employment.

http://www.nahbgreen.org/pdf/toolkit/Green_Technology_and_Sustainability_at_Portland_Community_College.pdf

Greening Schools

A joint effort to help schools provide a safe and healthy environment. The project was also designed to provide teachers with standards-based tools to introduce the concepts of waste reduction and pollution prevention to students.

http://www.greeningschools.org/resources/view_cat_teacher.cfm?id=64&g=5&t=0&s=0

Humber College's Sustainable Energy and Building Technology

The three-year, multidisciplinary program will position you to work effectively with other professionals in providing truly integrated solutions in the sustainable technologies sectors that deal with energy efficiency and renewable energy. You will be able to assess site characteristics and client needs, provide advice on renewable energy, building design and heating/cooling system alternatives, prove energy efficiency through energy audits and energy performance simulation, cost the energy system and select appropriate suppliers and contractors.

http://www.nahbgreen.org/pdf/toolkit/Sustainable_Energy_and_Building_Technology-Humber_College.mht

iSeek Solutions

Provides educator resources regarding energy education. Offer lesson plans and activities, curricula, and a wide variety of other resources for post-secondary education.

<http://www.iseek.org/industry/energy/education/curriculum.html>

Jefferson State Community College Construction & Building Science Technology

Courses developed that address Green/Sustainability topics (See Appendix-B for details)

Purdue University Construction Management Program

Courses developed that address Green/Sustainability topics (See Appendix C for details)

Standards-Based, Post-Secondary Curriculum Model in Sustainable Building Design

This study was designed to determine the competencies and learning experiences important to the formation of a standards-based, post-secondary sustainable building design curriculum model.

http://www.nahbgreen.org/pdf/toolkit/Standards_Based_Post_Secondary_Curriculum_Model_in_Sustainable_Bldg_Design.pdf

Synopsis of "Green" Curriculum Activities

Provides an overview (with links) to sample curriculum activities taking place within the state of Michigan.

http://www.nahbgreen.org/pdf/toolkit/Synopsis_of_GreenCurriculum_Activities.doc

USGBC's Course Definitions

The 100-Level courses are designed for individuals who have limited or no prior knowledge of green building principles. The 200-Level courses are designed for individuals familiar with the LEED Rating System and green building principles. The 300-Level courses are designed for individuals who are implementing and applying the LEED Rating System.

<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2177>

II. Theory-Related Material

Air Distribution System Design

Central heating and cooling systems use an air distribution or duct system to circulate heated and/or cooled air to all the conditioned rooms in a house. Properly designed duct systems can maintain uniform temperatures throughout the house, efficiently and quietly.

http://www.toolbase.org/PDF/DesignGuides/doe_airdistributionsystemdesign.pdf

Air-Tightness of U.S. Dwellings

This report uses data to determine relevant leakage characteristics in the US housing stock in terms of region, age, construction type and quality. It answers the following kinds of questions: What is the construction quality of the building envelope? Where are the air-leakage pathways? How tight is the building?

http://www.nahbgreen.org/pdf/toolkit/Air_Tightness_of_US_Dwellings.pdf

Assessment of Damage to Residential Buildings Caused by the Northridge Earthquake

This report evaluates the performance of single-family homes and low-rise multifamily buildings during the 1994 Northridge, CA earthquake, and identifies the nature and extent of damage those homes suffered. The primary purpose of the report is to provide a statistically-based representation of the seismic performance of residential construction relative to local construction characteristics.

<http://www.huduser.org/portal/publications/destech/damage.html>

Building Moisture and Durability

This project set out to develop a set of recommendations for future research on moisture problems in housing that will help to prevent such problems or resolve them once they have occurred. The research recommendations were developed following a review and analysis of the extensive technical literature concerning the problems created by bulk water and excessive water vapor in houses, and the solutions to those problems.

<http://www.huduser.org/Publications/pdf/BuildingMoistureandDurability.pdf>

Clean Energy Ideas

A list of many solar, wind and geothermal energy related articles, including various articles on other forms of renewable energy. All publications focus on the environment and renewable energy, including how to help improve the quality of the air, and to possibly reduce the future effects of global warming.

<http://www.clean-energy-ideas.com/articles/>

Department of Energy: Building America Best Practices Series

Builders and Buyers Handbook for Improving New Home Efficiency, Comfort, and Durability in the Cold and Very Cold Climates [See EcoVillage Case Study]

http://www.nahbgreen.org/pdf/toolkit/DOE_Building_America_Best_Practices_Vol_3.pdf

PLUS more than 4,000 publications on energy, efficiency, etc.

http://search.nrel.gov/query.html?q=url%3Aeere.energy.gov%2Fbuildings%2Fbuilding_america%2F+url%3Apublications%2Fpdfs%2Fbuilding_america%2F&style=eere&qsc=eren&ws=0&qm=0&st=1&nh=10&lk=1&rf=0&oq=&col=eren&qt=Building+America+Best+Practices+Series%3A+Volume+3&x=23&y=11

Design Guide - Residential PEX Water Supply Plumbing Systems

This Design Guide provides the information and resources necessary to design and install cross-linked polyethylene (PEX) water supply systems in residential buildings. It includes comprehensive design concepts and installation guidelines to increase the acceptance and proper use of PEX.

http://www.toolbase.org/PDF/DesignGuides/pex_designguide.pdf

GreenBuildingAdvisor.com

The most complete green building resource on the Web

<http://www.greenbuildingadvisor.com/homes/teenagers-build-affordable-lead-platinum-home>

Green Engineering Web Sites

- University Programs and Centers (US)
- Government
- Corporate
- International
- Other

<http://www.eng.vt.edu/green/links.php>

HVAC Sizing Methodology for Insulated Concrete Homes

The objective of this work was to compile available information regarding energy use in concrete homes, develop additional information as needed, and use this information to develop a methodology to properly size heating, ventilating, and air-conditioning (HVAC) equipment for concrete homes in the US and Canada.

<http://www.huduser.org/portal/publications/destech/HVACSizing.html>

Minnesota Sustainable Housing Initiative

This knowledge base is a collection of information, tools, and protocols for sustainable building. At the core of the knowledge base is a set of tools and protocols to evaluate and measure performance outcomes against program goals. In addition its website serves as a long-term public repository for regional case studies. The case studies include life cycle costs to provide reliable information for decision makers, and examples of effective solutions.

<http://www.mnshi.umn.edu/toolbox/library.html>

New Building Products Development Guide

Guides building products manufacturers and inventors through the activities to create, develop, evaluate, and launch new building products.

<http://www.housing-commercialization-tools.com/index.aspx>

Considerations for Developing “Green” and/or “Clean” Building Products

<http://www.housing-commercialization-tools.com/process/ProductStage.aspx?Node=2>

Considerations for Financing the Development of Green Building Products

<http://www.housing-commercialization-tools.com/finance/index.aspx>

Water Intrusion Evaluation for Caulkless Siding, Window, and Door Systems

The purpose of this research is to design, evaluate, install, and monitor wall siding systems that do not require caulk, either initially or during routine maintenance.

<http://www.toolbase.org/PDF/CaseStudies/caulklessidingevaluation.pdf>

Water Technology Fact Sheet: Porous Pavement

Porous pavement—along with other infiltration technologies like infiltration basins and trenches—have demonstrated a short life span. Failures generally have been attributed to poor design, poor construction techniques, sub soils with low permeability, and lack of adequate preventive maintenance. This article describes key design factors that can increase the performance and reduce the risk of failure of porous pavements (and other infiltration technologies).

http://www.nahbgreen.org/pdf/toolkit/Water_Technology_Fact_Sheet_Porous_Pavement.pdf

III. Technology-Related Material

Air Distribution System Installation and Sealing

Central heating and cooling systems use an air distribution or duct system to circulate heated and/or cooled air to all the conditioned rooms in a house.

Even when properly designed, duct systems must be installed correctly to be efficient, maintain uniform temperatures throughout the house, operate quietly, and not adversely impact comfort or indoor air quality.

http://www.toolbase.org/PDF/DesignGuides/doe_airdistributionsysteminstallation.pdf

Alternatives to Structural Plywood & OSB

Plywood and OSB are considered commodity products and are used interchangeably. Supply or price characteristics that apply to one typically influence these characteristics in the other sheathing product. Uncertainty in price or supply of OSB and plywood has prompted the industry to consider alternative sheathing approaches for residential housing.

<http://www.toolbase.org/Design-Construction-Guides/Interior-Partitions-Ceilings/plywood-alternatives>

Durable Building Envelope

Details for New Construction and Additions” shows builders the components of an affordable and durable building envelope--the foundation, walls and roof that separate conditioned and unconditioned spaces.

<http://www.toolbase.org/ToolbaseResources/level4DG.aspx?ContentDetailID=4155&BucketID=4&CategoryID=53>

Energy-Efficient Lighting

This Tech Set provides an integrated approach to improving the efficiency and effectiveness of lighting used in and around the house.

<http://www.toolbase.org/ToolbaseResources/level4DG.aspx?ContentDetailID=4153&BucketID=4&CategoryID=53>

ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist

The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label. The Checklist requires visual inspection of framing areas where air barriers are commonly missed and inspection of insulation to ensure proper alignment with air barriers, thus serving as an extra check that the air and thermal barriers are continuous and complete. State, local, and regional codes, as well as regional ENERGY STAR program requirements, supersede the items specified in this Checklist.

http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Thermal_Bypass_Inspection_Checklist.pdf

Forced Air System

This Tech Set shows you how to improve the energy efficiency, durability, and performance of the forced air system through proper design and installation procedures. The key is to bring the mechanical contractor into the house’s design process to ensure both the easy installation of ductwork in conditioned space and the proper sizing and design of the HVAC equipment and duct placement.

<http://www.toolbase.org/ToolbaseResources/level4DG.aspx?ContentDetailID=4154&BucketID=4&CategoryID=53>

Frost-Protected Shallow Foundations

Frost-Protected Shallow Foundations (FPSF) provides protection against frost damage without the need for excavating below the frost line. An FPSF has insulation placed strategically around the outside of a foundation to direct heat loss from the building toward the foundation, and also to use the earth’s natural geothermal energy.

<http://www.toolbase.org/Technology-Inventory/Foundations/frost-protected-shallow-foundations>

Ten Steps to Improved Stormwater Compliance

The NAHB Environmental Issues Committee provides online stormwater compliance cards that can be downloaded and printed. The cards outline the Top-10 stormwater compliance issues and how to fix them. The cards can be printed, laminated, attached by a ring, and carried to the field.

<http://www.nahb.org/generic.aspx?sectionID=1286&genericContentID=89113>

Want to Build Green with Engineered Wood Products (EWPs)?

Website that allows you to 1) choose your preferred green building program from among various the options, 2) learn which points EWPs can help earn, and 3) market to builders and homeowners.

<http://www.ewpa.com/green/buildgreen.php>

Waste Management at the Construction Site

Construction and demolition (C&D) debris combined comprises 24 percent of municipal solid waste, which is leading to increased costs and regulation. Some municipalities now ban C&D waste from landfills. Some progress is being made in diverting such waste from landfills, but substantial barriers still exist to a widespread adoption of environmentally sound waste-management practices at construction sites.

www.pathnet.org/si.asp?id=1069

IV. Standards-Related Material

Breaking Down the Barriers: Challenges and Solutions to Code Approval of Green Building

The Development Center for Appropriate Technology led an effort to research issues related to building regulatory challenges for green building by addressing the experience of people seeking to gain code approval for green building projects and those who approve or deny building plans. The results revealed that building codes frequently present barriers to the approval of green building alternatives. Those barriers are both technical and non-technical in nature. Both groups of respondents overwhelmingly indicated that supporting information for alternatives accompanying plans was the most significant factor in gaining code approval. Nontechnical factors were about as likely to affect approval as is a conflict with the intent of the code. A set of recommended strategies for gaining approval and recommendations for training of both code users and code officials is offered.

http://www.nahbgreen.org/pdf/toolkit/Breaking_Barriers_Challenges_and_Solutions_to_Code_Approval_of_Green_Building_by_DCAT.pdf

Built Green Verifier Code of Ethics

The accredited 3rd Party Verifiers of the Built Green Program are committed to providing quality and professional service to their customers and the public. This Code of Ethics sets forth principles and rules of conduct enforced by Built Green through specific procedures contained in its Accreditation Standards. This Code of Ethics is a minimum standard applicable to all accredited.

http://www.nahbgreen.org/pdf/toolkit/Built-Green_Verifier_Code_of_Ethics.pdf

DCAT: Presentations, Other Organizations and Resources Related To Building Codes and Standards

DCAT's program Building Sustainability into the Codes has pioneered the concept that the responsibility of safeguarding public health, safety and welfare inherently includes protecting future generations and the natural systems on the Earth that are our collective life support systems and the basis of our very existence. Its vision of transfer of leadership is coming to fruition as organizations such as the International Code Council (ICC) take up green building and issues of sustainability in their own vision and mission in relation to safeguarding the public from hazards attributed to the built environment.

<http://www.dcat.net/resources/index.php>

Florida Green Home Standard Checklist

Florida Green Building Coalition, Inc. document for providing a Florida green building designation resulting in environmental and economic benefits.

http://www.nahbgreen.org/pdf/toolkit/Florida_Green_Std_chklist.pdf

Florida Green Home Standard Reference Guide

A reference guide intended to serve two purposes: to provide information on green home practices and to provide details on how to earn points for complying with the Florida Green Home Designation Standard.

http://www.nahbgreen.org/pdf/toolkit/Florida_Green_Home_Std_Ref_Guide.pdf

ICC 700-2008 National Green Building Standard (NGBS)

The ANSI approved ICC-700-2008 National Green Building Standard (NGBS) is a collaborative effort between the ICC and NAHB. The Standard provides the "green" practices that can be incorporated into new homes, including high-rise multifamily buildings, home remodeling and additions, hotels and motels, and the site upon which the green homes are located.

http://store.builderbooks.com/cgi-bin/builderbooks/874?id=YTf3aAqN&mv_pc=27

Life Cycle Environmental Performance of Renewable Building Materials in the context of Residential Construction

These research guidelines were developed to ensure a consistent and comparable approach among the various institutions, panels, and task groups conducting CORRIM (Consortium for Research on Renewable Industrial Materials) research. The guidelines detail the information required, include definitions, conventions and measurement units, and cover a range of methodological issues with particular emphasis on establishing boundaries and analysis limits to scope studies.

<http://www.corrim.org/pubs/reports/2005/phase1/index.asp>



Minnesota GreenStar: Certified Green Homes and Remodeling

Minnesota GreenStar is a green building standard and green certification program for both existing and new homes that promotes healthy, durable, high-performance homes. MN GreenStar designed its green certification and green building programs from the ground up to be the best system for Minnesota, giving builders and remodelers the tools to excel.

<http://www.mngreenstar.org/about-minnesota-greenstar/green-certification-programs-green-building-programs-overview>

Press Release for MN Greenstar's® Launch of New Green Realtor Training

<http://www.mngreenstar.org/images/Press/NewGreenRealtorTraining.pdf>

National Green Building Program

Through the National Green Building Program, the National Association of Home Builders is helping its members move the practice of green building into the mainstream. Energy efficiency, water and resource conservation, sustainable or recycled products, and indoor air quality are increasingly incorporated into the everyday process of home building.

<http://www.nahbgreen.org/About/default.aspx>

The NAHB Green Scoring Tool is useful to skilled professionals as well as novices, providing information about the why and how of green building at every step.

<http://www.nahbgreen.org/ScoringTool.aspx>

V. Applications-Related Material

Building a Greener Workforce

Today, HBI is building a greener workforce by ensuring its training is aligned to the new National Green Building Standard™. The Institute is also raising awareness on the importance of green building practices and contributing to the development of a workforce that is skilled in resource-efficient and environmentally friendly techniques.

<http://www.hbi.org/page.cfm?pageID=446>

Building for Environmental and Economic Sustainability (BEES)

BEES measures the environmental performance of building products using the environmental life-cycle assessment approach specified in International Organization for Standardization (ISO) 14040 standards. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and waste management. Economic performance is measured using the ASTM.

<http://fire.nist.gov/bfrlpubs/build07/PDF/b07018.pdf>

Contractors Guide Seattle/King County 2002-2003

This guidebook provides recycling and waste prevention information for all builders, from the handyman and remodeler to large commercial contractors. It is your handbook for saving money and resources by recycling and preventing waste on the job-site.

http://www.nahbgreen.org/pdf/toolkit/Recycling_Construction_Guide_Seattle_King_County.pdf

Edminster-Bohner High Performance Whole-House Renovation

A project driven by several environmental goals, along with a specific problem to be solved. The principal environmental goals were to improve the home's overall energy performance and durability; additional environmental goals were to improve daylighting and ventilation while enhancing comfort and aesthetics. The specific problem that needed to be solved was a wood-framed pony wall that extended below grade, representing a long-term durability risk.

http://www.nahbgreen.org/pdf/toolkit/Edminster_Bohner_High_Performance_Whole_House_Renovation.pdf

Green Building Communications Plan

The City of Seattle and the US Green Building Council (USGBC) embarked on a program to create and implement a customizable communications plan. The stated goal of the communication program is to create more demand for green buildings by helping owners and occupants make the connection between green buildings and their own values. A series of interviews were conducted to learn how Seattle could support developers as early adopters of green building and LEED.

http://www.nahbgreen.org/pdf/toolkit/Green_Building___Communications_Plan.pdf

Green Building: Principles and Practice

In its most general form, green building can be defined as the resource efficient design, construction, and operation of buildings by employing environmentally sensible construction practices, systems, and materials. If followed properly, green building techniques can provide a building owner with significantly lower operating and maintenance costs, increased comfort and environmental quality, and a higher resale value.

http://www.nahbgreen.org/pdf/toolkit/Green_Building___Principles_and_Practice_UFL_Law.pdf

Green Building Template: A Guide to Sustainable Design Renovating for Baltimore Rowhouses

The Green Building Template lays the foundation for future renovation projects by creating a replicable, adaptable framework. Its success depends on an integrated, holistic study, since building systems are highly interconnected. The process involves asking the right questions early, helping to set priorities, and giving the design team the tools to follow through and synthesize solutions.

http://www.nahbgreen.org/pdf/toolkit/A_Guide_to_____Sustainable_Design_in_Renovating_Baltimore_Rowhouses.pdf

Green By Design: Seven Steps to Green Building

This section introduces you to seven steps to consider in a green building project. Its focus is on houses, but most of the ideas presented are applicable to any kind of building—new construction or remodeling, residential or commercial. These steps are not meant to be comprehensive, but to give you some guidance as you make your building plans.

http://www.nahbgreen.org/pdf/toolkit/Green_Building_by_Design_7_Steps_to_Green_Building_Austin_Energy.pdf

Green Home Building Rating Systems—A Sample Comparison

This report evaluates the costs and technical requirements of bringing two sample code-compliant production houses in different climate zones (Dallas and Washington, DC metropolitan areas) into compliance with three different green building rating systems at one point in time (January 2008).

<http://www.nahbgreen.org/Content/pdf/GreenHomeRatingComparison.pdf>

Home Energy Projects: An Energy Conservation Guide for Do-It-Yourselfers

This Checklist enables readers to develop a prioritized list of conservation measures for their homes. Chapters on planning the work itself include: Getting the Job Done Correctly and How to Prioritize the Measures.

http://www.nahbgreen.org/pdf/toolkit/Southface_Home__Energy_Projects.pdf

How to Build Green Sustainable Housing

[Sustainable Design, Construction, and Land Development Guidelines for the Southeast](#) Guidebook providing basic information on, better land use techniques, creating land-conserving subdivisions, using green building materials and the latest energy- and resource- efficient building techniques.

<http://www.southface.org/ez/media/sustainablecommunitydevelopment.pdf>

[A Builder's Guide to Energy Efficient Homes in Georgia](#)

Manual providing practical information on how to build an energy- and resource-efficient residential house in Georgia (mixed-climate).

<http://www.southface.org/ez/media/georgiabuildersguide.pdf>

[Home Energy Projects](#)

An Energy Conservation Guide for Do-It-Yourselfers that was created for the state of Alabama with information that applies throughout the southeast U.S. Home Energy Projects and contains how-to instructions.

<http://www.southface.org/ez/media/homeenergyprojects.pdf>

NAHB's Certified Green Professional (CGP)

The National Association of Home Builders' Certified Green Professional™ designation recognizes builders, remodelers and other industry professionals who incorporate green building principles into homes—without driving up the cost of construction. Class work leading to the designation provides a solid background in green building methods, as well as the tools to reach consumers, from the organization leading the charge to provide market-driven green building solutions to the home building industry.

http://www.nahb.org/reference_list.aspx?sectionID=1174

VI. Environmental-Related Material

Building-Material Emissions Study

California's Department of Health Services (DHS) conducted research within its Indoor Air Quality Section of the Department's Environmental Health Laboratory Branch (EHLB) to determine the effect of materials with recycled content in relation to indoor air quality. It became clear that emissions data were required for standard building materials and their alternative sustainable counterparts. The study focused entirely on those building materials with indoor air quality implications.

http://www.nahbgreen.org/pdf/toolkit/Building_Material_Emissions_Study.pdf

Choose Green Report: Industrial and Institutional Cleaners

A list is provided of cleaners that meet the criteria discussed in this report. To find out what is inside your cleaning products, follow these steps until you get the answers you need. If your cleaners do not meet the preferred attributes, consider substituting them with some of the products recommended in this report.

http://www.nahbgreen.org/pdf/toolkit/Choose_Green_Report_Industrial_and_Institutional_Cleaners.pdf

Forest Certification in North America

Forest certification, or green certification as it is sometimes called, is an attempt to identify forestland that is well managed. Although some systems mention forest sustainability with its tri-part perspectives of ecological, economic, and social aspects of managing forests, no system is able to deal effectively with the scale and time issues inherent in ensuring sustainability.

http://www.nahbgreen.org/pdf/toolkit/Forest_Certification_in_North_America.pdf

G/Rated Techsheets: Low Toxic Solutions: Adhesives, Sealants, Primers, and Paints

This techsheet provides a list of products that provide the same service as conventional construction materials but have a substantially smaller environmental impact. Supplier and manufacturer information follows the product list and most of these products can be purchased locally. Consumers have the power to reduce negative long-term environmental impacts while creating a healthier built environment. Conscious decision-making when purchasing building products has long-term benefits for building occupants and the environment.

<http://www.portlandonline.com/shared/cfm/image.cfm?id=121850>

Harvard Law School's Environmental Law & Policy Clinic Study

The study, by Harvard Law School's Environmental Law & Policy Clinic and sponsored by Manko, Gold, Katcher & Fox, a Philadelphia law firm, addresses a number of liability questions raised by green building.

http://www.nahbgreen.org/pdf/toolkit/Harvard_Law_School_Envir_Law_and_Policy_Clinic_Study.pdf

Leaching of Wood Preservative Components and Their Mobility in the Environment

Preservative-treated wood is an economical, durable, and aesthetically pleasing building material; therefore, it is a natural choice for construction projects in our National Forests, National Parks, and other public lands. However, we need to ensure that the chemicals used in treated wood do not pose a threat to people or the environment. The purpose of this report is to provide a summary of the pertinent literature on leaching of wood preservative components and their mobility in the environment.

http://www.nahbgreen.org/pdf/toolkit/CCA_Leaching.pdf

Mold in Residential Buildings

The presence of mold in residential and commercial buildings is generating a new wave of litigation against builders, building owners, and property managers for personal injury and property damage. It has been the subject of disputes between insurers and their policy holders. And, while mold growth in indoor environments is not new, the issue has generated national media attention and led to the creation of dozens of mold sites on the Internet.

<http://www.toolbase.org/Home-Building-Topics/Mold-Moisture/mold-residential-buildings>

Combination Constructed Wetlands, Aquatic and Soil Filters Designed for Reclamation and Reuse of Water

The research emphasis within this project is on treatment and reuse rather than disposal. The addition of human waste into high-quality water and its disposal into ground and surface waters is not sustainable. This practice makes inefficient use of water supply and simultaneously adversely impacts it.

http://www.nahbgreen.org/pdf/toolkit/Wetlands_Soil_Filters_and_Reuse_of_Water_article.pdf

Appendix A

Green Building for Building Professionals Outline

Goal:

To provide a foundation for understanding the Green Building system and process and its integration with the ANSI National Green Building Standard™.

Intended Audience:

(Tier 1) Builders, Remodelers, Trade Contractors, Project Managers, Superintendents, Field Employees, and Design Professionals

(Tier 2) Vendors, Real estate professionals, Appraiser, Education Professionals, Code Officials, Office Employees, Homeowner

Course Objectives:

- Explain the benefit of building green for building professionals and their customer. (background and survey information)
- To explain the relationship between building science and the disciplines of green building and remodeling.
 - Site and Lot Design and Development
 - Resource Efficiency
 - Energy Efficiency
 - Water Use Efficiency
 - Indoor Environmental Quality
 - Homeowner Education and Product Maintenance
- To provide an understanding of how to incorporate green building and the ANSI National Green Building Standard into a company's products or services.
- Provide a foundation for the building professional to distinguish and promote their product built to the ANSI National Green Building Standard.

NOTE: Instructor should have a current copy of the Verifier's Resource Guide. Participants will have a copy of the ANSI NGBS. Instructor should have the NAHB "Before You Build Green" Pamphlet.

1. Introduction – Green Building and ANSI National Green Building Standards

Section Learning Outcomes

- Why build green and how it benefits you and your customer?
- What is the Standard and how was it developed?
- What is the systems approach and why is it important?
- How do cost efficiencies come into play with a systematic approach?
- 1.1. Green Building is a system (30,000 ft overview)
 - 1.1.1. Systematic approach to the entire new building, renovation, or project.
 - 1.1.2. Starts with the planning stage
 - 1.1.3. Ends with end-user (consumer) operating the system properly
 - 1.1.4. Benefit of green building
 - 1.1.4.1. Cost efficiencies
 - 1.1.4.2. Value of green
- 1.2. Green Building History
 - 1.2.1. Early Activities in Green Building (70s and 80s)
 - 1.2.2. Local/Regional Program Development
 - 1.2.2.1. Austin, Denver, Seattle, Michigan etc.

- 1.2.3. Development of Green Building Guidelines
 - 1.2.3.1. History
 - 1.2.3.2. Scoring System
- 1.2.4. Other National Programs
 - 1.2.4.1. Energy Star, Environments for Living, Health House, Building America, LEED-H, LEED-ND
- 1.2.5. ANSI National Green Building Standard
- 1.3. ANSI National Green Building Standard
 - 1.3.1. Development
 - 1.3.2. Components
 - 1.3.2.1. Green subdivisions
 - 1.3.2.2. Green buildings
 - 1.3.2.3. Green multi-unit buildings
 - 1.3.2.4. Green renovations and additions (emphasize that the principles and standards apply to remodeling; how to read the standard for renovations)
 - 1.3.3. Categories Overview (Chapters)
 - 1.3.3.1. Site Design and Development (explain difference between 1.3.3.1 and 1.3.3.2)
 - 1.3.3.2. Lot Design, Preparation and Development
 - 1.3.3.3. Resource Efficiency
 - 1.3.3.4. Energy Efficiency
 - 1.3.3.5. Water Efficiency
 - 1.3.3.6. Indoor Environmental Quality
 - 1.3.3.7. Operation, etc.
 - 1.3.4. Implementation
 - 1.3.4.1. Point System
 - 1.3.4.1.1. Mandatory Items
 - 1.3.4.1.2. Online scoring tool
 - 1.3.4.2. Verification Process
- 1.4. Correlation of course and Standard chapters

2. Building Science

Section Learning Outcomes

- What are the building science principles?
- How does each building science principle apply to a structure?
- How do the building science principles work together in a structure and what is the impact?
- What are the positive and negative implications of each building science principle?
- How do the building science principles operate differently in structures located in various climate zones?
- 2.1. The Importance of Building Science Principles
- 2.2. Heat Transfer – the principles (with examples)
 - 2.2.1. Conduction
 - 2.2.1.1. Thermal bridging
 - 2.2.2. Convection
 - 2.2.3. Radiation
- 2.3. Moisture Migration – the principles (with examples)
 - 2.3.1. Bulk
 - 2.3.2. Vapor
 - 2.3.3. Permeability
- 2.4. Air Pressure – the principles (with examples)
 - 2.4.1. Airflow
 - 2.4.2. Pressure
 - 2.4.3. Stack Effect

- 2.4.4. Mechanical Pressures
- 2.5. Climate Zones and their impact
 - 2.5.1. Elements of climate zones (e.g., heating degree days, annual precipitation, temperature, cooling degree day)
 - 2.5.2. Compare elements in the 8 climate zones
 - 2.5.2.1. Provide website address of Research Center site that provides heating degree day chart for major cities
 - 2.5.3. Design impact of climate zone (key concepts only)

3. Whole House Approach

Section Learning Outcomes

- How do building science and climate zones work within each assembly?
- Generally, what is the current standard practice (code) regarding each assembly?
- What makes the current standard practice deficient from a green standpoint?
- How do you green the assembly to improve current practice?
- How does the whole house approach affect renovations?
- 3.1. The Whole House Approach
 - 3.1.1. Specific to climate zones
 - 3.1.2. Changes cost; education saves
 - 3.1.3. Integrated design
 - 3.1.3.1. It starts at the design stage (new and renovation)
 - 3.1.3.2. Three partners: designer, construction team, owner
 - 3.1.3.2.1. Construction team: Builder, Trade partners, HERS rater, suppliers, and, etc.
 - 3.1.4. Site considerations (regarding each learning outcome)
 - 3.1.4.1. Solar Orientation (incorporate the solar geometry tool)
 - 3.1.4.2. Shading
 - 3.1.4.3. Heat Gain/Heat Prevention
 - 3.1.4.4. Storm Water run-off strategies
 - 3.1.5. Building envelope (regarding each learning outcome)
 - 3.1.5.1. 5 Ds:
 - 3.1.5.2. Foundations and slabs
 - 3.1.5.2.1. Moisture migration
 - 3.1.5.2.2. Heat loss
 - 3.1.5.2.3. Thermal bridging
 - 3.1.5.3. Band and Floors
 - 3.1.5.3.1. Moisture Control
 - 3.1.5.3.2. Air infiltration
 - 3.1.5.3.3. Insulation
 - 3.1.5.3.4. Thermal bridging
 - 3.1.5.4. Walls
 - 3.1.5.4.1. Moisture control
 - 3.1.5.4.2. Air infiltration
 - 3.1.5.4.3. Insulation
 - 3.1.5.4.4. Thermal bridging
 - 3.1.5.5. Ceilings/Attics/Roofs
 - 3.1.5.5.1. Moisture control
 - 3.1.5.5.2. Air infiltration
 - 3.1.5.5.3. Insulation
 - 3.1.5.5.4. Thermal bridging

- 3.1.5.6. Special Considerations
 - 3.1.5.6.1. Soffits & Chases
 - 3.1.5.6.2. Interior Walls
 - 3.1.5.6.3. Shower walls
- 3.1.6. Systems (regarding each learning outcome)
 - 3.1.6.1. HVAC
 - 3.1.6.2. Indoor Air Quality
 - 3.1.6.3. Electrical
 - 3.1.6.4. Plumbing
- 3.2. Remodeling Considerations
 - 3.2.1. Evaluate existing buildings
 - 3.2.1.1. Structural integrity
 - 3.2.1.2. Thermal envelope
 - 3.2.1.3. Moisture barrier
 - 3.2.1.4. Systems (electrical, mechanical, and plumbing)
 - 3.2.2. Discuss scope of project
 - 3.2.2.1. Including green in client priorities
- 3.3. Good better best
 - 3.3.1. Examples of interdependencies
 - 3.3.2. Relative cost implications of good better best
 - 3.3.3. Refer to current Appendix B House Design Recommendations by Climate Region

4. **Site Design and Development** (NGBS Chapter 4)

Section Learning Outcomes

- What is a green site development?
- What is the process for stand-alone certification?
- What is the difference between site design and lot design?
- What are the four fundamental issues?
- What practice is mandatory?
- How can you balance the NGBS Practices and land use environmental regulation or mandates?

4.1. Goals and Intent

- 4.1.1. Definitions (site and lot)
- 4.1.2. Defining project objectives (different approach depending)
- 4.1.3. Location and site selection
 - 4.1.3.1. Evaluating for best use
- 4.1.4. Market issues ANSI Mandated Item Summary

4.2. Site Selection

- 4.2.1. Natural resource assessment
- 4.2.2. Land type
 - 4.2.2.1. Greyfields, Brownfields, Infill
- 4.2.3. Location
 - 4.2.3.1. Proximity to Infrastructure
 - 4.2.3.2. Proximity to transit
 - 4.2.3.3. Proximity to community amenities

4.3. Site Design

- 4.3.1. Assemble Project Team
 - 4.3.1.1. Design team and training
 - 4.3.1.2. Mandatory development practices checklist
- 4.3.2. Natural Environment
 - 4.3.2.1. Solar Orientation
 - 4.3.2.2. Minimizing disturbance (by design)

- 4.3.3. Stormwater considerations
- 4.3.4. Landscaping
- 4.3.5. Operation and maintenance plans (keeping it green)
- 4.3.6. Site density
- 4.3.7. Multi-use development
- 4.4. Construction activity
 - 4.4.1. Supervision personnel
 - 4.4.2. Vegetation protection
 - 4.4.3. Soil Disturbance
 - 4.4.3.1. Delineation of limits
 - 4.4.3.2. Equipment
 - 4.4.3.3. Restoration
 - 4.4.4. Habitat maintenance
- 4.5. Innovative Practices
 - 4.5.1. Design above code and regulations
 - 4.5.1.1. Driveways, parking areas and street widths
 - 4.5.1.2. Cluster Development
 - 4.5.1.3. Hybrid Zoning (i.e. Incentive Zoning)
 - 4.5.2. Mass Transit
- 4.6. Scoring System
 - 4.6.1. Four (Star) Levels

5. **Lot Design, Preparation, and Development** (NGBS Chapter 5)

Section Learning Outcomes

- What is the difference between lot design and site design and how they are scored?
- What are additional practice area considerations?
- What are renovation practices relating to lot design?
- 5.1. Lot Design has the same fundamental issues
 - 5.1.1. Part of the Green Buildings (Whole House) point and rating system
 - 5.1.2. Points are totaled with other NGBS Chapters with minimum performance levels
- 5.2. Additional Practice Area considerations (in addition to NGBS Chapter, Site Design, common items)
 - 5.2.1. Lot Selection
 - 5.2.1.1. Mass Transit Availability
- 5.3. Lot Design
 - 5.3.1. Specific Tree Pruning and Maintenance
 - 5.3.2. Underground Parking addition to Slope Disturbance
 - 5.3.3. Green Roof addition to Stormwater Management
 - 5.3.4. Mixed Use Development
- 5.4. Lot Construction
 - 5.4.1. Utility Construction Equipment and Methods
- 5.5. Innovative Practices
 - 5.5.1. Heat Islands
- 5.6. Addition and Renovation inclusions (additional points)

6. **Resource Efficiency**

Section Learning Outcomes

- What are the major concepts in the resource efficiency categories?
- How do the ANSI standards provide solutions for the resource efficiency categories?
- What are the mandatory items within resource efficiency and why are they important?

- 6.1. Major concepts
 - 6.1.1. Quantity
 - 6.1.1.1. Size/layout (i.e. emphasize 601.1 (5))
 - 6.1.1.2. Advanced framing
 - 6.1.1.3. Prefabricated systems (e.g., modular, panelized, trusses)
 - 6.1.1.4. Alternative systems (e.g., SIPs, ICFs, wood-steel construction)
 - 6.1.2. Durability – longer lasting buildings
 - 6.1.2.1. Moisture Management, UV Protection, Termite Protection for:
 - 6.1.2.1.1. Foundation
 - 6.1.2.1.2. Walls
 - 6.1.2.1.3. Doors and windows
 - 6.1.2.1.4. Roof
 - 6.1.3. Composition
 - 6.1.3.1. Engineered wood products
 - 6.1.3.2. Rapidly renewable materials
 - 6.1.3.3. Recycled material
 - 6.1.3.4. Reused – reclaimed materials
 - 6.1.3.5. Pre-finished materials
 - 6.1.3.6. Agricultural based materials
 - 6.1.3.7. Certified products
 - 6.1.4. Handling
 - 6.1.4.1. Protecting materials
 - 6.1.4.2. Waste Management and Recycling
 - 6.1.4.2.1. Onsite
 - 6.1.4.2.2. Offsite
 - 6.1.4.2.3. Occupant
 - 6.1.5. Sustainability through Life Cycle Analysis
 - 6.1.5.1. Cradle to cradle (life cycle assessment)
- 6.2. ANSI Mandated Items Summary
- 6.3. Additional considerations for renovations

7. Energy Efficiency

Section Learning Outcomes

- What are the basics of the Energy Code?
- What is the role of Energy Star in this section of the Standard?
- What are the issues in each energy efficiency category?
- How do the ANSI standards provide solutions to the energy efficiency categories?
- What are the mandatory energy efficiency items and why are they important?

7.1. Basics

- 7.1.1. Areas to address
 - 7.1.1.1. Design
 - 7.1.1.2. Implementation
 - 7.1.1.3. Testing and verification
- 7.1.2. Energy Code Defined
 - 7.1.2.1. Current approved IECC or local code, whichever is the most stringent
 - 7.1.2.2. Energy Star Program
- 7.1.3. Design Mandated Items
 - 7.1.3.1. Paths to compliance
 - 7.1.3.2. Performance – Emerald
 - 7.1.3.3. Prescriptive
 - 7.1.3.4. Energy Star and Bronze level

- 7.2. Verification
 - 7.2.1. Role of the HERS Rater and accredited verifier
 - 7.2.1.1. Explain HERS index
 - 7.2.2. Commissioning (single family and multi-family)
 - 7.2.3. Performance testing
 - 7.2.3.1. Thermal Bypass Checklist
 - 7.2.3.2. Blower Door (Air changes per hour)
 - 7.2.3.3. Duct Pressure
 - 7.2.3.4. Infrared imaging
 - 7.2.3.5. Exhaust flows and combustion gases
 - 7.2.3.6. Examples (energyconservatory.com)
- 7.3. Determining Base Load
 - 7.3.1. Simple Terms
 - 7.3.1.1. BTU, heat load
 - 7.3.1.2. KW and KWhr
 - 7.3.1.3. Standards of Efficiency (e.g., AFUE, COP, SEER, EER, etc.)
 - 7.3.2. REM rate or similar
- 7.4. Insulation, Air Sealing & Building Envelope
 - 7.4.1. Air Barrier
 - 7.4.1.1. Air changes per hour
 - 7.4.2. Vapor Retarder
 - 7.4.3. Insulation
 - 7.4.3.1. Grade 1, 2, and 3
 - 7.4.3.2. R value (effective R value) and relationship to U value
 - 7.4.3.3. Batts and blankets
 - 7.4.3.4. Loose fill and blown in
 - 7.4.3.5. Foams (spray-applied and sheet-applied)
 - 7.4.3.6. Alternatives (e.g., ICFs, SIPs)
- 7.5. Windows, Doors, and Skylights
 - 7.5.1. Frame and glazing options
 - 7.5.1.1. Materials
 - 7.5.1.2. Insulated units
 - 7.5.1.3. Low-E
 - 7.5.1.4. Super spacers
 - 7.5.2. Fenestration ratings (NFRC)
 - 7.5.2.1. U-values
 - 7.5.2.2. SHGC
 - 7.5.2.3. VLT
 - 7.5.2.4. Air leakage
 - 7.5.3. Day lighting
- 7.6. HVAC Concerns
 - 7.6.1. Manual J or other equivalent compliance
 - 7.6.1.1. Manual S
 - 7.6.2. Heating
 - 7.6.2.1. Furnace
 - 7.6.2.2. Boiler
 - 7.6.2.3. Electric
 - 7.6.2.4. Heat Pumps
 - 7.6.2.5. Reverse Chiller
 - 7.6.2.6. Geothermal

- 7.6.2.7. Solar
 - 7.6.2.7.1. Passive (i.e., Solar Geometry Tool, other tools)
 - 7.6.2.7.2. Active
- 7.6.3. Cooling
 - 7.6.3.1. Sizing
 - 7.6.3.2. How System Works
 - 7.6.3.3. Heat Pumps
 - 7.6.3.4. Geothermal
 - 7.6.3.5. Passive Cooling
- 7.6.4. Duct Systems
 - 7.6.4.1. Design (Manual D)
 - 7.6.4.2. Materials
 - 7.6.4.3. Supply principles
 - 7.6.4.4. Return principles
- 7.7. Electrical
 - 7.7.1. Baseload usage
 - 7.7.2. Seasonal usage
 - 7.7.3. Lighting
 - 7.7.4. Appliances
 - 7.7.4.1. Energy Star label description
 - 7.7.5. Energy saving strategies
 - 7.7.6. Photo-voltaic, wind, and other
 - 7.7.6.1. Net metering
- 7.8. Water Heating
 - 7.8.1. Conventional and Options on Conventional
 - 7.8.1.1. Indirect Heaters
 - 7.8.1.2. Recirculation systems
 - 7.8.2. Tankless heaters
 - 7.8.3. Reverse Chillers (air-to-water heat pump)
 - 7.8.4. Solar
- 7.9. ANSI Mandated Items Summary
- 7.10. Additional considerations for renovations

8. Water Efficiency

Section Learning Outcomes

- What is the need and why is it important everywhere?
- What are the issues in the water efficiency categories?
- How does the ANSI standard provide solutions for water efficiency categories?
- What are the different types of plumbing systems?
- What are the mandatory water efficiency items and why are they important?
- 8.1. Problem of decreasing world-wide water supplies
 - 8.1.1. Statistics
 - 8.1.1.1. Status of fresh water
 - 8.1.1.2. How much water we use
 - 8.1.1.3. Percentage of potable water
 - 8.1.2. Current "global" status
 - 8.1.2.1. Business development and growth pertaining to water
 - 8.1.2.2. New products emerging
 - 8.1.2.2.1. Water Sense
 - 8.1.3. "Local" conditions
 - 8.1.3.1. Legislative movement

- 8.2. Indoor Water Strategies
 - 8.2.1. Water use percentages
 - 8.2.2. Water supply systems design
 - 8.2.2.1. Routing
 - 8.2.2.2. Volume
 - 8.2.2.3. Flows
 - 8.2.3. Water delivery
 - 8.2.3.1. Low-flow fixtures and appliances
 - 8.2.3.2. No-flow fixtures and appliances (e.g., composting toilets, waste strategies, etc.)
 - 8.2.3.3. Recirculating systems
 - 8.2.4. Water disposal
 - 8.2.4.1. Greywater reuse
- 8.3. Exterior Water Strategies
 - 8.3.1. Water use percentages (50%)
 - 8.3.2. Design
 - 8.3.2.1. Plant selection
 - 8.3.2.2. Landscape design
 - 8.3.3. Delivery
 - 8.3.3.1. Low volume irrigation strategies
 - 8.3.3.2. Controls
 - 8.3.4. Disposal
 - 8.3.4.1. Hydrozoning
 - 8.3.4.2. Onsite use of waste water
- 8.4. Rainwater harvesting
 - 8.4.1. Limited coverage
 - 8.4.2. Interior and exterior uses
 - 8.4.3. State and local regulations
- 8.5. ANSI Mandatory Items

9. Indoor Environmental Quality

Section Learning Outcomes

- What are the issues in the indoor air quality categories?
- Why is proper ventilation so important to a green home?
- How do the ANSI standards provide solutions for the indoor air quality categories?
- What are the mandatory indoor air quality items and why are they important?
- What are the renovation considerations related to indoor environmental quality?

- 9.1. Define problem/need
 - 9.1.1. History (How we got where we are today)
 - 9.1.2. Tightness of structure
 - 9.1.3. Products and off-gasing
 - 9.1.4. Radon
 - 9.1.5. Healthy indoor environment needs air changes
- 9.2. Eliminate
 - 9.2.1. Construction methods
 - 9.2.1.1. Moisture control and elimination
 - 9.2.1.2. Dust and debris control and elimination
 - 9.2.1.3. Duct sealing and location
 - 9.2.2. Construction material selection
 - 9.2.2.1. Building materials
 - 9.2.2.2. Interior finishes
 - 9.2.2.3. Furnishings
 - 9.2.2.4. Certified products (e.g., certification agencies such as CARB)

- 9.2.3. Consumer products (cleaning agents)
- 9.3. Separate
 - 9.3.1. Physical barrier
 - 9.3.2. Pressure barrier
 - 9.3.3. Combustion byproduct (include fireplaces)
 - 9.3.4. Central vacuum
- 9.4. Ventilate
 - 9.4.1. Define Air Change Per Hour (ACH) and standard
 - 9.4.2. Positive, negative, balance
 - 9.4.2.1. Spot (supply, only; exhaust only)
 - 9.4.2.2. Balanced
 - 9.4.2.3. HRV/ERV
- 9.5. Filtrate
 - 9.5.1. HEPA
 - 9.5.2. MERV
 - 9.5.3. Electrical
 - 9.5.3.1. Electrostatic air cleaner
 - 9.5.3.2. Ultraviolet (may not work due to air flow rates and time of exposure)
- 9.6. Radon Mitigation
 - 9.6.1. Zone
 - 9.6.2. Testing
 - 9.6.3. Strategies for mitigation
 - 9.6.3.1. Passive (This is a great example of how to achieve indoor environmental quality through depressurization.)
 - 9.6.3.2. Active
- 9.7. Items mandatory in ANSI National Standards
- 9.8. Additional considerations for renovation

10. Operation, Maintenance and Building Owner Education

Section Learning Outcomes

- Why is building owner education important?
- What should be included in building owner education?
- How do you create a learning experience for your client so they understand their role?
- What resources do you provide to the building owner?
- 10.1. Protect your business investment through education of consumer
 - 10.1.1. Involve the building owner and sales people throughout the green process
- 10.2. Owner Education
 - 10.2.1. Operation of the building and its components
 - 10.2.2. Maintenance of the building and its components
 - 10.2.3. Orientation Event
 - 10.2.3.1. Building owner manual
 - 10.2.3.1.1. Topics that should be included (see Standard for mandatory and voluntary items)
 - 10.2.3.2. Orientation walkthrough
- 10.3. ANSI Mandatory Item Summary
- 10.4. Additional considerations for multi-family and renovation

11. Green Marketing

Section Learning Outcomes

- What impact do governmental mandates and incentives have on a marketing plan?
- How do you avoid liability issues when marketing a green product?
- How do you gauge how green is your market, company, and client?
- What methods do you use to market and sell green to clients?

11.1. Assessment

- 11.1.1. Market: How green is your market?
- 11.1.2. Company culture: How green are YOU and your team members?
- 11.1.3. Product: How green is your product?

11.2. Implementation

- 11.2.1. Educate trades
- 11.2.2. Enhance processes and systems
- 11.2.3. Budget considerations

11.3. Marketing

- 11.3.1. Differentiate your knowledge and credentials
- 11.3.2. Designation on business cards
- 11.3.3. Press release (provide sample)
- 11.3.4. Public relations (e.g., speaking engagements and community involvement etc.)
- 11.3.5. Incentives (e.g., tax credits, utility program incentives, etc.)

11.4. Selling

- 11.4.1. Liability issues
 - 11.4.1.1. NAHB "Before you Build Green"
 - 11.4.1.2. Caution of marketing promises that cannot be kept/made
 - 11.4.1.3. Benefits of third-party verification
- 11.4.2. Client triggers (i.e., forest green, efficiency green, green triggers, etc.)
- 11.4.3. Sell value not cost
 - 11.4.3.1. Present cost in perspective
 - 11.4.3.2. Recapture cost leads to ROI
 - 11.4.3.3. Life cycle cost vs. Life cycle value (i.e., philosophical approach vs. practical approach)
 - 11.4.3.4. Do the highest return things first (e.g., checklist)
 - 11.4.3.5. Incentives
- 11.4.4. Reverse marketing
- 11.4.5. Scoring tool as a selling tool
- 11.4.6. 15-second sound bites on how to sell it (list of marketing and selling resources)

Appendix B

Jefferson State Community College Green Curriculum Development

Point of Contact: Micah Kaufhold, (205)856-7847, mkaufhold@jeffstateonline.com

<http://www.jeffstateonline.com/ConstructionBuildingScience/ConstructionManagement.aspx>

CMT 161 – Introduction to Sustainable Construction (1 Hr)

The purpose of this course is to introduce the student to the Green Building movement in response to the growing demand for sustainable, healthy, and energy-efficient construction methods. Students will study the proven methods of new and remodeled green construction. Emphasis will be placed on teaching the hard science and the commonsense solutions to building sustainable, healthy and energy-efficient structures. Upon completion of this course, a student will be aware of the building-science theory of green construction.

CMT 220 – Sustainable Project Delivery (3 Hrs)

The purpose of this course is to introduce the student to green project delivery from the contractor’s point of view. This course will focus on the green building process and the potential impact of green construction on building projects and on the contractor’s business. Students will know how to evaluate green requirements, document a green project and evaluate risk associated with green project delivery. Upon completion, the student will be able to bid, contract and subcontract green projects, facilitate green procurement, manage green construction and perform green project commissioning and closeout.

DPT	CRS.	COURSE TITLE	THEORY	LAB	COURSE
CMT	161	INTRODUCTION TO SUSTAINABLE CONSTRUCTION	1	0	1
Course Description				Added	3/12/09
PREREQUISITE: As required by program. The purpose of this course is to introduce the student to the Green Building movement in response to the growing demand for sustainable, healthy, and energy-efficient construction methods. Students will study the proven methods of new and remodeled green construction. Emphasis will be placed on teaching the hard science and the commonsense solutions to building sustainable, healthy and energy-efficient structures. Upon completion of this course a student will be aware of the building science theory of green construction.					

DPT	CRS.	COURSE TITLE	THEORY	LAB	COURSE
CMT	220	SUSTAINABLE PROJECT DELIVERY	3	0	3
Course Description				Added	3/12/09
PREREQUISITE: As required by program. The purpose of this course is to introduce the student to green project delivery from the contractor’s point of view. This course will focus on the green building process and the potential impact of green construction on building projects and on the contractor’s business. Students will know how to evaluate green requirements, document a green project and evaluate risk associated with green project delivery. Upon completion, the student will be able to bid, contract and subcontract green projects, facilitate green procurement, manage green construction and perform green project commissioning and closeout.					

Appendix C

Purdue University Green Curriculum Development

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http://www.tech.purdue.edu/bcm/academics/undergraduate/bcm_course_catalog.cfm

Incorporating the National Association of Home Builders (NAHB) Certified Green Professional (CGP) Designation into a University Residential Construction Management Specialization

by Eric Holt

The residential construction industry is going through a period of transformation. Economic conditions and a growing interest in sustainability are likely to change the way home building will be done in five years. Graduates seeking employment need to have the most up-to-date green building training to be competitive. In response to the needs of the residential construction industry, construction management programs need to incorporate green building into their curriculum. The Certified Green Professional (CGP) Designation from the National Association of Home Builders (NAHB) is recognized nationally for leading the way in green building and enhancing the professionalism of the residential construction industry. Incorporating the CGP curriculum and professional designation, not previously provided at the university level, has many challenges, not the least of which are anticipation of the career aspirations of the students enrolled and the expected educational outcomes required by the industry. This paper examines the basis for the addition of the CGP curriculum and professional designation into construction technology education, the contractual relationship between the university and NAHB, the requirements of the educators delivering the courses, and the integration and administration of NAHB industry curriculum into an undergraduate residential construction management program.


Key Words: Green Building, NAHB, Undergraduate Education, Degree Specialization

Introduction

The residential construction industry is going through a period of transformation. Economic conditions and a growing interest in sustainability are likely to change the way home building will be done in five years. This change does not mean that wooden 2x4's are being replaced with plastic. Rather, it has to do with the business plans, marketing plans, sales plans, subcontractor agreements, etc. that are required to effectively manage residential projects. With the collapse of the housing market, the job market for homebuilding industry professionals has also followed suit. As a result, construction management (CM) graduates seeking jobs as well as current homebuilding professionals need to have the most up-to-date training to be competitive.

Green Building is growing rapidly in both the commercial and residential construction markets (Tinker, 2004). While there are multiple green certification programs available for the residential market, the top two recognized programs are the United States Green Building Council (USGBC) with their Leadership in Energy and Environmental Design (LEED) for Homes, and the National Association of Home Builders (NAHB) National Green Building Program. Both programs offer 3rd party green certification of homes. The NAHB National Green Building Program has the American National Standards Institute (ANSI) ICC 700-2008 National Green Building Standard (NGBS) for residential green building certification with the added benefits of a Certified Green Professional Designation (NAHB, 2009) for industry professionals.

The Certified Green Professional (CGP) designation is part of the NAHB Professional Designation and Green Building Program. This designation gives building professionals training and credibility in green building. Homebuilders with the CGP designation have the potential to become more successful at green building because they have learned to identify and adapt to the social, economic, political, environmental, and technological issues affecting green building and their business.



In response to the needs of the residential construction industry, construction management programs need to incorporate green building into their curriculum. (Tinker, 2004). In today's tight job market, a college graduate with a professional designation would be set apart from their peers. It is the goal of Purdue University's Department of Building Construction Management (BCM), through collaboration with the NAHB University of Housing, to incorporate the NAHB professional designation into the BCM program. A graduate of the program will have the opportunity to obtain three professional designations; Residential Construction Superintendent (RCS), Certified Aging in Place Specialist (CAPS), and Certified Green Professional (CGP). The focus of this paper is on the incorporation of the CGP certification process into the Purdue University BCM program and their Residential Construction Management (RSCM) area of concentration.

Course Concept


The RSCM area of concentration is one of six offered by the Purdue University BCM program. These concentrations prepare students for employment in a focused area of construction management. Each concentration has two to four area specific courses and the students must take 6 to 12 semester hours specific to the area of concentration to earn the specialization designation on their transcript. It is the goal of the RSCM concentration to provide advance training to students pursuing a career in the homebuilding industry, through a combination of residential coursework and qualified work experience. The course work includes the areas of land development, design, planning, estimating, scheduling, residential construction methods, marketing, cost analysis, and customer service.

The RSCM program update is an attempt to reflect the current changes in the housing market and the need for CM graduates to be prepared for an increasingly competitive job market. The Purdue University RSCM faculty believed that an industry-university partnership with the NAHB would greatly enhance the RSCM course offerings. Purdue University has maintained a long-term working relationship with NAHB through their Student Chapter and its involvement with the annual NAHB Student Competitions. The advancement of this partnership facilitates faculty and student professional development as well as the incorporation of a nationally recognized industry professional designation program into the RSCM area of concentration (Kudav, Cala, Davis, & Patel, 2004; Tener, 1996). A proposal incorporating NAHB designations in the RSCM area of concentration was submitted to the National Housing Endowment (NHE), the philanthropic arm of the NAHB, for their Homebuilding Education Leadership Program. Through this initiative, Purdue University's RSCM students can enhance their educational portfolio with several professional designations, including the CGP. It is also the goal of this BCM / NAHB collaboration to become a model for university residential construction education programs. This program could be replicated at peer institutions, therefore increasing the impact and the number of students and industry practitioners with NAHB professional designations.

Course Development

A license agreement between the NAHB and Purdue University for use of NAHB copyright materials was required before the CGP curriculum could be taught in the university classroom. This was the first license agreement ever granted to a university. The agreement lists details for payment of NAHB fees, instructor requirements, and use of the NAHB curriculum.

The CGP designation is comprised of two NAHB courses; the two day (16 hours) "Green Building for Building Professionals" and the one day (eight hours) "Business Management for Building Professionals". These courses are normally taught through a local Home Builders Association (HBA). The Business Management course is a requirement for other designations as well. Once a student has taken Business Management, it can be applied to the other designations. For each course, NAHB provides an instructor manual, PowerPoint slides, a student guide, a skills check exam, a Scranton answer sheet, as well as course and instructor evaluation forms.



There is an annual site License Fee of \$300 and a \$50 material fee for both the Green Building and Business Management courses, along with a \$145 graduation fee for the CGP designation. The RSCM students pay the course fees and view it as part of their normal book cost. Currently the NHE HELP Grant is being utilized to pay the CGP Graduation Fees for the students. The RSCM instructor follows the same procedure to order the instructional material from NAHB as an industry professional would follow.

To become an instructor for any of the NAHB professional designations, a building professional/educator must first have industry experience related to the designation. They must take the designation courses in the original industry format that they are offered, pass the skills check, and earn the designation. They must also take the NAHB “Train the Trainer” Course. They must then submit their instructor application for review by the NAHB instructor review committee. The committee review typically takes three to six weeks and the committee reserves the right to withhold instructor approval. Two Purdue University faculty members have completed the NAHB CGP instructor approval process.

Residential Construction: Green Building is a three credit, two-hour lecture, two-hour lab, 16-week course. This provides approximately 60 contact hours with the students. It is stipulated in the license agreement that the 24 hours of content required for the CGP designation be taught using the NAHB curriculum as provided to the university. The balance of 36 contact hours is open to explore and expand upon green building topics by the instructor.

The NAHB CGP Designation course objectives were incorporated into the overall course objective list for Residential Construction: Green Building as follows.

At the completion of the course, the students will be able to:

- Explain the goals of the National Association of Home Builders, the National Green Building Program, the Green Building Guidelines, and identify the individual components of the program.
- Explain the basic building science principles behind the growth of the green building movement.
- Explain considerations for locating and designing green development sites.
- Describe the strategies for effective moisture control and durability for each component of the building envelope.
- Describe various resource-efficient materials used to achieve comfortable, safe, and sustainable buildings.
- Describe green building energy efficiency requirements and the strategies for meeting, exceeding and verifying them.
- Describe indoor and outdoor water conservation practices.
- Identify methods for achieving indoor air quality.
- Describe important considerations for approaching green building objectives in a remodeling project.
- Explain a homeowner’s and builder’s role in effective operation and maintenance of a green home.
- Identify successful business management, marketing, and sales strategies to sell green.
- Discuss common business challenges for residential construction as well as practical tips and tools to overcome them.
- Apply the key measures of business performance to a residential construction business.
- Complete an audit of a residential construction project, using the NAHB Verifiers Guide and Checklist.

The final project for the course is to score house plans for the local Habitat for Humanity (HFH) chapter. The local chapter already has their homes Energy Star certified and is interested in having them Green Certified. The students were broken into small groups and given one of the “typical” plans that the local chapter builders. They students were required to score the homes using both the Green Building Guidelines and the National Green Building Standards online scoring tool. They were required to provide a scoring report, a written report documenting the areas that HFH needed to add to their construction process to meet the Bronze and Silver Level, and a group presentation for the class and HFH.

Success in the student's achievement of the objectives is assessed by utilizing the Green Building and Business Management section review questions as assigned homework, individual student research combined with class presentations, a group Green Building Scoring Tool certification project, and two multiple choice exams provided by NAHB. Upon successful completion of the course, submission of a graduations application, signed Code of Ethics, and two years industry experience are requirements of the CGP graduation. The NAHB accepts a completed BCM degree in lieu of the two year industry experience requirement.

The course content for the Residential Construction: Green Building, as offered in the fall semester of 2009, is outlined in Table 1.

Table 1–Residential Construction Course Outline

Wk #	Major Topic	Instructional Activities	Subject Matter Covered
1	NAHB & the National Green Building Program	Lecture & discussion	Course Overview NAHB Green Building Program
2	Green Building & Energy Programs	Lecture & discussion Student research/pres.	Energy Star Homes & HERS Rating LEED for Homes Blower Door & Duct Blast Test Zero Energy Homes
3	NAHB Verifier	Guest Speaker	NAHB Verify Process HERS Rating
4	NAHB Green Building for Building Professionals	Lecture & discussion Student research presentation	Green Building Into Building Science Principles
5	NAHB Green Building for Building Professionals	Lecture & discussion Student research/presentation	Site Development Building Envelope
6	NAHB Green Building for Building Professionals	Lecture & discussion Student research/presentation	Resource Efficiency Energy Efficiency
7	NAHB Green Building for Building Professionals	Lecture & discussion Student research/presentation	Water Efficiency Indoor Air Quality
8	NAHB Green Building for Building Professionals	Lecture & discussion Student research/presentation	Remodeling Considerations Effective Operation
9	NAHB Green Building for Building Professionals	Lecture & discussion Student research/presentation	Homeowner training Marketing & Selling Green NAHB Green Building Exam
10-11	NAHB Green Scoring Tool	Lecture & discussion Group Scoring Project	Scoring Tool Setup Scoring Tool Training
12	NAHB Business Management for Building Professional	Lecture & discussion	Business Basics Planning: The Map Purpose: Creating the Itinerary
13	NAHB Business Management for Building Professional	Lecture & discussion	People: Who to Chose Performance: Are We There Yet? Progress Monitoring & Evaluation NAHB Business Management Exam
14	Group Project Progress	Report & Discussion	Green Guidelines & Standard
15	Group Project Presentation	Report & formal presentation	Green Home Certification
16	Course Review & Wrap-up	Lecture & discussion	CGP Graduation Requirements Course Evaluation

Courses that are offered as part of areas of concentration in Building Construction Management at Purdue University are typically classified as technical electives within the overall curriculum. New courses may be offered without review under a temporary course number. Review by the **** College of Technology Curriculum Committee is required prior to listing a course as a permanent part of the curriculum. University level review of these technical electives is not required by Purdue. The only prerequisite for students wishing to take the Residential Construction: Green Building course is the requirement that they join the NAHB Student Chapter. As expected, the registered students tended to be predominantly juniors and seniors. The introductory nature of the material allowed the sophomores taking the course to participate fully. Residential Construction: Green Building is being offered again in the spring semester of 2010 with an enrollment of 24. The course will be offered in the fall semester of 2010 in anticipation of continued student interest.

Student Evaluations & Perception


NAHB provided a participant feedback form for each student taking the course. The feedback survey results from the Fall 2009 class of 19 are as follows in Table 2.

Table 2–NAHB Participant Feedback Survey Results for Fall 2009

NAHB Participant Feedback Questions	Strongly Agree - Strongly Disagree					Mean
	5	4	3	2	1	
1. What were your objectives for attending this course (check all that apply?)						
Earn Designation-100% (19 of 19)						
Professional Growth–58% (11 of 19)						
Networking Opportunity–16% (3 of 19)						
2. I will be able to apply what I learn to my job.	74% (14)	26% (5)	0% (0)	0% (0)	0% (0)	4.74
3. The audio-visual aids helped me follow along and learn the info.	53% (10)	37% (7)	5% (1)	5% (1)	0% (0)	4.37
4. The course increased my knowledge of the subject.	68% (13)	32% (6)	0% (0)	0% (0)	0% (0)	4.68
5. The examples and activities helped me understand the information.	58% (11)	37% (7)	5% (1)	0% (0)	0% (0)	4.53
6. I could follow along with the instructor(s) in the student guide.	74% (14)	26% (5)	0% (0)	0% (0)	0% (0)	4.74
7. I was encouraged to ask questions and participate throughout class.	79% (15)	21% (4)	0% (0)	0% (0)	0% (0)	4.79
8. The course prepared me for the test.	79% (15)	21% (4)	0% (0)	0% (0)	0% (0)	4.79
9. I would recommend this course to others.	84% (16)	16% (3)	0% (0)	0% (0)	0% (0)	4.84
10. Overall, the course met my expectations.	84% (16)	16% (3)	0% (0)	0% (0)	0% (0)	4.84

Discussion of Challenges and Lessons Learned

Though the feedback survey does reveal a positive experience for the students, it is limited and does not determine what the students actually learned about green building. The NAHB feedback surveys are standard and non-course specific. They are utilized for every professional designation course offered in the daylong industry format. A university student level green building course evaluation is being developed to be utilized spring 2010.



The original format design of the CGP curriculum is a three day course. The PowerPoint presentations, questions, and activities are paced for the three-day format. One of the challenges for the instructors was to re-pace the course over a 16-week period. During the day format, the time is more flexible to allow for good discussion and closure before moving on. It is challenging when good discussion or a section is cut short by the end of class. This requires the instructor to reconnect the line of thinking during next class period.

Another challenge with the Green Building course is that the PowerPoint presentation was designed in 2006. The slides discuss topics in green building that are still relevant to today, but with lots of bulleted list and verbiage. There are many more visual and web media resources on the topic of green building available today. To incorporate this updated material the instructors have added secondary presentation material alongside the NAHB Curriculum. Students were encouraged to use up-to-date resources for their research topics and presentations. The group activities were also designed for industry professional with field experience. A majority of the students did not have the field experience to understand or relate to some the group discussion activities.

The importance of a blower door and duct blaster test is discussed throughout many sections of the green building course. Because of the importance of these tests and the 3rd party verification for a Green Home certification, it would be a beneficial teaching experience to actually see these test performed. The BCM department does not currently own the required testing equipment, so a field trip to a home being tested was planned. Unfortunately, the verifier did not show up at the jobsite during the class period as they were scheduled, so the students were unable to observe the test.

Future Course Planning

With the continuing growth of Green Building resources, there is a great opportunity to supplement and expand the green building course in conjunction with the NAHB Curriculum. Some of the course considerations are the integration of the Building America and Builders Challenge program through the NAHB Research Center's partnership with the U.S. Department of Energy. The Research Center is currently developing a green building educational curriculum tool kit for two and four year universities with residential construction management programs. Purdue University is participating in the development of this resource.

The BCM Department is currently seeking funds to purchase blower door test equipment to be integrated into the mechanical concentration and the commercial sustainability class. The availability of this test equipment will enhance the current green building course offering as well.

Currently the HELP Grant from NHE is paying the students \$145 CGP designation graduation fees. Once the grant money has been fully utilized, the students will have to pay the fees themselves unless another source funding can be found.

Conclusion

Offering the CGP designation in Purdue University's undergraduate concentration in Residential Construction Management has been well received by both the industry and the student body. However, much additional work is required to continue development of undergraduate education in residential construction. Continued input and support from industry as well as the interest and involvement of members of the community of university educators is needed to create a mature discipline. These first steps being undertaken by the Department of Building Construction Management at Purdue University are only a small part of the effort required to fulfill the commitment that has made to the development of the specialization.



References

Kudav, G., Cala, M., Davis, B. M., & Patel, J. J. (2004). *Industry-university partnership - A model for faculty professional development and curricular innovation*. Paper presented at the ASEE Annual Conference Proceedings, Salt Lake City, UT, United States.

NAHB (2009). New ANSI-Approved National Green Building Standard Becomes Benchmark for Green Home Certification. *Journal*. Retrieved from http://www.nahbrc.com/news/pressreleases/rc_20090205.aspx

Tener, R. K. (1996). Industry-University Partnerships for Construction Engineering Education. *Journal of professional issues in engineering education and practice*, 122(4), 156-162.

Tinker, A. a. B., Richard (2004). "Greening" the Construction Curriculum. *International Journal of Construction Education and Research*, 1(1), 26-33.

Department of Building Construction Management
College of Technology, Purdue University

BCM 360

BCM 360 - Residential Construction Course Syllabus Spring 2010

GENERAL INFORMATION

Course Description: A study of the best building practices in residential construction, based upon The National Green Building Standards, and other national programs. Course content includes partial fulfillment of the requirements for the Certified Green Professional designation (CGP) from the National Association of Home Builders.

Course Prerequisites: BCM Major or Instructor approval for non-BCM students
SPECIAL NOTE: **Students must be a member of the NAHB student chapter - \$20.00 Annual Dues**

Credits: 3 (2 lecture, 2 lab)

Textbooks: Green Building for Building Professionals, NAHB Education. Cost \$70.00
Business Mgmt. for Building Professionals, NAHB Education. Cost \$70.00
Books will be ordered through the NAHB Student Chapter.

To obtain the Certified Green Professional Designation from NAHB, you are required to either graduate from the Purdue BCM Department, or provide documentation of two (2) years residential construction experience. The NAHB graduation fee of \$170 is paid for you through the HELP Grant.

Additional Resources: National Green Building Standards (NGBS) ICC 700-2008.
2011 Purdue Solar Decathlon Home Plans
Remodeling Magazine - www.remodeling.hw.net/
Qualified Remodeler Magazine – www.qualifiedremodeler.com/
Residential Design & Build Magazine – www.rdbmagazine.com/
Additional printable resources will be identified in-class.

Course Objectives

At the completion of BCM 360, the students will be able to:

1. Explain the goals of the National Association of Home Builders Green Building Guidelines, and identify the individual components of the program.
2. Explain the potential benefit of building green for both building professionals and their customers.
3. Explain the relationship between building science and the disciplines of green building and remodeling, including:
 - Site/lot design and development
 - Resource efficiency
 - Energy efficiency
 - Water efficiency
 - Indoor environmental quality
 - Homeowner education and maintenance
4. Describe how to incorporate green building and the National Green Building Standard™ into a company's products or services.
5. Explain an approach to promoting a green product built to the National Green Building Standard™.
6. Discuss common business challenges for residential construction and learn practical tips and tools to overcome them.
7. Learn how to apply the key measures of business performance to a residential construction business.
8. Complete a designers report and an on-site audit of a residential construction project, using the National Green Building Standard™.

Instructor: Eric Holt

Office: Knoy G003 (Dale Koehler's Office)

Phone: 494-2457 (Dale Koehler's Phone) 765-404-3441

Email: eaholt@purdue.edu

Office hours: Monday 12:30 pm to 4:30 pm. Other times by appointment

Lecture/Lab: Monday and Wednesday - Knoy Hall – B029

1:30 pm – 2:20 pm - 10 min break -2:30 pm to 3:20 pm

Assessment Methods: **Disabling Conditions:** Any student who, because of a disabling condition, may require special arrangements in order to meet course requirements should contact the instructor by the third week of class in order to make the necessary accommodations. Students who do not contact the instructor by the third week of class, or as soon as they know they have a disabling condition, forfeit their rights to special accommodations. A student must work with the Dean of Student Office in order to receive special accommodations for this class.

Tests/Exams: There will be two (2) exams, required by the NAHB for the Certified Green Professional Designation and Business Management for Building Professionals.

Individual Presentations: Student will choose a Green Building product or method from the NGBS and give a 10 to 15 minute presentation to the class.

NAHB Green Scoring Tool Training: Students will work with the NAHB Green Scoring tool to evaluate a Habitat for Humanity Green Home and prepare the plans for certification.

Final Group Presentations: Students will be placed in groups and will be required to prepare a designers report on a plan/project of their choosing. Prepare a written report and deliver an oral presentation of approximately ten-minutes per group member. The group presentations will take place during the final class sessions of the semester. Groups who are making a class presentation are required to dress professionally and present a professional quality presentation. Each group is required to provide a copy of their presentation materials and report to the instructor prior to delivering their presentation. Be sure to include a completed reference page that follows APA format at the end of the written report.

Class Participation: Attendance is required for the NAHB Designations, guest speakers, in-class assignments, and final student presentations. Class participation is a large component of the grade for this course. Regular class attendance is strongly encouraged.

Grading: Grades will be based upon the total accumulation of points. Each assignment will be graded as objectively as possible, evaluating the student's knowledge of the material and the quality of the work performed.

<i>Assignment</i>	<i>Pnts</i>	<i>% of Total</i>
Attendance – Required by NAHB	100	17%
Homework - 20 @ 5 Points Each	100	17%
NAHB Green Professional Exam	100	17%
NAHB Business Management Exam	100	17%
Research Topics and In Class Presentations	50	8%
NAHB Green Scoring Tool Training	50	8%
Final Project – NAHB Green Certified Project	100	17%
Total	600	100%

Grading Scale:

The final letter grade will be based on meeting the criteria listed below:

- 100% to 90% = A
- 89% to 80% = B
- 79% to 75% = C
- 74% to 70% = D
- 69% to 0% = F

A list of grades will be maintained on Blackboard.

Course Policies:

1. To benefit fully from the class discussions, attendance is strongly encouraged. Students must be present to receive credit for in-class activities.
2. Each student is encouraged to check Blackboard periodically throughout the week. Some of the course lecture material will be posted. Use of Blackboard is encouraged to continue course discussions and to submit additional questions.
3. Use of the word processor or other technology (i.e., PowerPoint, Excel) is mandatory for all course assignments. Each student is encouraged to use tools such as spell check and grammar check to polish their work. Each piece of work must be labeled with your name and date.
4. Handouts in lecture are your responsibility. You must be in class to receive them. No make-up assignments, quizzes, or exams will be available. No make-up work will be given unless the student has a reasonable excuse and has met with the instructor prior to the class when the assignment, quiz, or exam is due.
5. Grading disputes must be put in writing (memo format) and submitted to Eric Holt. The grade will be reviewed, and a verbal or written response will be made within two days.
6. Each student is expected to participate and contribute in class discussions. The instructor will try to create and maintain a successful learning environment. In order to do this, class participation is required. Each student is encouraged to provide constructive feedback to the instructor on his or her likes and dislikes of the course content throughout the semester.

Academic Dishonesty:

The Department of Building Construction Management expects that students will follow the highest ethical and moral standards as students of Purdue University and members of the Building Construction Management family as described in the student code of honor found at:

http://www.purdue.edu/univregs/pages/stu_conduct/stu_conduct.html

The specific policy for this course regarding academic dishonesty is as follows:

Academic dishonesty for this course is defined as any act by a student in which the student is caught cheating, committing fraud, plagiarizing, or copying another student's work. Knowingly allowing another student to copy your work, either from this semester or from a previous semester, is also considered academic dishonesty.

Plagiarism Defined: The act of appropriating the literary composition of another, or parts or passages of his writings, or the ideas or language of the same, and passing them off as the product of one's own mind.

To be liable for plagiarism it is not necessary to exactly duplicate another's literary work, it being sufficient if lifting of substantial portion thereof makes unfair use of such work. (Black's Law Dictionary, 1979, 5th Ed. West Publishing Co. St. Paul, Minn.)

All verified incidents of academic dishonesty will be reported to the department chair and Dean of Students.

Campus Emergency: In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Here are ways to get information about changes in this course. Blackboard web page, my email address: eaholt@purdue.edu, and my phone: 765-494-2457 or 765-404-3441

Links to information about ongoing emergencies:

- On campus emergency: <http://www.purdue.edu>
Allow at least 10 minutes for information to be posted.
- Weather emergency:
<http://www.weather.com/outlook/homeandgarden/home/local/47906>
- Local news: <http://www.wlfi.com> and <http://www.jconline.com>
- Cell phones: Cell phone emergency text messages will be sent to those signed up for them. <http://www.purdue.edu/securepurdue/>

In the event of a serious influenza outbreak a number of constraints may be imposed by government health and security agencies. These may include:

- Cancelled events such as conferences and other public gatherings.
- Restricted or no access to campus buildings.
- Closures of local schools that may increase absenteeism of Purdue employees.
- Isolation of infected communities may occur in the event of a pandemic (Refer to National Strategy Pillar III of the Whitehouse's homeland influenza pandemic). This is also known as protective sequestration, extended restricted access to communities. Infected or exposed individuals may be restricted to home isolation. Quarantines and reverse quarantines may be imposed.
- Travel suspension may occur in here or in other parts of the country or globe while researchers are attending meetings, gathering data, etc. All travelers should be careful to have a back-up plan for unexpected extended stays of up to 12 weeks. The following Study Abroad websites offer helpful travel links and strategies that are available to all faculty. <http://www.studyabroad.purdue.edu/Travel/> and <http://www.studyabroad.purdue.edu/safety/>

Course Evaluation: During the last two weeks of the semester, you will be provided an opportunity to evaluate this course and your instructor(s). To this end, Purdue has transitioned to online course evaluations. On Monday of the fifteenth week of classes, you will receive an official email from evaluation administrators with a link to the online evaluation site. You will have two weeks to complete this evaluation. Your participation in this evaluation is an integral part of this course. Your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

Caveat: Course subject matter, schedule, assignments, and evaluation criteria are subject to change at the instructor's discretion.

BCM 360 – Residential Construction Calendar

BCM 360 Residential Construction Calendar – Spring 2010							
Wk	Date	Monday Lecture	Monday Lab	Date	Wednesday Lecture	Wednesday Lab	
1	Aug 23	Introduction & Overview	History of NAHB	Aug 25	Intro to Green Building & Green Washing Bring Resume to Class	NAHB Green Standards Scoring	HW #1 One page synopsis paper on Green Building
2	Aug 30	Energy Star & LEED For Homes	HW #2 One page synopsis paper on Energy Star & LEED for Homes	Sept 1.	2:30 Guest Speaker: John Lumkes– Energy Efficient Home – 2:30	HW #3 One page synopsis paper on Energy Efficient Home	
3	Sept 6	Labor Day	No Class	Sept 8	Legally Green: Deliver the green you promise	HW #4 One page synopsis paper on Legally Green	
4	Sept 13	NAHB Intro National Green Building Standard	HW#5 Green Build Section 1 Review Questions, Page 1-21	Sept 15	Building Science	HW#6 Green Build Section 2 Review Questions, Page 2-36	
5	Sept 20	Whole House Approach	HW#7 Green Build Section 3 Review Questions, Page 3-46	Sept 22	Site Design & Development, Lot Prep, Design, Development	HW#8 Green Build Section 4 Review Questions, Page 4-31	
6	Sept 27	Resource Efficiency	HW#9 Green Build Section 5 Review Questions, Page 5-36	Sept 29	Resource Efficiency	HW#10 Green Build Section 6 Review Questions, Page 6-84	Oct 1 Career Fair
7	Oct 4	Energy Efficiency		Oct 6	Energy Efficiency	HW#11 Green Build Section 7 Review Questions Page 7-101	
8	Oct 11	October Break	No Class	Oct 13	Water Efficiency	HW#12 Green Build Section 8 Review Questions, Page 8-26	
9	Oct 18	Indoor Air Quality, Operation, Maintenance and Building Owner Education	HW#13 Green Build Section 9 Review Questions, Page 9-52 Section 10 Review Questions Page 10-33	Oct 20	Green Marketing	HW#14 Green Build Section 11 Review Page 11-38	
10	Oct 25	NAHB Certified Green Professional Exam		Oct 27	Energy Audit		
11	Nov 1	Energy Audit		Nov 3	Business Management Into Sec. 1 Business Basics	HW#15 BusMgmt Section 1 Review Questions, Page 1-13	
12	Nov 8	Business Management Sec. 2 Planning	Performance: Are we there yet?	Nov 10	Business Management Sec. 2 Planning	HW#16 BusMgmt Section 2 Review Questions, Page 2-28	
13	Nov 15	Business Management Sec. 3 Purpose	HW#17 BusMgmt Section 3 Review Questions, Page 3-17	Nov 17	Business Management Sec. 4 People	HW#18 BusMgmt Section 4 Review Questions, Page 4-31	
	Nov 22	Business Management Sec. 5 Performance	HW#19 BusMgmt Section 5 Review Questions, Page 5-22	Nov 24	Thanksgiving Break	No Class	
14	Nov 29	Business Management Sec. 6 Progress	HW#20 BusMgmt Section 6 Review Questions, Page 6-10	Dec 1	NAHB Business Management Exam		
15	Dec 6	Green Building Final Presentation	Green Building Final Presentation	Dec 8	Green Building Final Presentation	Green Building Final Presentation	NAHB Green Project Binder Due
16	Dec 13	Finals Week					

**BCM 360 Residential Construction
NAHB Book Sales, Membership, Course Fees Purdue
University Student Chapter**



Name:				For NAHB use only			
Address:				Date		Initials	
City, State, Zip:				Chk #			
Major:				Cash			
Phone:							
Email:							
Grad Year:							
Shirt Size:							
Qty	Description	Price		NAHB Retail Value			
				Member	Non-Member		
1	Green Building book	\$70.00		\$395.00	\$470.00		
1	Business Management book	\$70.00		\$220.00	\$270.00		
1	NAHB Student Membership 09-10	\$20.00		\$170.00	\$170.00		
1	CGP Graduation/Processing fees		\$170 Paid by HELP Grant / BCM, sponsored by NAHB / NHE				
TOTAL		\$160.00		CGP	\$785.00	\$910.00	
<p>Payment preferably by check, or cash, no credit cards, sales tax is included on book purchases</p> <p align="center">PLEASE MAKE CHECKS PAYABLE TO NAHB STUDENT CHAPTER</p>							

