National Center for Healthy Housing

Comparing Green Building Guidelines and Healthy Homes Principles:
A Preliminary Investigation

The National Center for Healthy Housing
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Executive Summary

Recently, there has been a proliferation of voluntary green building programs aimed at improving commercial and residential environments. The guidelines for these programs primarily focus on product and material selection, maximizing energy-efficiency, and reducing the impact of building on the outdoor environment. However, proponents of green building programs are increasingly emphasizing the indoor environmental aspects of their programs and their related occupant health benefits. Ideally, a home should be designed, constructed, and operated in a manner where all building goals are optimized — including environmental, energy, durability, affordability, and occupant health concerns.

In this preliminary report, the National Center for Healthy Housing (NCHH) compared major national green building and indoor air quality guidelines with its own set of recommended healthy housing criteria to assess the extent to which these programs protect residents from health and safety hazards. The analysis examined guidelines produced by both the public and private sectors including: the U.S. Green Building Council's *LEED for Homes*, the National Association of Home Builders' *NAHB Green Home Building Guidelines*, and Enterprise Community Partner's *Green Communities Criteria*, spearheaded by Enterprise in partnership with NRDC and other national entities. NCHH also included in the analysis the U.S. Environmental Protection Agency's (EPA) *Energy Star with Indoor Air Package* and the American Lung Association's *Health House Builder Guidelines*, which are programs aimed primarily at improving the quality of the indoor environment.

The analysis examines whether national green guidelines address housing conditions known to affect health status, such as asthma and respiratory disease, unintentional injuries, and toxic agents. We compared the criteria in the selected guidelines with NCHH's healthy housing principles, which were developed by a group of national experts under a cooperative agreement from the Centers for Disease Control and Prevention (CDC) for use in a nationwide training and education program. In short, these Healthy Homes principles provide for keeping homes dry, clean, well-ventilated, pest-free, free from contaminants, safe, and well-maintained.

The results showed that there is significant variation in the degree to which national green guidelines consider occupant health. For example, although most programs had elements related to reducing moisture and improving ventilation, injury prevention was omitted from all of the guidelines and protection from contaminants such as lead and pesticides were not uniformly covered. Only one program, Green Communities, focused on affordable existing housing, an important consideration since low-income families are disproportionately impacted by housing-related health problems.

Overall, the analysis suggests that green building programs offer a significant opportunity to achieve public health benefits and have the potential to transform the housing market toward healthier building. This report suggests ways to strengthen the occupant health criteria for green building programs so that they may deliver greater benefits to those who are building and rehabilitating homes, and to the families who reside in them.

Background

Most communities rely primarily on residential building codes to protect occupants from housing-related health and safety hazards. The International Code Council (ICC) publishes building codes, which are recognized by many states and municipalities that regulate construction practices (see Appendix 1). Properly enforced building codes provide a baseline for building safety. According to the ICC, "the purpose of building codes is to establish the minimum acceptable requirements necessary for protecting the public health, safety and welfare in the built environment."[1] Traditionally, the minimum standard concentrated upon structural, fire, electrical, mechanical, and plumbing concerns.

Expanding on these basic protections, dozens of jurisdictions have created more comprehensive green and healthy housing building criteria (see Appendix 2 for a list of green building programs by region). For this analysis we chose to focus on guidelines with a national focus. These guidelines exist in many formats and are produced by several organizations with varying goals, such as energy conservation, improved quality of life, and preventing adverse environmental impacts.

We obtained green building guidelines or checklists from the National Association of Homebuilders (NAHB), and the United States Green Building Council (USGBC) and Enterprise Community Partners. In addition, we obtained the indoor air quality guidelines from the U.S. Environmental Protection Agency and the American Lung Association. The following section provides a summary of the guidelines developed by these organizations.

Summary of Programs Included in the Analysis

National Association of Home Builders Green Home Building Guidelines

The National Association of Home Builders (NAHB) developed its Green Home Building Guidelines with "mainstream" builders in mind. It is intended for people with some expertise in environmentally conscious design and construction and includes a criteria list with several performance levels and associated verification measures. The program emphasizes and rewards durable, well-built homes. There is also a companion user guide to assist with implementation. NAHB developed the guidelines through a consensus-based process in 2004, with input from a variety of stakeholder groups. The development process included borrowing or actively involving administrators of the then twenty-eight existing regional green building programs. The guidelines seek to reduce the environmental impacts of housing development by focusing on several key aspects of the building process, which are termed "guiding principles." The stakeholder group determined the minimal requirements for a house in each of these guiding principle groups, and then developed additional features for each principle to distinguish a home as "green." The stakeholder group identified point values for these additional features and developed bronze, silver, and gold designations for them (see Figure 1). The point schedule assumes that a home is located in the same Department of Energy designated climate as Baltimore, Maryland. Unlike LEED for Homes (described below), NAHB's program requires point totals in each category (site, water, energy, etc) and it assigns Bronze, Silver, or Gold performance levels in each category.

[1] http://www.iccsafe.org/government/Toolkit/Briefing.pdf

Figure 1: Principles and Levels of Compliance

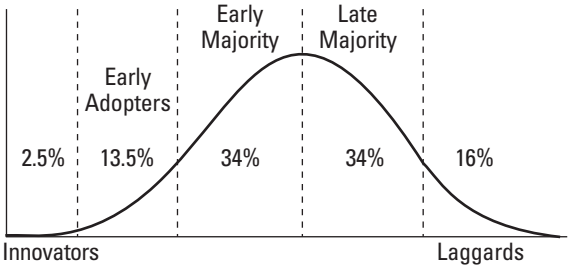
	Bronze	Silver	Gold
Lot Design, Preparation, and Development	8	10	12
Resource Efficiency	44	60	77
Energy Efficiency	37	62	100
Water Efficiency	6	13	19
Indoor Environmental Quallity	32	54	72
Operation, Mainenance, and Homeowner Education	7	7	9
Global Impact	3	5	6
Additional points from sections of your choice	100	100	100

Leadership in Energy and Environmental Design for Homes (LEED for Homes)

The U.S. Green Building Council (USGBC) administers the Leadership in Energy and Environmental Design (LEED) program. LEED for Homes is a voluntary initiative designed to actively promote the transformation of the mainstream home building industry toward more sustainable practices. The LEED for Homes Program's long term goal is to recognize and reward the top 25% of new homes, in terms of environmental stewardship. LEED for Homes includes market rate and affordable homes as well single family and multifamily homes. USGBC is targeting the innovators, early adopters, and early majority segments of E.M.Rogers' taxonomy (Figure 2). The program is being piloted thru early 2007. A public review of the LEED for Homes rating system is planned for the second half of 2006.

Figure 2: Innovation Adoption by Group

Rogers Adoption/Innvation Curve



www.valuebasedmanagement.net

USGBC has seven committees of national experts that have oversight over LEED for Homes, including the LEED for Homes Product Committees, five Technical Advisory Groups, and a Technical Scientific Advisory Committee (TSAC). A Builder Review Panel evaluated the pilot program and provided input to the pilot version of the Rating System that rolled out in August 2005. A public review period also occurred just prior to the release of the pilot. The pilot demonstration phase is planned for eighteen months. The product development cycle includes two public reviews, and a membership ballot. The costs of participation in the LEED for Homes Pilot are largely established by local or regional Providers. The Provider is responsible for the third party inspection and performance testing services. These verification and rating services will take a total of approximately 2 to 3 days per home, although the costs will very with the size and location of the homes, and the number of green measures to be inspected and tested. USGBC charges each builder a $150 fee to register in the Pilot, and an additional $50 fee to certify each LEED Home. LEED for Homes has seven primary criteria categories with associated point totals adding up to a maximum of 108 (Table 1).

LEED for Homes has several performance tiers termed Certified (30-49 points), Silver (50-69 points), Gold (70-89 points), and Platinum (90-108 points). The third-party Provider is responsible for determining the LEED for Homes score and the rating.

Table 1: Criteria Categories and Associated Point Values

Category Name	Prerequisite (Y/N) and Type	Max. Point Total
Homeowner Awareness	Y-Homeowner Manual	1
Location and Linkages		10
Energy & Atmosphere	Y-ENERGY STAR Home	29
Sustainable Sites	N	14
Water Efficiency	Y-water plan	12
Indoor Environmental Quality	Y-combustion venting, humidity control, ventilation (manual D, whole house and spot), construction contamination control, radon and car emission control	14
Materials & Resources	Y-durability plan, no tropical hardwoods, waste management	24
Innovation & Design Process	N	4

Enterprise Community Partners Green Communities Criteria

Green Communities,™ a major initiative by Enterprise Community Partners (Enterprise), is a five-year, $555 million initiative to create more than 8,500 homes that deliver significant health, economic and environmental benefits for low-income families and communities. This groundbreaking effort is a partnership between Enterprise, the Natural Resources Defense Council, Global Green USA, the American Institute of Architects, the American Planning Association, the National Center for Healthy Housing, Southface, and leading corporate, financial and philanthropic institutions. The foundational document for the program was the Seattle SEAGreen.

Projects developed under the criteria must satisfy all mandatory elements, and gain additional points (twenty-five points for new construction or twenty for rehabilitation projects) from optional criteria. The criteria allow flexibility if a particular hardship is demonstrated and an alternative is proposed that meets the intent and accomplishes the same outcome as the criteria. Building projects that conform to the criteria are eligible for grants, loans, and tax credit equity as incentives. This is currently the only green building program that requires a certain percentage of new homes or apartments to be dedicated to lower-income residents. Some studies have demonstrated that mixed income neighborhoods can demonstrate significant health improvements, compared to segregated, low-income communities.

The criteria are divided into categories in a similar fashion as the other green building programs:

- Integrated Design Process
- Location and Neighborhood Fabric
- Site Improvements
- Water Conservation
- Energy Efficiency
- Materials Beneficial to the Environment
- Healthy Living Environment
- Operations and Maintenance

Optional criteria are available in Location and Neighborhood Fabric, Site Improvements, Energy Efficiency, Materials Beneficial to the Environment, and Healthy Living Environment. Integrated Design Process, Water Conservation, and Operations and Maintenance contain mandatory elements exclusively. A review panel evaluates each project for grant approval that includes a self-certification of compliances by the grantee's project architect and construction manager, thereby eliminating the need for a third-party rating system.

American Lung Association Health House Builder Guidelines

The American Lung Association Health House Builder Guidelines are primarily focused on the indoor environment and occupant health (particularly respiratory health) and focus on newly constructed homes. Both required and optional elements are included. Optional elements are upgrades that are recommended to enhance building performance. The

Guidelines are organized by the following building categories:

- Site
- Building Envelope
- Finishes and Furnishings
- Mechanical Equipment
- Commissioning
- Construction, Hygiene, Safety and Health

The basic tenets of the Health House guidelines are to prevent moisture accumulation from soil, precipitation, and condensation; limit or modify materials that off-gas pollutants; ensure ventilation to all critical areas of a house; promote the ease of home cleaning; and to educate the homeowner about critical operation and maintenance procedures.

U.S. Environmental Protection Agency Energy Star with Indoor Air Package Pilot Specifications

The U.S. Environmental Protection Agency (EPA) developed the Energy Star with Indoor Air Package (IAP) Pilot Specifications to recognize homes equipped with a comprehensive set of indoor air quality measures. IAP is targeted to production builders, which according to EPA, are the most rapidly growing sector of the home building industry and is highly influential in home building trends. Homes that comply with these specifications can use "Indoor Air Package" as a complementary label to Energy Star for homes. As a prerequisite for this label, a home must first be Energy Star qualified. Energy Star is a performance-based program, which requires qualified homes to be at least 30% more energy efficient than homes built to the 1993 national Model Energy Code or 15% more efficient than state energy code, whichever is more rigorous. These savings are based on heating, cooling, and hot water energy use and are typically achieved through a combination of building envelope upgrades, high performance windows, controlled air infiltration, upgraded heating and air conditioning systems, tight duct systems, and upgraded water-heating equipment. IAP requires a suite of additional prescriptive measures, consisting of seven primary components:

- Moisture Control
- Radon Control
- Pest Control
- HVAC Systems
- Combustion Safety
- Building Materials
- Home Commissioning

Like Energy Star, IAP requires third-party verification through the Home Energy Rating System (HERS) to ensure compliance.

Method of Analysis

We developed a matrix to compare the criteria of the five national programs with NCHH's recommended health and safety criteria that enable a home to meet NCHH's seven healthy homes principles:

- Keep It Dry
- Keep It Clean
- Keep It Well Ventilated
- Keep It Safe
- Keep It Free of Contaminants
- Keep It Pest Free
- Keep It Well Maintained

These principles were developed by a broad-based expert workgroup of housing and health professionals as part of the U.S. Centers for Disease Control and Prevention — funded National Healthy Homes Training Center and Network. For more information see *www.healthyhousing.org/training*. The principles reflect the latest in scientific research and best practices related to reducing housing-related health hazards.

In the left column of Table 2 is a list of NCHH's recommended criteria for achieving the above principles. This detailed matrix indicates the extent to which each of the five programs includes similar or equivalent criteria to that recommended by NCHH. A program received a score of three for a mandatory criterion that is equivalent to NCHH's recommended criterion. A program received a score of two if the criterion was similar (e.g., partially addressed the criterion) and was mandatory. A score of one was assigned to a criterion that was either similar or equivalent, but optional. A program received a zero for a criterion that was omitted altogether. In some circumstances a not applicable (N/A) was assigned to a given criteria. For example, under the Green Communities program, very few garages will be installed and therefore, the criteria related to air handling equipment in garages was consider N/A.

Table 3 summarizes the degree to which these programs meet the overarching healthy homes principles. Programs that required all of NCHH's criteria (e.g., scored a two or three for every criterion within a category) received the highest rating. A program that scored a two or three for 75 to 99 percent of the items within a category received the middle rating. Programs that achieved a two or three for less than 75 percent of the criteria received the lowest ranking. For instance, the *Keep it Dry* principle contains 12 criteria. To achieve the highest rating, a program would have to score a 2 or 3 for all 12 criterion. The middle ranking would be assigned if it scored a 2 or 3 for nine or more of the 12 criteria (12 x 75%=9). The ALA Health House program scored a two or three for all 12 criteria and therefore, received the highest rating. The EPA Indoor Air Package scored a three for ten out of the 12 criteria and therefore, it received the middle ranking. Because none of the NAHB Green Home Builder Guidelines were mandatory it scored a one for all of the Keep it Dry criteria and therefore, received the lowest ranking.

This analysis does not assign a weighting factor to each individual criterion, because this would involve making subjective judgments about the value of an individual criterion, which would require scientific data to support weighting one item more heavily than another. From a public health standpoint we view all of the healthy homes principles as important to the health and safety of residents. In developing the recommended healthy homes criteria and the underlying healthy homes principles we have attempted to reflect current knowledge and best practices and to incorporate criteria that are feasible to implement (e.g. can be broadly adopted) and will contribute to health improvements. There is a need for additional research to identify how much each factor contributes to the occupants' overall health status.

The review did not consider the costs of the various building standards because none of the standards provide cost estimates. Only the Green Communities Criteria explicitly considers costs. In addition, of the guidelines, only the Green Communities Criteria are directed toward both new construction and rehabilitation activities. Of the guidelines reviewed, the Green Communities Criteria has the broadest application when viewed in this context.

Results

Table 2 shows the results of the analysis.

Table 2: Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
Keep It Dry						
For conventional hot water heaters and equipment that condense water (e.g., air conditioner, dehumidifier) install drains or catch pans that capture overflow or leaks.	1	0	3	3	3	LEED MR 4.1; NAHB Sec. 4.1.1, GCI 7-8, ALA 191, EPA 4.9;
Do not install mold-susceptible materials such as vinyl wallpaper, paper-faced gypsum board, and unsealed grout in wet areas. Use highly durable, moisture-resistant materials in tub/shower enclosures (cement board, fiberglass-reinforced board).	1	1	3	3	3	LEED MR 4.1; NAHB Sec 5.3.2; GCI 7-10; ALA 50, 183; EPA 1.20

Table 2 (cont.): Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
Basements and Concrete Slabs: Provide proper drainage to the lowest level of concrete. Waterproof exterior of below grade foundation walls. Provide continuous crushed stone under footings or provide pipe through footing for drainage of any accumulated water under slab to drainage. Install a capillary break of 4 inches of clean or washed gravel (0.5-inch or greater), placed over soil. Cover with a 6-millimeter (mil) polyethylene sheeting moisture barrier, with joints lapped one foot or more to prevent moisture from migrating from the soil through the slab to a living or storage area. On interior below-grade walls, avoid using separate vapor barrier or a below- grade vertical insulation that can trap moisture inside wall systems (e.g., polyethylene sheeting, vinyl wallpaper or foil faced). Raise paper covered gypsum board 1/2 inch above concrete slabs.	1	1	2	2	3	LEED MR 4.1; NAHB 2.2.3 and 2.2.11; GCI 7-11; ALA 24, 29-31, 46-49, 60, 61; EPA 1.16, 1.18; LEED 4.1; ALA 184; EPA 6.3;
Crawlspaces: Do not vent crawl spaces. Cover floor with continuous sealed vapor retarder sealed to walls and insulate walls.	1	0	0	2	3	LEED MR 4.1; ALA 32, 51-59; EPA 1.17
Insulate cold water pipes in climates and building conditions susceptible to moisture condensation. Avoid putting plumbing in exterior walls.	1	1	3	3	0	LEED EA7.1; NAHB 5.3.5 & 5.3.6; GCI 7-9; ALA 68;
Surface Water Drainage: Divert water drainage away from the building by directing gutters and downspouts to flow onto splash blocks or a proper drainage system. Slope new and rebuilt walk-ways, stairs, patios and thresholds away from the buildings. Best practices include a grade of 0.5 inch per foot, or approximately a 4 percent pitch. EPA recommends a 2 percent pitch (0.25 inch per foot) for hard surfaces such as patio slabs, walks and drive-ways. Provide drain tile at footings, level or sloped to discharge to outside grade (daylight) or to accessible sump pump. Top of drain tile pipe must always be below the level of where bottom of concrete slab or crawl space floor will occur. Pipe shall be surrounded with minimum of 6 inches of 3/4 inch washed or clean gravel that is fully wrapped with fabric cloth. Use a sealed sump pump system. Drainage system not required in pure sand.	1	1	3	3	3	LEED MR 4.1; NAHB 2.2.5 & 2.2.6 & 2.2.9; GCI 7-12; ALA 9, 21, 103-106, 109; EPA 1.15, 1.14, 1.19, 1.20;
Minimize and properly flash all roof penetrations and construct effective eaves. Where feasible, extend eaves (ideally 18 inches to 2 feet, climate conditions permitting) to keep water away from the building. Provide step flashing at intersections of roof and walls with the exception of continuous flashing at metal and rubber membrane roofs. Use metal "kick-out" flashing at the end of roof/wall intersections to direct water away from wall.	1	1	2	3	3	LEED MR 4.1; NAHB 2.2.1 & 2.2.12 & 2.2.2; GCI 7.12.(how); ALA 95-102; EPA 1.1, 1.2, 1.3, 1.5;

Table 2 (cont.): Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
Install continuous drainage plane fully sealed at all penetrations that directs water away from wall assemblies.	1	1	2	2	3	LEED MR 4.1; NAHB: 2.2.9; GCI 7-12; ALA 63, 69, 69; EPA IAQ: 1.7, 1.13
Install effective flashing on all rough openings, including membrane flashing on bottom of all rough openings for windows (pan flashing) and doors, using adhesives compatible with drainage plane materials and window and door head casing flashing. Ensure proper installation of windows and doors to protect moisture-sensitive materials from rainwater intrusion.	1	1	3	3	3	LEED MR 4.1; NAHB 2.2.12; ASTM 21.12; GCI 7-12; ALA 74-77; EPA 1.8;
Reduce moisture problems caused by unnecessary heat loss into and out of the unconditioned space. No non-airtight recessed light fixtures in insulated ceilings.	1	1	1	3	3	LEED EA 2.1; NAHB 3.3.1; ALA 242; EPA 1.10, 1.11; GCI 5.1
Plan landscaping so that mature plantings will be at least 24" from house. Avoid planting trees where root systems can penetrate the foundation and plumbing.	1	1	0	3	0	LEED MR 4.1; ALA 10, 13
Avoid wall-to-wall carpet in wet areas including bathrooms, kitchens, utility rooms, basements, or entryways.	1	0	3	3	3	LEED MR 4.1; GCI 7-4; ALA 134; EPA 6.10;
KEEP IT CLEAN						
Install permanent walk-off mats, provide track off system, or design to accommodate track off mats. Provide sufficient storage area for shoes and boots to encourage removal when entering building.	1	0	0	3	0	LEED IEQ 8.2; ALA 79-82
Do not install carpet in at least one bedroom. If feasible, install smooth and resilient flooring in all rooms.	1	0	1	3	0	LEED MR 5.2; GCI 7-17A, ALA, 83, 121, 145-155
If possible, install central vacuum system with exhaust to the outdoors.	2	0	1	3	3	LEED IEQ 8.2; GCI 7-17B; ALA 143; EPA 4.21

Table 2 (cont.): Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
KEEP IT WELL VENTILATED						
Except for exhaust fans ducted to multiple bathrooms, install Energy Star-labeled local exhaust bathroom fans per ASHRAE 62.2 that exhaust to the outdoors, are equipped with a humidistat sensor or timer, and have rates of at least 20 cfm continuous (50 cfm intermittent). For kitchens with gas cook tops and/or gas ovens, install power-vented Energy-Star labeled fans or range hoods per ASHRAE 62.2 that exhaust to the exterior and have rates of 5 air changes per hour or 100 cfm intermittent.	3	1	2	3	3	LEED IEQ 5.1, 5.2; NAHB 3.3.2; GCI 7-5; ALA 208-209, 237; EPA 4.16
Adequately ventilate all living areas by following ASHRAE 62.2 or as a rough rule of thumb providing 15 cubic feet per minute of fresh air, per occupant, either via the HVAC system or through natural ventilation.	3	1	3	3	3	LEED IEQ4.1; GCI 7-6; ALA 206; EPA 4.15
Size HVAC systems to prevent short-cycling of heating or air conditioning and ensure adequate dehumidification (ACCA Manual J and S).	3	1	3	3	3	LEED EA 6.2; NAHB 3.1.2; GCI 7-7; ALA 240; EPA 4.8
Do not install air handlers or duct work in garage. Exhaust ducts allowed if leakage is limited to <5%.	3	0	N/A	3	3	LEED IEQ 10.1; ALA 89, 113; EPA 4.3, 4.12
Install air filters rated at MERV 8 or higher, and ensure that air handlers can maintain adequate pressure and air flow, OR Install Ductless Space Conditioning System	3	1	3	3	3	LEED IEQ 7.1; NAHB 5.2.3 (MERV 9); ALA 223; EPA 4.19
Avoid use of HVAC equipment during construction, mask HVAC outlets during construction, and clean HVAC ducts and coils before occupancy.	3	1	0	3	3	LEED IEQ 8.1; NAHB 5.1.7; ALA 169, 250; EPA 4.7, 7.1, 7.2;
Ventilate before occupancy. For the period between finishing and occupancy, ventilate the building at the highest rate the ventilation system can produce for a period of three days.	0	0	N/A	3	3	ALA 166-168, 251; EPA 6.5, 7.4, Green Comm requires all low-voc products; rendering criteria non-essential.

Table 2 (cont.): Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
KEEP IT SAFE						
Set water heater temperature at 120 degrees Fahrenheit.	0	0	0	0	0	
Install medicine storage cabinets with locks in homes that may be occupied by young children.	0	0	0	0	0	
Install grab bars inside and outside showers in housing units that may be occupied by persons over 55.	0	0	0	0	0	
Provide smoke detectors per code AND hardwired with battery backup.	2	2	2	2	2	Codes typically require smoke detectors hence all standards are scored as having achieved similar criteria; hardwired devices with battery backup not typically required.
Install one carbon monoxide (CO) alarm outside of each separate sleeping area in homes with combustion appliances. Install additional alarm on interior wall of attached garage.	3	1	2	3	3	LEED IEQ 2.1; GCI 7-13; ALA 199 (must meet Canadian std 6.19); EPA 5.6
KEEP IT FREE OF CONTAMINANTS						
Use low-volatile organic compounds (VOC) paints and primers. Use low-VOC sealants and adhesives. If carpet used, use tack strips to lay down carpets whenever possible.	1	1	3	3	0	LEED MR 5.2; NAHB 7.1.2; GCI 7-1; ALA 157; NAHB 7.1.3; GCI 7-2; ALA 43, 154, 179
Ensure any composite wood used, (including interior panel products, exposed particleboard, MDF) is free of added urea formaldehyde, or sealed with a low-VOC, water-based sealant or laminate. Wire shelves are appropriate as an alternative.	1	0	3	3	3	LEED MR 5.2; NAHB 5.1.5; GCI 7-3; ALA 170-176; EPA 6.7 (ANSI 208.1 AND 208.2)
Carpet: If using carpet, install Carpet and Rug Institutes Green Label Plus certified carpet.	1	1	2	3	3	LEED MR 5.2; NAHB 5.1.6; GCI 7-4; ALA 5.2; EPA 6.9

Table 2 (cont.): Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
Use lead safe work practices when sanding, cutting, scraping, drilling or in any other way disturbing painted surfaces in homes built before 1978, unless lead testing documents show that the paint is not lead based. Follow Lead-Safe Work Practices. Follow 24 CFR 35 for federally owned or assisted properties. Follow the Lead Paint Field Safety Guide for all other properties.	N/A	N/A	3	N/A	N/A	GCI 7-16
Install detached garage OR tightly seal shared walls between garage and conditioned spaces with: continuous air barrier, tightly sealed door from living space to garage, air sealing of all penetrations, walls, ceilings and floors, and minimum 100 CFM exhaust fan rated for continuous exhaust with automatic timer control to run for a pre-set period of time when garage door opens and closes.	2	1	2	3	3	LEED IEQ 10.2, 10.3; NAHB 5.1.4; GCI 7-13; ALA 110-118; EPA 5.3-5.5;
Use smooth and cleanable environmentally friendly flooring products such as: linoleum, laminate, ceramic tile, bamboo, cork, wood (especially salvaged wood), rubber or other low VOC emitting products.	1	1	1	3	3	LEED MR 5.2; NAHB 2.4.1 & 2.6.1 (use materials from renewable resources); GCI 7-10, 7-17A; EPA 5.1;
Ensure all combustion fueled equipment in conditioned spaces is vented to the outside and either sealed-combustion, direct vent, power-vented, induced draft, or aerodynamically de-coupled from the indoor air. No unvented fireplaces OR all fireplaces and solid fuel heating must have tight-fitting doors and dedicated utside combustion air. Non-closed combustion systems must be aerodynamically de-coupled from the indoor air.	3	1	2	3	3	LEED IEQ 2.1; NAHB 5.1.1 (water heaters only); GCI 7-8 (water heaters only); ALA 198; E PA 5.1; LEED for Homes 2.1, 22; GCI 7-8 (water heaters only); ALA 198; EPA 5.2
If home is located in EPA Region 1, or local data suggest that there is a radon risk, design and install radon mitigation system, and perform short term radon test. Radon test all homes after completion and before occupancy. Radon mitigation systems are strongly recommended for EPA region 2.	2	1	2	2	3	LEED IEQ 9.1, 9.2; GCI 7-11; EPA 2.1-2.3, 7.6; NAHB 5.2.5

Table 2 (cont.): Degree of Consistency with Healthy Homes Principles (1=least consistent; 3= most consistent).

Criteria	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package	Relevant Criteria
KEEP IT PEST FREE						
Seal all wall, floor and joint penetrations with rodent proof materials and low VOC caulk if appropriate. Apply boric acid in holes and cracks likely to experience pest problems.	1	1	3	3	2	LEED SS 5; NAHB 3.3.1 (w/o rodent-proof and boric acid provisions); GCI 7-15; ALA 37-39, 107; EPA 3.1
KEEP IT WELL MAINTAINED						
Provide a "User's Manual" for the house, including written operation instructions for the house, maintenance schedule, maintenance instructions, equipment literature, equipment warranties.	3	3	3	3	3	LEED HA 1; NAHB 6.1; GCI 8-1, 8-2; ALA various; EPA 7.8
The builder shall provide the home buyer with a Homeowner's Manual / binder that includes: • Healthy Home/Indoor Environment Certificate; and • The completed checklist of Healthy Homes features; and • The product manufacturer's manuals for all installed equipment, fixtures, and appliances. • A walkthrough of the home before closing, that is at least 60 minutes in duration. The walkthrough should include: • Identification of all installed equipment, and • How to use measures and operate the equipment in their Healthy Home appropriately; and • How to maintain the measures and equipment in their Healthy Home properly.	3	2	2	3	2	LEED HA 1; NAHB 6.1 & 6.2 ; GCI 8-1,8-2), 8-3; ALA 252; EPA 7.7

Table 3. Comparison of National Green Building Program Guidelines with Key Healthy Housing Principles

Healthy and Affordable Building Principles	LEED for Homes	NAHB Green Home Building Guidelines	Green Communities	ALA Health House	Energy Star Indoor Air Package
KEEP IT DRY*	◒	○	◒	●	◒
KEEP IT CLEAN	○	○	○	●	○
KEEP IT WELL VENTILATED	◒	○	◒	●	●
KEEP IT SAFE	○	○	○	○	○
KEEP IT FREE OF CONTAMINANTS	○	○	◒	●	●
KEEP IT PEST FREE	○	○	◒	●	●
KEEP IT WELL MAINTAINED	●	●	●	●	●

* Received credit for detailed climate-based durability plan.

● all criteria required ◒ 75% of criteria required ○ less than 75% of criteria required

Discussion

There is substantial variation in the occupant health criteria of the national programs. Because of their specific focus on occupant health, the ALA Health House and EPA's Energy Star Indoor Air Package generally scored better. LEED for Homes includes a 10 point credit for completing the ENERGY STAR with IAP certification. The green programs were more variable in their consistency with NCHH's criteria. For example, NAHB's guidelines are flexible in nature enabling a wider variety of practices to attain air quality goals. Although this offers builders the ability to exceed the basic requirements, it also provides the opportunity for builders to under-perform on indoor air quality measures. The NAHB standards received the lowest rating because the criteria are optional and it is difficult to ascertain whether they would be followed.

All of the standards and guidelines specify low or no volatile organic compound (VOC) emitting materials as a mandatory or optional requirement. Traditional sources of formaldehyde, panels with urea formaldehyde resins such as particleboard or plywood, are either discouraged or required to be sealed with a low VOC sealer. From an occupant health standpoint, wood is a "healthy" building material, generally creating a cleanable surface without contribution of contaminants to the home. Woods visual warmth

may also offer intangible emotional value to occupants. Wood has been historically an expensive material that raised affordability concerns and its harvest can reveal broader sustainability issues.

Polyvinyl chloride products are another controversial material group for green building. Some environmental groups consider vinyl the worst plastic from an environmental and human health perspective, citing among other things the disproportionate impacts vinyl production facilities have on the poor and communities of color[2] and the harmful chemicals generated through the vinyl production process, including chlorine and dioxins. Vinyl building products are not restricted by any of the standards, although most encourage natural products through optional criteria. Other residential green building guidelines such as SeaGreen in Seattle discourage the use of vinyl because of its environmental health impacts. The leading green building guidelines for the health care industry, the Green Guide for Health Care, offer credits for avoiding vinyl.

All of the programs have similar, some more explicit, requirements or recommended practices for moisture control. LEED for Homes and the NAHB guidelines provide builders with more moisture control options, while the other standards explicitly require specific surface water controls and building practices to prevent moisture problems. The moisture management requirements for LEED for Homes are optional and therefore scored a one in the detailed matrix. However, the program requires the preparation of an extensive durability plan tailored to local climate conditions as well as verification of that plan. NCHH believes that several of the criteria in the Keep it Dry category are universally appropriate and should be mandatory requirements (e.g. avoiding carpets in wet areas). At the same time, we recognize that local climate conditions and geology vary considerably in the United States and that a sound moisture management plan should reflect these differences. We acknowledged LEED's approach in Table 2 by assigning the middle ranking to the Keep it Dry category.

The Green Communities, Energy Star with Indoor Air Package and Health House guidelines all discourage the use of carpeting in moisture-prone areas such as kitchens, bathrooms, entryways, and basements. Neither the NAHB guidelines nor LEED for Homes explicitly restrict the use of carpets. Although LEED for Homes does recommend using either less carpeting or GRI certified carpeting.

Ventilation varies among the programs. LEED for Homes and Energy Star with Indoor Air Package specifies ASHRAE 62.2. Green Communities includes many but not all of the 62.2 requirements. Health House requires more ventilation than 62.2 and NAHB requires less ventilation than the other programs.

Conclusion

The goals of the green and healthy housing programs and guidelines vary by the mission and constituency of the organizations that develop them. NAHB's Green Home Building Guidelines are intended to serve as a foundation upon which other organizations can develop their own guidelines. The Guidelines have a very informative and well-referenced user's guide to assist with implementation. LEED has a formidable presence in commercial green building and therefore it brings brand recognition to the residential environment. A major advantage to LEED for Homes is its third-party assurance of performance. Green Communities Criteria is extremely well organized and user-friendly and has an additional focus on lower-income residents and addresses housing rehabilitation. Each criterion, intent, and explanatory statement is concise and easy to follow. The Energy Star with Indoor Air Package is also very well organized and referenced. The ALA Health House program is extremely detailed, but less user friendly by comparison. A key strength of the Health House program is that it involves builder training and as such does not rely on the criteria list as the main vehicle for promoting change in practice. Overall, for healthy indoor environments, Energy Star Indoor Air Package Pilot Specifications and the ALA Health House Builder Guidelines offer the greatest protection of occupants whereas the Green Communities Criteria explicitly consider the special needs of affordable housing and existing housing.

Importantly, this study did not examine program feasibility or effectiveness. Simply strengthening program criteria without corresponding behavior change among builders will not achieve healthier homes. Likewise, widespread compliance with criteria that are not explicitly linked to the health benefits they claim does not move the nation toward better quality housing. This preliminary analysis demonstrated the

[2] www.rachel.org/bulletin/pdf/RachelS_Environment_Health_News_1012.pdf

need for further scientific research and evaluation of the health benefits for residents living in green housing. Tracking and measuring the expected health improvements among all of the green programs is worthy of consideration. Furthermore, there is a need to standardize the health and safety hazard assessment and treatment protocols currently in use across the country. Finally, additional research and evaluation are needed to understand both the impact of green building programs on public health during the "use" phase, and also the lifecycle impacts on public health. A cradle to grave approach to building acknowledges both the impacts for current residents, as well as considerations for future families and communities.

NCHH applauds the national and local organizations that have developed green building programs to help conserve our nation's energy and natural resources, protect the environment, increase our access to nature, and protect families from environmental health threats. These programs offer new opportunities to create more livable and sustainable communities and underscore the relevance of the built environment to our health and well-being. NCHH hopes this review will promote the proliferation of these programs and will spur a greater commitment to resident health as these programs evolve and new programs emerge.

References

1. American Lung Association, *"Health House Builder Guidelines,"* 2004.

2. American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., *"ASHRAE Standard Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings,"* 2002.

3. Building for Social Responsibility/Vermont Energy Investment Corporation, *"Vermont Builds Greener Program v. 3.5,"* 2005.

4. Environmental Building News, *"Vermont's Built Green Pushes the Envelope,"* Vol. 12 (7), 2003.

5. The Evergreen Foundation, *"Green Communities Criteria,"* 2005.

6. International Code Council, http://www.iccsafe.org/government /Toolkit/Briefing.pdf

7. National Association of Home Builders, *"NAHB Green Home Building Guidelines,"* 2004.

8. United States Environmental Protection Agency, *"Energy Star with Indoor Air Package Pilot Specifications,"* 2005.

9. U.S. Green Building Council, *"TSAC PVC Task Group: Assessment of Technical Basis for a PVC-Related Materials Credit in LEED,"* 2004.

10. U.S. Green Building Council, *"LEED for Homes v. 1.23,"* 2005.

11. www.valuebasedmanagement.net/methods_rogers_innovation_adoption_curve.html

Appendix 1

International Code Council Model Building Codes

- International Building Code
- International Residential Code
- International Fire Code
- International Plumbing Code
- International Mechanical Code
- International Fuel Gas Code
- International Energy Conservation Code
- International Private Sewage Code
- ICC Performance Code
- ICC Electrical Code – Administrative Provisions
- International Property Maintenance Code
- International Zoning Code
- International Existing Building Code
- International Urban-Wildland Code

International Codes-Adoption by Jurisdiction

ICC makes every effort to provide current, accurate code adoption information, but in some cases jurisdictions do not notify ICC of adoptions, amendments or changes to their codes. To ensure you have accurate information, please contact the jurisdiction.

X = Effective Statewide A = Adopted, but may not yet be effective L = Adopted by Local Governments S = Supplem
03 = 2003 Edition 00 = 2000 Edition

Jurisdiction	IBC	IRC	IFC	IMC	IPC	IPSDC	IFGC	IECC	IPMC	IEBC	ICCPC	IUWIC	IZC	ICCEC
Alaska	X	L	X	X	L		L							
Alabama	L	L	L	X	L	L	L	L	L	L	L		L	L
Arkansas	X	X	X	X	X03			X03						
Arizona	X	L	L	L	L		L	X	L					L
California														
Colorado	L	L	L	L	L	L	L	L	L	L		L	L	L
Connecticut		X03		X	X			X03						
Delaware	L	L		L	X		L	L	L					
Florida				X	X		X							
Georgia	X	X	X	X	X		X	X						
Hawaii														
Iowa	L	L	L	L	L	L	L	L	L	L			L	L
Idaho	X	X	X	X				X						
Illinois	L	L	L	L	L	L	L	A00,L	L	L			L	L
Indiana	X	X	X	X			X							
Kansas	X	L	L	L	L	L	L	X	L					L
Kentucky	X	X		X					L					
Louisiana	X	L		X			L		L					
Massachusetts	A	A		A										
Maryland	X	X		L	L		L	L		L				L
Maine	X03	X03	L	L	L	L	L	L	L				L	L
Michigan	X	X	X	X	X		X		X	X				
Minnesota	X	X	X											
Missouri	L	L	L	X	X	L	L	L	L	L			L	L
Mississippi	L	L	L	L	L	L	L	L	L	L	L			L
Montana	X	X		X			X			X				
North Carolina	X	X	X	X	X		X	X						
North Dakota	X	X	L	X			X		L					
Nebraska	L	L	L	L	L	L	L	L	L	L			L	L
New Hampshire	X	L	L	X	X		L	X	L					
New Jersey	X	X		X			X							
New Mexico	X03	X03	L	L	L		L	X03	L	X03				
Nevada	L	L	L	L	L		L		L					
New York	X	X	X	X	X		X	X	X					
Ohio	X	L	L	X	X		X		L					
Oklahoma	X	X	X	X	X	L	X	L	X	X			L	L
Oregon		X	X	X			X							
Pennsylvania	X	X	X	X	X		X	X	L	X	X	X		X
Rhode Island	X03	X03		X03	X03		X03	X03						
South Carolina	X03	X03	X03	X03	X03	L03	X03	X03	L03	L03				
South Dakota	X	L	X	L			L	L	L	L				
Tennessee	L	L	L	L	X		L	L	L	L				
Texas	L	X	L	X	X	L	L	X	L	L			L	L
Utah	X03	X03	X03	X03	X03		X03	X03						
Virginia	X	X	X	X	X		X	X	X			L		X
Vermont				X										
Washington	X	X	X	X			L			L		L		
Wisconsin	X		L	X			X	X						
West Virginia	X	X		X	X		X	X	X	X				
Wyoming	X	L	X	X	L		X		L					L
District of Columbia	X	X	X	X	X		X	X	X					
Department of Defense	X													
National Park Service	X													
Puerto Rico					X									
U.S. Virgin Islands	L03	L03		L03				L03						

Appendix 2

List of Local Residential Green Building Programs

Name of Program	Location	Year Begun	Type	Contact	Phone	E-mail	Website
Earth Advantage®	Pacific Northwest	1999	Private	Randy Hansell	(503) 603-1649	randy_hansell@pgn.com	http://www.earthadvantage.com/
Green Building Program	Scottsdale, AZ	1998	Municipal	Anthony Floyd, AIA, CBO	(480) 312-4202	afloyd@ci.scottsdale.az.us	http://www.scottsdaleaz.gov/greenbuilding
I-Built	Arizona	2003	HBA	Jean Richmond-Bowman	(928) 779-3071	jean@nazba.org	
Southern Green Building Alliance	Tucson, AZ	TBA	TBA	Loretta Ishida	(520) 624-6628	Loretta@dcat.net	
California Green	California	2001	HBA	Don Mull	(866) 340-8912	dmull@cbia.org	http://www.cagreenbuilder.org/Builder
Green Building Program	Alameda County, CA Waste Management Authority		Municipal				www.stopwaste.org
Innovative Building Review Program	Santa Barbara County, CA	1995	Municipal	Kathy Pfeifer	(805) 568-2507	kathypm@co.santa-barbara.ca.us	http://www.silcom.com/~sbcplan/ibdrc.html
Sustainable Development Initiative	City of Berkeley, CA						http://www.cityofberkeley.info/sustainable/
GreenStar Building Efficiency Program	City of Chula Vista, CA	2000	Municipal				www.ci.chula-vista.ca.us
Innovative Building Review Program	County of Santa Barbara, CA	1995					www.silcom.com/~sbcplan
Green Building Program	City of Santa Monica, CA	1999	Municipal				www.greenbuildings.santa-monica.or

Name of Program	Location	Year Begun	Type	Contact	Phone	E-mail	Website
Built Green Colorado	Denver	1995	HBA	Kim Calomino	(303) 778-1400 x212	kcalomino@hbadenver.com	http://www.builtgreen.org/
City of Aspen Efficient Building Program	Aspen, CO	2003	Municipal	Denis Murray	970-920-5488	denism@ci.aspen.co.us	www.aspenpitkin.com/depts/41/bldg_efficient.cfm
Green Points Program	Boulder, CO	1997	Municipal	Elizabeth Vasatka	(303) 441-1964	vasatkae@ci.boulder.co.us	http://www.ci.boulder.co.us/environmentalaffairs/green_points/index.htm
Florida Green Building Coalition, Inc	Florida	2001	non-profit	Roy Bonnell - Executive Director	(239) 263-6819	ExecDir@FloridaGreenBuilding.org	http://www.FloridaGreenBuilding.org
Earth Craft House	Atlanta, GA	1999	HBA (w/ nonprofit ad-ministration)	Dianne Butler	(404) 872-3549 x118	dianne@southface.org	http://www.earthcrafthouse.org
Hawaii BuiltGreen	Hawaii	TBA	HBA	Nalani E. Blane	(808) 847-4666 ext. 210	rtc@bia-hawaii.com	http://www.bia-hawaii.com/subpage.asp?section=70
Maryland Environmental Design Program	State of Maryland Dept. of Natural Resources Maryland	1998					www.dnr.state.md.us/ed
Green Built, Inc.	(Greater) Grand Rapids, Michigan	2001	non-profit	Ann Dykema	(616) 281-2021	adykema@hbaggr.com	http://www.hbaggr.com
Green Built Grand Traverse	Grand Traverse Area, MI	2004	HBA	Douglas Lape	(231) 946-2305	mailbox@hbagta.com	http://www.hbagta.com/green.html
Build Green Program of Kansas City	Kansas City, MO	2002	HBA	Sarah Wolak	(816) 942-8800 x226	swolak@kchba.org	http://www.buildgreenkc.com
NJ Green Affordable Green Program	New Jersey	1998	Municipal	Darren Port	(609) 292-3931	njgreenhome@dca.state.nj.us	www.nj.gov/dca/dhcr/hsg_prog/njgreenhomes.shtm
Green Guidelines	Battery Park City, NY	2000					www.batteryparkcity.org/publications.htm

Name of Program	Location	Year Begun	Type	Contact	Phone	E-mail	Website
New Mexico Building America Partner Program	Central NM		Federal	Lindsay Chism	(505) 866-6479	ldcconsulting@msn.com	www.bapartner.com
Green Building Program	Hudson Valley HBA, NY	TBA	HBA	Margo Thompson	(301) 430-6308	mthompson@nahbrc.org	
Green Building Program	Schenectady HBA	TBA	HBA	Margo Thompson	(301) 430-6308	mthompson@nahbrc.org	
NC HealthyBuilt Homes	North Carolina	2003	Government	Dona Stankus	919-513-0307 or 800-336-2786 (in NC only)	dona_stankus@ncsu.edu	http://www.ncsc.ncsu.edu/programs/North_Carolina_HealthyBuilt_Homes_Program.cfm
G/Rated Green Building Incentive Program	Portland, OR		Municipal	Mike O'Brien (or Rob Bennett)	(503) 823-5494 or (503) 823-7725	mobrien@ci.portland.or.us	http://www.green-rated.org/
EcoBuild	Memphis, TN		Municipal	Kieth Kulow	(901) 528-4748	ecobuild@mlgw.org	http://www.mlgw.com/SubView.php?key about_ecobuild
Green Building Program	Austin, TX		Municipal	Richard Morgan	(512) 505-3709	richard.morgan@austin energy.com	www.ci.austin.tx.us/greenbuilder
Build San Antonio Green	San Antonio, TX		HBA/ Non-profit	Linda Stone	(210) 224-7278	lstone@mp4e.info or gsabagov@satx.rr.com	http://www.buildsagreen.org/
Green Building Program	Frisco, TX		Municipal	Jeff Witt	(972) 335-5540 x145	jwitt@ci.frisco.tx.us	http://www.ci.frisco.tx.us/planning/greenbuilding_index.htm
VT Building for Social Responsibility (BSR)	Vermont	2004	non-profit	Peter Schneider	(802) 658-6060 ext. 1141	pschneider@veic.org	http://www.vermontbuildsgreener.org
Green Home Choice	Arlington County, VA	May, 2003	Municipal	Stella Tarnay	703-228-4792	starnay@arlingtonva.us	http://www.co.arlington.va.us/des/epo/green.htm

Name of Program	Location	Year Begun	Type	Contact	Phone	E-mail	Website
Built Green of King and Snohomish Counties	Bellevue, WA		HBA	Robin Rogers	(800) 522-2209	rrogers@mba-ks.com	http://www.builtgreen.net/
Built Green Kitsap	Kitsap County, WA		HBA	Art Castle	(360) 479-5778	acastle@kitsaphba.com	http://www.kitsaphba.com/bbk.html
Built Green of Southwestern Washington	Clark County, WA		HBA	Mary Gould	(360) 694-0933	mary@biasw.org	http://www.builtgreennw.com/index.asp
Sustainable Building Program	City of Seattle, WA	2000	Municipal				www.cityofseattle.net/sustainable building
Tacoma-Pierce County Built Green	Tacoma, WA		non-profit	Tiffany Speir	(253) 272-2112	TSpeir@mbapierce.com	http://www.mbapierce.com
WI Green Built Home	Madison, WI		non-profit	Nathan Engstrom	(608) 280-0360	nengstrom@greenbuilthome.org	http://www.greenbuilthome.org

Appendix 3

Other Resources

Source: Coalition of Green Building Programs (CGBP)

National Programs and Organizations

U.S. Department of Energy (DOE)	Energy Star	www.energy.gov
DOE Energy Codes	Building Codes	www.energycodes.gov
DOE/Windows and Glazing Program	Efficient Windows Collaborative (EWC) (1997)	www.efficientwindows.org
DOE/Building Technologies Program(BT)	Zero Energy Home (ZEH) (2002) /Zero Net Energy (ZNE)	http://www.eere.energy.gov/
DOE & EPA	Building America Program (1995)	www.buildingamerica.gov
International Code Council (ICC)	International Residential Code/International Energy Conservation Code (IRC/IECC)	www.iccsafe.org
Environmental Protection Agency (EPA)	EPA Energy Star Label program (1992) Energy Star Windows/ Doors/Skylights (1998)	www.energystar.gov
	EPA Energy Star® Qualified New Home (1994)	www.energystar.gov/homes
	Energy Star with Indoor Air Package (TBA)	http://www.epa.gov/
Energy & Environmental Building Association (EEBA)	Houses That Work/Building America	www.eeba.org
Enterprise Community Partners/Natural Resources Defense Council	Green Communities	www.enterprisecommunity.org http://www.nrdc.org/
Masco Contractor Services	Environments for Living® Program-Diamond Class	www.eflhome.com
National Association of Homebuilders (NAHB)	Model Green Home Building Guidelines	www.nahb.org/gbg
Sustainable Buildings Industry Council (SBIC)		www.SBICouncil.org
The Green Building Initiative (GBI)	Promotes NAHB Green Guidelines	www.thegbi.com
The Alliance for Healthy Homes	Community-based capacity building and policy change to promote . healthy housing	www.afhh.org

The National Center for Healthy Housing	Develops and promotes healthy housing guidelines and training	www.centerforhealthyhousing.org
U.S. Green Building Council (USGBC)	LEED for Homes	www.usgbc.org
US Department of Energy (DOE) & EPA	Building America Program (2003)	www.buildingamerica.gov

Home Builders Association Programs

HBA of Metro Denver	Built Green™ Colorado (1995) Statewide (2000)	www.builtgreen.org
Kitsap County HBA (WA)	Build Green (1997)	www.kitsaphba.com
Maryland National Capital BIA- HBA	Building Green (1998)	www.mncbia.org
Master Builders Association of King/Snohomish Counties (WA)	Built Green™ Program (2000)	www.builtgreen.net
Master Builders Association of Pierce County (WA)	Built Green™ (2003)	http://mbapierce.com/page.php?id=42
Home & Building Association of Grand Rapids, Michigan (HBAGGR)	Green Build, Inc. (2001)	www.hbaggr.com
HBA of Grand Traverse City, MI	Green Built Program (2001)	www.hbagta.com
Building Industry Association of Hawaii	Hawaii BuiltGreen (2001)	www.bia-hawaii.com/builtgreen
New Mexico	Green Builder Program (1997) /Building America Partner Program (2001)	www.bapartner.org
HBA of Greater Kansas City (KA)	Build Green (2002)	www.buildgreenkc.com
Northern Arizona Building Association	i-BUILT Program (2003)	www.nazba.org
The Greater Houston Builders Association	GHBA Green Building Program	www.ghba.org

Regional Non-profit Organizations and Programs

Advanced Energy		www.advancedenergy.org
American Lung Association St. Paul, MN	Health House® (1993) - St. Paul MN	www.healthhouse.org Greater Atlanta HBA/Southface
Energy Institute (GA)	Earth Craft House™ (1999)	www.earthcrafthouse.com
Wisconsin Environmental Initiative	Green Built Home™ (1999)	www.greenbuilthome.org
Energy Center of Wisconsin Milwaukee, WI	Wisconsin Green Building Alliance's (WGBA)	www.wgba.org
Florida Green Building Coalition Inc. (FGBC)	Green Home Destination (2001)	www.floridagreenbuilding.org
	Florida Solar Energy Center	www.fsec.ucf.edu
North Carolina Solar Center/State Energy Office, NC Dept. of Admin.	North Carolina HealthyBuilt Homes Program (2004)	http://healthybuilthomes.org/news.cfm
Cleveland Environmental Center	Greater Cleveland Green Building Coalition (1999)	www.clevelandgbc.org
Seattle, WA	NWEBC-Northwest EcoBuilding Guild (1993)	www.ecobuilding.org
Santa Barbara, CA	Green Building Alliance	www.gballiance.com/intro.htm
Vermont Energy Investment Corp.	Vermont Builds Greener Program (2003)	www.vermontbuildsgreener.org
Massachusetts Technology Collaborative	Green Homes NorthEast (GHNE)	www.greenhomesnortheast.org
Central New Mexico	Building America Partner Program (2001) /EEBA (2003)	www.bapartner.org
State of Alaska Off. of Energy Programs/Univ. of Alaska Cooperative Extension service/ Energy Rated Homes of Alaska/Alaska State Home Builders Association	Alaska Craftsman Home Program, Inc. (ACHP) (1987)	www.alaska.net/~achp
Washington, DC/DC Habitat for Humanity	GreenHOME(1999)	www.greenhome.org
Metropolitan Partnership for Energy/Greater San Antonio Builders Assoc.(GSABA)	Build San Antonio Green (2004)	www.buildsagreen.org
San Francisco Bay Area	Build It Green	www.build-green.org

Earth Advantage™(2005)	Earth Advantage™(1999)	www.earthadvantage.com
Pittsburg, PA Non-profit	Green Building Alliance(1997)	www.gbapgh.org
Green Energy Ohio	Green Energy Ohio	www.greenenergyohio.org

Remodeling Programs

Home Builders Association of Metro Denver	Built Green Colorado (1995) Statewide(2000)	www.builtgreen.org
Kitsap County HBA (WA)	Build Green (2000)	www.kitsaphba.com
Master Builders Association of King and Snohomish Counties (WA)	The Built Green™ Program (2000)	www.builtgreen.net
City of Boulder (Co)	Green Points Remodeling Program (2001)	www.environmentalaffairs.com
Portland General Electric (OR)	Earth Advantage™(2001)	www.earthadvantage.com
Alameda County	Home Remodeling Green Building Guidelines(2001)	www.stopwaste.org
Greater Atlanta HBA (GA)	Earth Craft House™ (2003)	www.atlantahomebuilders.com
City of Scottsdale	Scottsdales GREENBUILDING Program (2003)	www.ci.scottsdale.az.us/greenbuilding
City of Seattle, WA	Green Home Remodel (2004)	www.seattle.gov/sustainablebuilding/greenhome.htm

Utility Programs

City of Austin/Austin Energy	Austin Energy's Green Building Program (Energy Star 1983)(1991)	www.ci.austin.tx.us/greenbuilder
Tucson Electric Power	TEP Guarantee Home Program (1997)	www.tucsonelectric.com
Arizona Public Service	APS Performance Built Homes™(2001)	www.aps.com/homes

Consultants

Masco Contractor Services	Environments for Living® (2001)/Diamond Class (2005)	www.eflbuilder.com
U.S. GreenFiber LLC	Engineered For Life™ (1998)	www.cocooninsulation.com
Tucson Electric Power	TEP Guarantee Home Program (1997)	www.tucsonelectric.com
ConSol, Energy Consultants		www.consol.ws
Building Science Corp.		www.buildingscience.com
Portland General Electric (OR)		www.earthadvantage.com
O'Brien & Co., Inc.	Master Builders Association of King and Snohomish Counties (WA)	www.obrienandco.com
Ibacos Inc		www.ibacos.com
Steven Winter Associates, Inc.		www.swinter.com
Affordable Comfort		http://www.affordablecomfort.org/
Quality Built™		www.qualitybuilt.com
Northwest Energy Efficiency Alliance/		Better Bricks www.betterbricks.com
The Green Builder		www.thegreenbuilder.com
Green Building Services		

Assurance Programs/Inspection/Certification

Quality Built™		www.qualitybuilt.com
SkyeTec Environmental Building Solutions	Environmental Diagnostic Services (EDS) Inc.	www.skyetec.com
Third Eye		www.thirdeyeqa.com

International Resources/Database

International Initiative for a Sustainable Built Environment	www.iiSBE.org
Sustainable Building Information System(SBIS)-Canada	www.sbis.info/
Renewable Resource Data Center (RReDC)/National Center for Photovoltaics (NCPV)	http://rredc.nrel.gov
Canada Mortgage and Housing Corporation(CMHC)	http://www.cmhc-schl.gc.ca/
Canada Green Building Council (CaGBC)	www.cagbc.ca
Canadian Office Of Energy Efficiency/R-2000 Certification	www.r2000.gc.ca
Net-Zero Energy Home Coalition	www.associations.cc/nzeh/index.html
Natural Resources Canada's Office of Energy Efficiency	http://oee.nrcan.gc.ca

Committee's/Council's/Research Groups

American Institute of Architects Committee on the Environment (COTE)	www.aia.org/cote_default
Lawrence Labs, Berkeley, CA-Building Technologies/Energy Analysis/Indoor Environment	http://eetd.lbl.gov/
Oak Ridge National Laboratory(ORNL)	www.ornl.gov
National Renewable Energy Laboratory	www.nrel.gov
Rocky Mountain Institute	www.rmi.org/
NESEA-Northeast Sustainable Energy Association	www.nesea.org
Energy Center of Wisconsin-Daylighting Collaborative	www.daylighting.org
Lighting Design Lab/Better Bricks/Northwest Energy Efficiency Alliance	www.daylightinglab.com
Lighting Research Center/Rensselaer Polytechnic Institute	www.lrc.rpi.edu/

North Carolina Daylighting Consortium (NCDLC)	www.ncsc.ncsu.edu/programs/north_carolina_daylighting_consortium.cfm
Green Design Initiative	http://gdi.ce.cmu.edu/
ADPSR-Architects/Designers/Planners for Social Responsibility	www.adpsr.org

Renewable Energy Resource

U.S. Department of Energy (DOE) www.energy.gov	Energy Efficiency and Renewable Energy	www.eere.energy.gov
U.S. Department of Energy (DOE)	Energy Efficiency and Renewable Energy-Links	http://www.eere.energy.gov/
DOE/EPA/NREL/Private Foundations	Renewable Energy Policy Project (REPP)/Center for Renewable Energy + Sustainable Technology(CREST)	www.crest.org
EnergyTrust of Oregon, Inc.	Renewable Programs	www.energytrust.org/
National Renewable Energy Laboratory		www.nrel.gov
Sandia National Laboratories		www.sandia.gov
DSIRE-Database of State Incentives for Renewable Energy		www.dsireusa.org
Renewable Energy Access	RenewableEnergyAccess.com	www.renewableenergyaccess.com
California Energy Commission	Emerging Renewables Program Rebates	www.consumerenergycenter.org/erprebate/index.html
	Renewable Energy Links	http://www.consumerenergycenter.org/renewables/index.html
	Biomass	www.energy.ca.gov/links/biomass.html
California Biomass Energy Alliance (CBEA)		www.calbiomass.org
The Geothermal Heat Pump Consortium	GeoExchange®/Geothermal State Incentives	www.geoexchange.org/incentives/incentives.htm

Center for Resource Solutions	Green-e Renewable Electricity Certification Program	http://www.green-e.org/
American Council for an Energy-Efficient Economy(ACE3)		www.aceee.org
Net-Zero Energy Home Coalition		www.associations.cc/nzeh/index.html
Midwest Renewable Energy Association		www.the-mrea.org
Florida Solar Energy Center		www.fsec.ucf.edu

Building America Teams & Partners

US Department of Energy (DOE) & EPA	Building America Program (1995)	www.buildingamerica.gov
BIRA-Building Industry Research Alliance	ConSol, Energy Consultants	www.consol.ws
Building Science Consortium	Building Science Corporation	www.buildingscience.com
CARB-Consortium for Advanced Residential Buildings	Steven Winter Associates, Inc.	www.carb-swa.com
BAIHP-Building America Industrialized Housing Partnership	Florida Solar Energy Center	www.fsec.ucf.edu/Bldg/baihp/
IBACOS-Integrated Building and Construction Solutions, Inc	IBACOS	www.ibacos.com

E-newsletters

Greener Buildings.com/National Institute of Building Sciences (NIBS)	www.greenerbuildings.com
Eco-Structure Mag.	www.eco-structure.com
Green@work Mag.	www.greenatworkmag.com
GreenClips	www.greenclips.com
Building Green-Environmental Building News	www.BuildingGreen.com

SCS Certified News	www.scscertified.com
THE NON-TOXIC TIMES, The Seventh Generation Newsletter	news@seventhgeneration.com
PATH- A Public-Private Partnership for Advancing Housing Technologies	www.pathnet.org/
Institute for Local Self-Reliance(ILSR) /The Carbohydrate Economy	www.carbohydrateeconomy.org
Solar e-Clips/The Rahus Institute	www.californiasolarcenter.org
Solarbuzz, Inc.	www.solarbuzz.com
Gypsum Today	www.gypsumtoday.com/
ACEEE's Grapevine Online-American Council for an Energy-Efficient Economy	www.aceee.org
B.I.P.E.R.-Building Industry Professionals For Environmental Responsibility /iGreenBuild.com	www.iGreenBuild.com
CRI-Carpet and Rug Institute-Newsline	www.carpet-rug.org
GreenBiz.com/National Environmental Education and Training Foundation	www.greenbiz.com
Northwest Energy Efficiency Alliance-Energy Star Lighting Program	www.lightsite.net
EcoIQ.com	www.EcoIQ.com
The Ashkin Group, LLC.-Destination Green e-newsletter	www.ashkingroup.com
CM Cleaning & Maintenance Management Online	www.cmmonline.com
TheGreenGuide	www.thegreenguide.com
Residential Architect Online	www.residentialarchitect.com
HousingZone.com's Green Building Forum	http://housingzone.com/forum-green/
Sustainable Industries Journal	www.sijournal.com

Iris Communications, Inc./Oikos	www.oikos.com
McGraw-Hill Construction Architectural Record Newsletter-WebInsider	http://archrecord.construction.com/newsletter/0508.asp
Healthy Building Network	www.healthybuilding.net