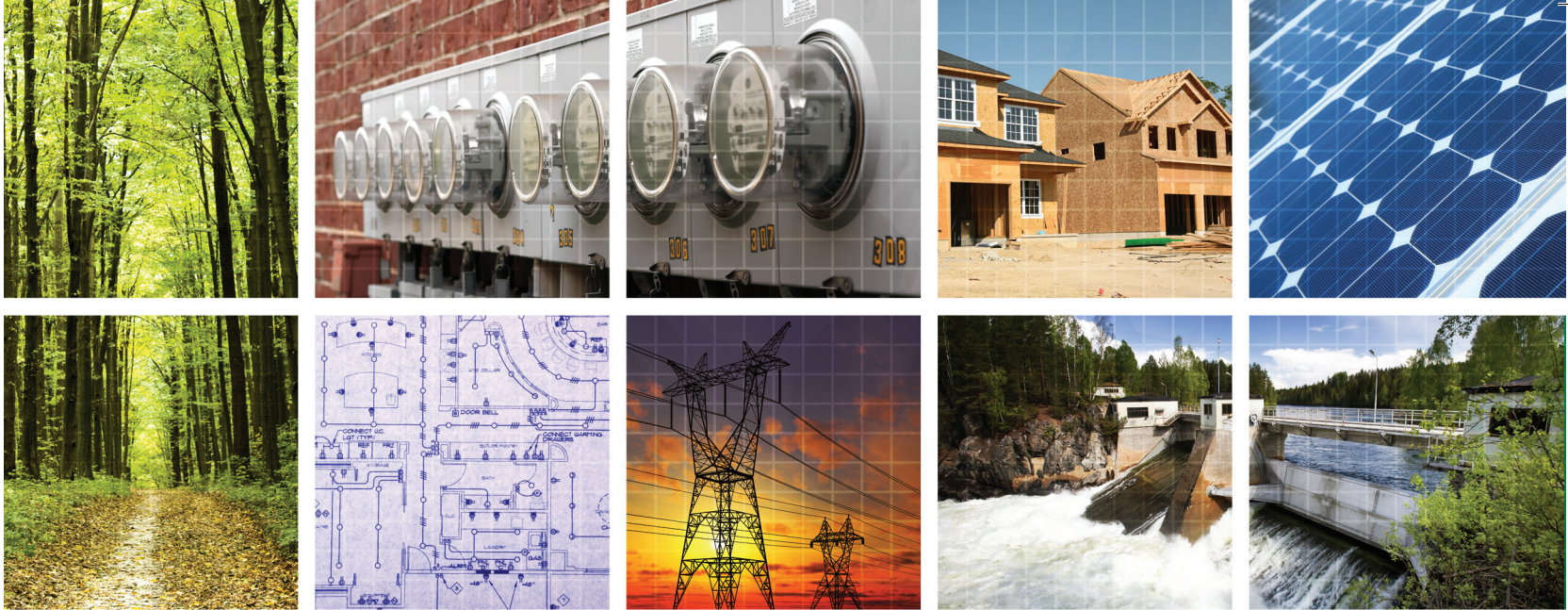




BUILDING TECHNOLOGIES PROGRAM | Green Building Codes

Going *Beyond* Code

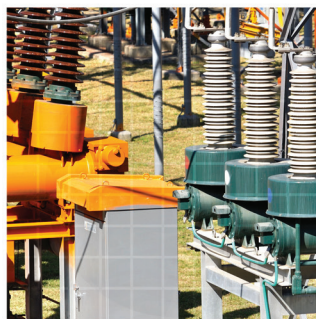
A Guide to Creating Effective Green Building Programs
for Energy Efficient and Sustainable Communities



U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy


Building Energy Codes



Preface

The *Going Beyond Code Guide* is designed to help state and local governments design and implement successful “beyond code” programs for new commercial and residential buildings. The goal is to help states and localities establish voluntary or mandatory programs that go well beyond traditional minimum code requirements for new buildings. The guide addresses keys to successful adoption and implementation and discusses the primary areas that are typically included in beyond code or green building programs, including energy efficiency materials and resource conservation, water efficiency, indoor environmental quality, and site development and land use. Detailed descriptions and analysis of actual programs are discussed, including lessons learned and best practices. States and localities can use the information on local programs, national codes and standards, and the model energy efficiency criteria for residential and commercial buildings to find the best approach for their jurisdiction to develop and implement an effective beyond code program.

The guide is based on the Southwest Energy Efficiency Project’s (SWEET’s) *Going Beyond Code, A Guide to Creating Energy Efficient and Sustainable Buildings in the Southwest* (SWEET 2008a), by Britt/Makela Group and SWEET. This guide was prepared by Building Energy Codes Program in collaboration with SWEET.

The U.S. Department of Energy’s Building Energy Codes Program is an information resource on energy codes and standards for buildings. They work with other government agencies, state and local jurisdictions, organizations who develop model codes and standards, and building industry to promote codes that will provide for energy and environmental benefits and help foster adoption and implementation of and compliance with those codes

SWEET is a public interest organization dedicated to advancing energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. SWEET provides local officials with guidance and technical assistance as part of their effort to ensure beyond code programs are cost-effective, deliver net benefits of energy and water efficiency, reduce waste, and increase the comfort of households and businesses. For more information, visit www.swenergy.org.

Acknowledgements

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1

Introduction

States and local jurisdictions across the nation have demonstrated leadership in developing programs and policies to promote green building and beyond code initiatives, more stringent building energy codes, and energy and water efficient building practices and criteria for new public and private buildings. Encouraged by the success of these “early adopters” and the national evolution of green building codes, many states, tribes, and local jurisdictions are pursuing code adoption. Many are actively developing beyond code requirements and are interested in incorporating elements of voluntary programs into mandatory codes.

Effectively implementing a beyond code program can be challenging for local governments. Challenges can include industry opposition, difficulties in deciding what programs and performance criteria to use, and conflicting agendas of those involved (elected officials, planning and development staff, permitting and code enforcement officials, and building industry stakeholders). This guide analyzes successful beyond code programs and presents information and resources to help states and local jurisdictions develop and implement effective beyond code programs.

Whether voluntary or mandatory, beyond code programs generally incorporate the six elements of construction and performance of new buildings: site selection and development, energy efficiency, water conservation, materials and resources, indoor environmental quality, and owner’s building operations manuals. **Green building practices encourage innovation and integrated design to help decrease a building’s impact on the indoor and outdoor environment** by increasing energy efficiency, conserving water, and reducing emissions and waste. Beyond code programs are centered on preserving the natural environment through innovative processes, tools, and institutions.

Green Building Codes = Beyond Code = Sustainability

Use of the terms to define codes and programs that regulate or encourage sustainable or green building is in transition. This guide uses the term “beyond code” to describe programs that exceed traditional minimum building codes, such as the *International Residential Code* (IRC), *International Building Code* (IBC), *International Mechanical Code* (IMC), the *International Energy Conservation Code* (IECC), and the standards produced by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), among others. Beyond code and green building programs regulate or encourage sustainability through siting, site development measures, water and energy conservation and efficiency, materials and resource efficiency, and indoor environmental quality. There are many terms to describe certification programs such as the U.S. Green Building Council’s (USGBC’s) Leadership in Energy and Environmental Design (LEED) rating system, locally developed green building codes and programs, or the nationally developed ANSI/ASHRAE/USGBC/IES¹ Standard 189.1-2009 (also referred to in this document as ASHRAE Standard 189.1 for brevity) or *International Green Construction Code* (IgCC). Whether the programs are voluntary or mandatory, they all go well beyond the minimum standards required under widely adopted codes and standards—hence the term “beyond code.” In the future, however, “beyond code” will likely become business-as-usual. This guide occasionally uses the term “green building code,” acknowledging this term is widely recognized.

1 IES – Illuminating Engineering Society of North America.

1.1 Purpose of this Guide

This guide helps state and local governments by:

- Providing recommendations and guidance for the successful adoption, integration, and implementation of locally and nationally developed programs
- Addressing critical issues that jurisdictions must consider when adopting or developing a green building or beyond code program
- Detailing the elements that promote sustainable development in a typical beyond code program
- Analyzing savings and cost effectiveness of green building
- Reviewing and analyzing successful beyond code programs

Jurisdictions can find creative ways to overcome these challenges by learning from the successful implementation of beyond code programs across the country. By understanding the history of beyond code programs and the direction beyond code programs are taking today, jurisdictions can explore options for adoption, compliance, verification, and enforcement.

1.2 Recommendations for State and Local Officials

The following are recommendations for jurisdictions developing beyond code programs. Each recommendation is described in more detail in Chapter 2, with supporting information and examples from programs implemented by one or more jurisdictions.

Establish Goals with Measurable Objectives. Develop clear, comprehensive goals for beyond code programs, with specific, measurable objectives. If the goal is a directive from the mayor or council, create a broad-based task force of stakeholders to develop a program to meet that goal. Establish near- and long-term milestones and a process for measuring and evaluating progress toward the milestones.

Evaluate Existing Zoning Laws and Policies. Conduct a comprehensive evaluation of existing policies, codes, and ordinances that may impact the implementation and effectiveness of a beyond code program.

Convene a “Beyond Code” Task Force. Establish an inclusive, collaborative design process involving a stakeholder task force—this has been a valuable investment for many jurisdictions. Begin with a stakeholder group that includes, at a minimum, affected government agencies and departments, local building professionals, and special interest groups. Successful programs typically include the following stakeholders in the process:

- Local elected officials
- A range of city staff representing building, planning, and other affected departments
- Building industry representatives
- Homebuilders association members
- Architects
- Trades people, home inspectors, and raters
- Utilities
- Energy or water conservation specialists, or both
- Interested community activists and representatives

Integrate the Program Across Departments. Provide training to staff to familiarize them with the local or third-party program. Staff members should be able to provide direction and support to applicants seeking third-party verification as well as assistance with local programs.

Provide Valuable Incentives for Participants. Determine which financial incentives will motivate builders in specific jurisdictions the most. Focus groups, stakeholders, and market surveys can be effective ways to assess the market. Ensure that incentives are realistic from a funding standpoint. Ideal incentives are cost effective or cost neutral to the responsible agency or have a reliable funding mechanism. Provide program participants with access to information on available third-party rebates and incentives (this can be done at little cost to the agency).

Develop and Provide Education and Outreach Materials. Provide education for the public, design and building communities. Develop a lecture series and provide program-specific training for the design-build community. The lecture series should include benefits to consumers of the program, as well as a variety of sustainability topics. Offer assistance in working through a comprehensive approach to bring the project in compliance with the program.

Conduct a Strategic Marketing and Outreach Campaign. Develop a marketing program that will educate the public on the value of homes or businesses built to the program's standards. Help provide visibility for program participants through website coverage, press releases, newspaper advertisements, or announcements on municipal websites, and signage at building sites.

Develop Strategic Partnerships. Identify and establish relations with potential partners in your community. Consider civic and professional organizations, colleges and universities, libraries, utilities, and other organizations whose goals parallel those of your program. Collaboratively identify ways in which you can work together in support of mutual goals. Develop a coordinated communications plan for education and outreach efforts.

1.3 Background

While the packaging and metrics of green building codes are new, the objectives of the codes are not. In the 1970s and into the 1980s, communities addressed energy efficiency, water conservation, and waste reduction in a variety of ways. Energy efficiency was commonly seen as a function of not just the building, but also of the building's siting, orientation, and shading, and the neighborhood layout. The 1980 era general plan for the City of Davis, California, is one such example of this approach to energy-efficient buildings. As an outgrowth of ecological awareness and conservation, communities adopted solar access requirements, allowed for solar panels and clotheslines, and discussed the heat island effect of wide roads and hardscape.

Overall, communities were taking a comprehensive approach to sustainability, designing walking and bike paths to connect residents, revising general plans to accommodate new conservation goals, and reflecting the changes in zoning ordinances.

With the advent of Title 24 in California and the national Model Energy Code (precursor to the IECC), which that was widely adopted in the 1990s, energy efficiency was codified in a new way, focusing energy conservation primarily on building energy efficiency. The IECC and ASHRAE Standard 90.1 have been effective in transforming building energy efficiency, but conservation and sustainability outside the building shell have become secondary priorities in many communities.

Today, that trend is reversing itself, and beyond code programs are growing substantially. Over the last 20 years, states and jurisdictions have invested extensive time and energy developing local beyond code programs or "green building programs." Hallmark examples include Austin, Texas, Scottsdale, Arizona, and Boulder, Colorado. The comprehensive description of programs in Southwest Energy Efficiency Project's

(SWEET's) *Going Beyond Code: A Guide to Creating Energy Efficient and Sustainable Buildings in the Southwest* (SWEET 2008) illustrates the scope of locally developed programs.

In the mid to late 2000s, states and jurisdictions began turning to the USGBC's LEED as an alternative to developing a local program; Rohnert Park, California, and Chandler, Arizona, were two of the first jurisdictions to do so. On the East Coast, jurisdictions in New York began requiring ENERGY STAR for New Homes (ES) to raise awareness for and participate in energy efficiency. By 2009, over 300 programs from across the nation were documented, and national code organizations were working on the development of codified programs (BCAP 2009).

As of September 2011, the International Code Council (ICC) and ASHRAE have released three national codes:

1. ICC 700-2008, *National Green Building Standard*, a residential beyond-code program
2. Public Version 2 of IgCC (final version available in early 2012)
3. ASHRAE Standard 189.1, *Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings*

1.3.1 The Movement Toward Adoption of Regional and National Beyond Code Programs

As regional and national beyond code programs become more available, jurisdictions have another tool to guide less impactful, more sustainable construction and development. Regional and national codes provide peer-reviewed, nationally vetted documents that save jurisdictions the time and effort of developing and maintaining codes locally.

Regional codes have been used extensively throughout California and the Mid-Atlantic region. The GreenPoint Rated system, a program of Build it Green, has been used extensively throughout California, with varying levels of certification, selected by the jurisdiction. EarthCraft House (a product of Southface Energy) is used from Virginia to Georgia. Both programs are third-party verified and maintained by nonprofit organizations.

The first national comprehensive residential beyond code program was ICC 700, which provides the benefits of a comprehensive program that is maintained by the National Association of Homebuilders. Not written in codified language, it can still be adopted by ordinance just as ES has been adopted in New York municipalities.

Other national codes include the IgCC and ASHRAE 189.1. Unlike ICC 700, these codes are enforceable and are intended to be codified at the local level. The draft IgCC has been adopted by less than half a dozen jurisdictions as of September 2011. Prior to these standards, voluntary third-party green building rating systems, such as LEED, were the accepted strategy for implementing green building standards, and many federal agencies have adopted varying levels of LEED certification to assist in meeting federal requirements. Recently, the U.S. Army adopted ASHRAE 189.1, in addition to LEED certification, to meet sustainability requirements (DoD 2010).

1.4 Complying with Beyond Code Programs

Determining a way to verify compliance is key for a jurisdiction adopting a green code or beyond code program. Methods vary depending on the type of program and available staffing. When adherence to a third-party program (such as ES or LEED) is mandatory, jurisdictions often require verification of compliance. Jurisdictions must also address requirements for documenting compliance.

Enforcement is a key concern for beyond code programs, especially for multi-faceted programs that address issues like site suitability and water. Such programs make issues that typically don't involve building departments part of the building codes. One solution is the Sustainable Development Index, or similar use of zoning and other community measures, coupled with more stringent energy codes. With this tool, the planning department, among others, assesses development and the appropriateness of elements not directly related to the building department, freeing the building department staff to focus on construction issues.

Cities such as Chandler, Arizona, and Eagle County, Colorado, have recognized the need to address sustainability in the planning and developing process, which in turn can reduce compliance issues with beyond code programs. More recently, U.S. Environmental Protection Agency (EPA) Region 4 addressed sustainability by developing a Sustainable Design Assessment Toolkit (EPA 2010) that helps communities identify barriers to sustainable design within the permitting process. The toolkit addresses the principles that could affect the design, construction, renovation, operation, and maintenance of a building and its immediate site.²The toolkit offers two components: (1) an assessment tool and (2) a resource guide. EPA Region 3 has developed a similar program, and there are a number of non-profit organizations, such as Smart Growth, available to assist municipalities.

1.4.1 The Relationship Between Beyond Code Programs and the Baseline Energy Codes

Designers, builders, plan reviewers, inspection staff, and interested parties need to thoroughly understand the underlying baseline energy code when working with a beyond code program.

Most beyond code programs use the IECC or ASHRAE 90.1, or both, as an energy baseline, with additional requirements beyond that. Jurisdictions are both mandating these programs and offering incentives for voluntary compliance. The scope of these programs varies widely, from a simple requirement to comply 10% above the current IECC to comprehensive third-party green building certification programs such as LEED or adoption of the IgCC.

Beyond code programs improve efficiency in the residential and commercial building marketplace. Over time, such improvements become typical practice and are often submitted to the ICC or ASHRAE as a code change proposal. For example, high-efficacy lighting systems for residential homes have been included in incentive programs for some time and are now required in the IECC. Another example is the New Building Institute's (NBI's) *Core Performance Guide* (NBI 2007), which was codified and submitted as a proposed code change to increase the efficiency of commercial buildings (ICC 2009a).

² EPA recognizes the importance of not just "how" buildings are constructed, but also "where" they are constructed. There are companion resources to the toolkit that can help communities ensure that they are implementing smart growth or quality growth concepts. For more information on Smart Growth and its many benefits, see www.epa.gov/smartgrowth/. Also see the Essential Smart Growth Fixes for Urban and Suburban Zoning Codes Information on how to address zoning code barriers to more sustainable development practices: www.epa.gov/dced/essential_fixes.htm.

1.5 How to Use the Guide

This guide is a resource for states, tribes, local jurisdictions, and other organizations interested in developing and implementing beyond code programs. It can also help jurisdictions with updating or revising existing programs. The guide provides detailed information on many beyond code programs, with analysis and recommendations for program design, implementation, and review and evaluation.

This guide is organized around program implementation stages and includes several types of information, from broad policy guidance to specific energy efficiency programs and sample ordinances. This information is presented in chapters as follows.

Chapter 2 – Keys to Successful Beyond Code Programs: Adoption and Implementation Strategies: Details the strategies for successful program design and implementation.

Chapter 3 – Critical Issues: Explores the important issues jurisdictions must consider when selecting or developing a beyond code program. These critical issues include the decision to create a locally developed program or adopt a national or regional program, implementation strategies, building size requirements, and the choice to make the program voluntary or mandatory.

Chapter 4 – Elements of Beyond Code Programs: Details the types of measures jurisdictions use to increase energy efficiency, conserve water, promote sustainable development, and reduce waste. Elements include site selection and development, energy efficiency, water conservation, materials and resources, indoor air quality or environment, and owner's building operations manuals.

Chapter 5 – Benefits, Savings, and Cost Effectiveness: Analyzes the cost effectiveness of building highly efficient new homes and commercial buildings and examines the savings associated with energy and water efficiency, materials conservation and waste avoidance, and indoor environmental quality.

Chapter 6 – Resources: Provides a listing of resources for states and jurisdictions working with beyond code program.

The appendices include a list of acronyms, summaries of beyond code programs, and contact information by jurisdiction; model ordinances and checklists from communities that have adopted beyond code programs; and other documents that can help jurisdictions develop or update their beyond code programs.

2

Keys to Successful Beyond Code Programs: Adoption and Implementation Strategies

The first step in creating an effective beyond code program is adopting a set of strategies that is most likely to support successful program design and implementation. Based on a review of both long-standing and newly adopted programs, strategies that are most likely to lead to successful programs include:

- Establish clear goals, with specific, measurable objectives
- Implement community-wide assessment and planning
- Involve stakeholders in the decision-making process
- Implement the program using an integrated approach, with sufficient staffing
- Build in incentives to participate
- Establish structures and systems for effective partnerships, communication, and education

Together, these strategies help voluntary, mandatory, nationally, and locally developed programs create a more sustainable community.

2.1 Establish Clear Goals with Specific, Measurable Objectives

The most effective beyond code programs have been developed in response to **clearly articulated state or local goals with specific, measurable objectives**. The goal-setting process is often integral to program success; that is, programs that have clear policy direction from the mayor, city council, or county commissioners are more likely to succeed than programs that do not.

Goals usually are established by elected officials with additional support from municipal departments, such as planning and building. In some cases, jurisdictions will create a task force as part of the process to gain consensus on goals. Goals developed by the task force are presented to the council, or other decision-making body, for approval. Once program goals are established, local ordinances are issued to codify the goals and to offer a timeline and guidelines for accomplishing objectives.

2.1.1 Example: City of Dallas Green Building Program

The City of Dallas initiated a green building program as part of a strategy to attain the Dallas Green Building Task Force's vision that *"Dallas is Carbon Neutral by 2030 and is the Greenest City in the US."* The Dallas green building program is intended to improve air quality, reduce water use, and improve transportation and land use through green building strategies. The Green Building Task Force recommended a two-phase

implementation strategy for green building program requirements for all private developments and developed specific, quantifiable goals for each phase.

Phase I (adopted October 1, 2009):

Implement energy efficiency and water conservation requirements for all residential and commercial developments. Specific objectives include:

- Achieve a 7% reduction in greenhouse gas emissions from 1990 levels by 2012
- Require that all new homes are built 15% more efficient than code and meet 4 of 6 water efficiency strategies
- Commercial buildings less than 50,000 square feet must be 15% more efficient than code, while those greater than 50,000 square feet must meet 85% of LEED requirements

Phase II (beginning October 1, 2011):

Expand initiatives for new buildings into a comprehensive green building standard requirement. Specific objectives include:

- All commercial buildings must be LEED certifiable, with minimum of three Energy and Atmosphere points (17.5% better than code).
- All new homes must meet LEED for Homes or the Green Built North Texas Standard

The Green Building Task Force detailed the steps needed to achieve the goals of increased efficiency as a way to measure success. In April 2008, the city council approved an ordinance adopting the goals and subsequent green building program for all new homes and commercial buildings constructed in the city. Phase I of the Green Building Ordinance³ went into effect on October 1, 2009; with Amendment 27759⁴ (effective December 7, 2009); Phase II remains scheduled for October 2011.

2.1.2 Recommendation

Develop clear, comprehensive goals for beyond code programs, with specific, measurable objectives. If the goal is a directive from the mayor or council, create a broad-based task force of stakeholders to develop a program to meet that goal. Establish near- and long-term milestones and a process for measuring and evaluating progress toward the milestones.

The most effective beyond code programs have been developed in response to **clearly articulated state or local goals with specific, measurable objectives**. For more information on the city of Dallas' goals visit http://www.greendallas.net/pdfs/Green_Building_Ordinance.pdf

³ http://www.greendallas.net/pdfs/Green_Building_Ordinance.pdf

⁴ http://www.greendallas.net/pdfs/Green_Building_Ordinance_Amend27759.pdf

2.2 Community-Wide Assessment and Planning

Before embarking on a new program, municipalities must first evaluate existing zoning laws and other regulations for conflicts. For example, prohibitions on solar panels, solar water heating, graywater reuse, clotheslines, and rainwater capture may interfere with successful program implementation. More flexible parking requirements may be needed for both residential and commercial properties. Requirements for high water demand landscaping should be evaluated, along with any other municipal requirements that are contrary to the community's sustainability goals.

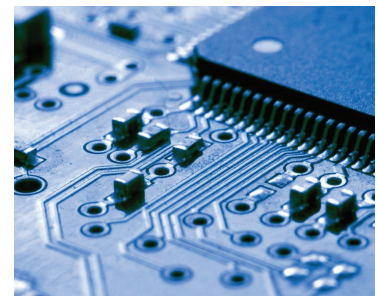
Key questions to consider are identified in *Developing Green Building Programs, A Step-by-Step Guide for Local Governments* (Global Green USA 2008):

- What general policies already support or are complementary to green building?
- What ordinances and regulations relate to green building?
- What programs are provided by other utilities or regional agencies?
- Where are the gaps?

The guide highlights the City of Pasadena's experience in regulatory evaluation, evaluating their zoning regulations and providing useful illustration for any jurisdiction embarking on this effort.

EPA's *Sustainable Design and Green Building Toolkit for Local Governments* (EPA 2010) provides further guidance, addressing the local codes or ordinances that affect the design, construction, renovation, and operation and maintenance of a building and its immediate site. Included are an assessment tool, a resource guide, and a guide to developing an action plan for implementing changes to the permitting process. In Section 1, Sustainable Design Permitting Assessment Tool and Resource Guide, the guide suggests questions for the initial assessment and ongoing effectiveness of any program:

- Have the most recent model codes/ordinances been adopted? Which ones (list the most common)?
- If model codes/ordinances are in place, are they enforced?
- If model codes/ordinances are not in place, are the existing codes/ordinances highly prescriptive or is there room, or requirement, for interpretation?
- If there is room for interpretation, is there a policy that supports and defines parameters for interpretation?
- Is there periodic review of codes/ordinances? If so, by whom?



Resources:
The Environmental Protection Agency's Sustainable Design and Green Building Toolkit for Local Governments
Global Green USA's Developing Green Building Programs: A Step-by-Step Guide for Local Governments

- Is there a clear process for variances? Who has the authority to grant variances, and is the granting of a variance a rare or common activity?

2.2.1 Recommendation

Conduct a comprehensive evaluation of existing policies, codes, and ordinances that may impact the implementation and effectiveness of a beyond code program.

2.3 Stakeholders and the Decision-Making Process



Effective beyond code programs reflect the values and desires of the communities they serve. The involvement of key stakeholders in collaborative program development and adoption promotes broad acceptance of the program and successful implementation of program objectives. The most successful programs encourage all interested parties to participate in drafting the program. This allows the stakeholders to work toward consensus and together recommend a plan of action to the decision makers.

Stakeholder involvement in the design process serves four critical purposes: (1) stakeholders serve as advocates for a strong program from their perspective; (2) a strong collaborative process protects the integrity of the program; (3) an inclusive process builds lasting consensus and a broader base of support; and (4) stakeholders can provide valuable insight into the viability of programs. The lack of one or more stakeholder groups inevitably leads to weakness in multiple areas, reduces the likelihood of broad acceptance, and can lead to unnecessary challenges or resistance to program implementation.

Consensus among stakeholders results in advocates for the program.

The Denver Metro Regional Green Building project illustrates an effective stakeholder process. During 2008, SWEEP held stakeholder meetings in Colorado to determine if there was interest in regional collaboration for a green building program. With funding from the Colorado Governor's Energy Office, SWEEP coordinated an effort to develop the regional standards for green building programs in the Denver metropolitan area. At that time, jurisdictions in the Denver Metro area were using a variety of locally developed programs and no nationally recognized program or standard had been developed, with the exception of LEED. It was initially anticipated that the outcome would be a regional program, based on a local program, and implemented fairly consistently across jurisdictions. During 2010, building officials, planners, trade associations, architects, builders, and state energy office staff convened as a Regional Task Force for Green Building to develop the standards. The stakeholders represented a mix of jurisdictions, including Boulder, with a long history of green building codes. The group identified two goals:

1. To agree on a national standard as the foundation for the program.
2. To develop a voluntary program that is flexible to support the needs of each local community.

The following sections provide the group's recommendations.

- Recommended Commercial Program: IgCC incorporating by reference ASHRAE Standard 189.1; Alternative Compliance Path: LEED
- Recommended Residential Programs: Prerequisite: ES 3.0 Recommended Residential Program: ICC 700/ National Association of Homebuilders (NAHB) National Green Building Standard (NGBS); Alternative Compliance Path: LEED for Homes

Perhaps the most significant impact of the broad stakeholder group was the realization that within the Denver Metro area there were significant differences in existing codes adopted and enforced, and differing levels of commitment and readiness for a green building program. Thus, the outcome of the stakeholder group also included recommended milestones, providing a stepped approach to implementing a comprehensive green building program. **The final outcome was more impactful for each of the jurisdictions than if the original working group would have developed the regional green building program without broadening the scope of participants.** A stakeholder group has a greater chance for success if it has clear directives, firm working agreements, and a skillfully facilitated process.

2.3.1 Recommendation

Establish an inclusive, collaborative design process involving a stakeholder task force—this has been a valuable investment for many jurisdictions. Begin with a stakeholder group that includes, at a minimum, affected government agencies and departments, local building professionals, and special interest groups. Successful programs typically include the following stakeholders in the process:

- Local elected officials
- A range of city staff representing building, planning, and other affected departments
- Building industry representatives
- Homebuilders association members
- Architects
- Tradespeople, home inspectors, and raters
- Utilities
- Energy or water conservation specialists, or both
- Interested community activists and representatives

2.4 Implementation and Integration

Whether adopting a national standard or developing a voluntary or mandatory local program, building and planning departments face the challenge of implementing a new program. Ideally, those responsible for program implementation also have participated in program development, as involvement in both can increase the sense of ownership of the program.

Building and planning department staff face different integration and implementation challenges, depending on whether the program supports the standards of a national or verifiable third-party program (ES, LEED, etc.) or is based on a locally developed checklist.

2.4.1 Implementation of a Third-Party Program

Requiring the use of third-party verified standards in building construction allows jurisdictions to focus on enforcing the basic building code. The burden of certification is on the builder, who must typically hire a qualified verifier, such as a Home Energy Rating Systems (HERS) rater, an ES provider, or LEED Accredited Professional (AP), to perform plan reviews and inspection services. While this alleviates the cost and inspection burden on local staff, many staff members are obtaining third-party accreditations in an effort to more effectively communicate the accomplishments and requirements, and to ensure consistent inspection quality.

Many jurisdictions throughout the U.S. have incorporated third parties into their beyond code programs. Palo Alto, California, for example, has mandated third-party certification for new construction. Commercial buildings fall under the new CALGreen with local amendments. Residential homes (three stories or less) must comply with the minimum energy prerequisites of the GreenPoint Rated program. Residential high rises (four stories or more) must demonstrate that the amount of energy used complies with 2009 GreenPoint Rated guidelines. As of January 1, 2011, HERS ratings are required for all multi-family renovations prior to attaining a building permit (Palo Alto 2011).

2.4.2 Implementation of a Locally-Developed Checklist Program

Programs developed locally that incorporate a customized checklist require local staff to be more involved in plan review and inspection. Generally, checklists are submitted during the plan review phase to demonstrate which building components are being complied with. Checklists must also be verified along with standard building code requirements in the plan review, permitting, and inspection processes. Some jurisdictions use paper copies of checklists, while others allow spreadsheets or electronic submittals.

Hayward, California, for example, has incorporated the use of a locally developed checklist into the city's private development green building ordinance. All applicants for new commercial buildings must submit this checklist with the permit application, including details on the inclusion of each checklist item in the project. Once the application is approved by city staff, a certificate of occupancy is issued that states the project complies with the city's beyond code program and includes all items on the local checklist. Appendix B includes a sample checklist from the City of Hayward.

2.4.2.1 Recommendations

Provide training to staff to familiarize them with the local or third-party program. Staff members should be able to provide direction and support to applicants seeking third-party verification as well as assistance with local programs.

2.5 Incentives

Beyond code programs often include incentives to increase participation and compliance. An incentive's effectiveness depends on what is most valuable to builders in each locality. Effective incentives save builders time and/or money, build capacity through training or design assistance, or add value to a business through subsidized marketing.

2.5.1 Saving Time: Expedited Permitting

In jurisdictions that have permitting times perceived as lengthy, expedited permitting can be an attractive incentive for participants in voluntary programs. Expedited permitting not only saves time, but speeds up project completion as well, which can increase the payback in investment in the project. Jurisdictions across the country offer expedited permitting, including Scottsdale, Arizona; Ashland, Oregon; Pima County, Arizona; Albuquerque, New Mexico; Charlotte County, Florida; and Las Vegas, Nevada.

Participants in Scottsdale's program are put on the "fast track" for plan review. Similarly, all applicants seeking LEED certification in Ashland, Oregon, receive priority plan checks. Pima County strives to complete green



To speed up the issuance of building permits, Whatcom County has developed a new expedited permit process that offers over the counter permits for waterless urinals, roof mounted PV solar panels, geothermal mechanical installations, solar water heating systems, and Energy Challenge projects. <http://sustainableconnections.org/greenbuilding/green-building-policy>.

building plan reviews in three days. Albuquerque's Green Path program promises a 50% reduction in plan review time (from eight weeks to four) as well as other special services. Participants are steered toward a dedicated Green Path counter with a shorter line, expedited plan review, and assurances that participating buildings will receive high profile recognition.

In some jurisdictions, plans must receive certain certifications to be eligible for priority plan reviews. This is the case in Fairfax, Virginia, where commercial buildings must be designed to achieve, at a minimum, LEED Silver, while residential homes must be designed to achieve, at a minimum, LEED Homes Silver, NGBS Silver, Earthcraft select status, or Green Globes (three to five green globes).

All residential and commercial buildings in Charlotte County, Florida, can be considered for the green building program and must meet the standards of LEED, the Florida Green Building Commission, Green Building Initiative, or the NAHB Green Building Program. Incentives include fast track permitting, possible parking and floor-area-ratio (FAR) reduction, and county marketing incentives including press releases, green building signage, and recognition awards.

2.5.2 Saving Money: Financial Incentives

Several types of financial incentives are currently in use in beyond code programs. Financial incentives can be in the form of fee reimbursements, property or income tax credit, or utility rate reductions, among others.

- Certification Fee Reimbursement:** Green buildings achieving LEED certification in the City of Columbus, Ohio, are eligible for LEED reimbursement ranging from a minimum of the certification fee to a maximum of three times the certification fee. All eligible projects must receive certification from the USGBC and credit for at least eight of twelve essential LEED credits designated by the city. The funds for certification reimbursement are available through the Green Columbus Fund, a \$1 million grant program to encourage green building and brownfield redevelopment. The City of Chandler, Arizona, offers reimbursement of LEED certification fees, ranging from 50% reimbursement for LEED certification to 100% reimbursement for LEED Platinum buildings. The city uses excess funds from another budget item to enable certification reimbursement.
- Property Tax Relief.** Virginia Beach offers property tax relief as an incentive for complying with the energy code requirements. This incentive applies to both residential and commercial projects and requires that the property owner prove that a home or building is at least 30% more efficient than the current state energy code. If a home or building is certified as 30% more efficient by an architect or engineer, the owner gets a 15-cent reduction in property taxes per \$100 of assessed value each year the incentive is offered. Likewise, The Green Building Tax Credit in Carroll, Maryland, provides a 25% tax credit for new buildings that achieve LEED

The City of Telluride, Colorado has created an Energy Mitigation Program that requires residents to offset the impact of excessive exterior energy use by either utilizing an on-site renewable energy source or making a payment in-lieu. The program requires mitigation for heated garages, snow melt systems, pools, spas, and larger homes. <http://www.telluride-co.gov/Modules/ShowDocument.aspx?documentid=2036>

Silver certification, a 50% tax credit for new buildings that achieve LEED Gold, and a 75% tax credit for new buildings that achieve LEED Platinum for five consecutive years.

- **Income Tax Credit.** New Mexico provides an income tax credit based on square footage and the level of LEED certification achieved by commercial or residential projects. The credit requires third-party verification and applies to all buildings that incorporate elements of LEED or Build Green New Mexico.
- **Utility Rate Reduction.** Reduced utility rates based on energy consumption are an incentive for many small business owners in Alabama. Beginning June 2011, businesses that use less than 20,000 kWh qualify for the lowest business rate available and businesses that utilize unused storefronts are eligible for a 15% monthly discount with a 1-year service agreement. In addition, businesses that increase the number of employees and increase power usage will receive a 24-month rate reduction, 10% the first year and 5% the second with a 1-year service agreement.
- **Greater Access to Rebates, Grants, Other Financial Incentives.** Many cities and states work extensively to promote and coordinate city- or state-sponsored incentives and grant programs for green building projects. New York, for example, offers incentives to projects that meet the requirements of the NYSERDA Green Residential Building Program (GRBP). Incentives range from \$5,125 for a single-family home up to \$13,375 for an 11-unit multi-family building. Details are provided below. Similarly, Eagle County, Colorado, offers property owners fixed-rate loans for energy improvements, such as replacement of inefficient windows and installation of solar energy systems, with the Energy Smart Program. Property owners can apply for a 15-year loan of up to \$30,000 at an interest rate of 6%. The incentive is intended to increase the use of residential sustainable building practices and to benefit the economy by creating employment opportunities for contractors focused on energy efficiency upgrades (Eagle County 2011).

New York Green Residential Building Program Incentive Summary:

Financial incentives are offered to projects that meet the requirements of the New York State Energy Research and Development Authority's Green Residential Building Program. Incentives are awarded based on the number of dwelling units and range from \$5,125 for a single-family home up to \$13,375 for an 11-unit multi-family building. Incentives are available until October 31, 2013, or until funds are no longer available.

To be eligible for the program, a residential building must:

- Have at least one dwelling unit, but less than 12.
- Be built or permanently sited in New York State.
- Receive a certificate of occupancy for a newly constructed building, or certificate of completion on or after January 1, 2010, but before October 31, 2013.
- If a substantially renovated project, the building owner must show that insulation and air-sealing measures have been completed (as shown by a completed ENERGY STAR Thermal Bypass Inspection checklist) and that two of three major building systems have been replaced and upgraded (plumbing, electrical, or HVAC).

In addition, the owner must demonstrate that the project meets the requirements of the GRBP, including:

- A Silver level certification or higher using the National Green Building Standard, LEED for Homes, or LEED for New Construction.
- A combination of installed energy-efficient lighting and appliances that will achieve at least 500 kWh of annual electric saving per dwelling unit.
- Verification that all combustion appliances have been tested for operational safety.
- Low-rise (three stories or fewer) residential buildings with four or fewer dwelling units must also meet additional energy efficiency and performance requirements, including a HERS score of 86 or higher and others listed in the program guidelines.

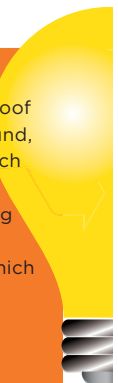
Source: <http://www.getenergysmart.org/GreenBuilding.aspx>

- **Combination “Carrot and Stick” Approach.** In Eagle County, Colorado, projects that exceed the minimum requirements receive fee reimbursements, rebates, and other financial incentives, while those that do not gain enough points pay a penalty. Unique to mandatory programs in the southwest, Eagle County charges a fee to projects that fall short of the prescribed number of points, in both the residential and commercial sectors. According to Adam Palmer, the ECO-build Specialist with Eagle County, the combination of incentives and in-lieu fees is working well. Although most applicants revise their applications to avoid paying the fees, the fees paid have thus far balanced out the reimbursement costs for projects that exceed minimum requirements. Similarly, in several counties or jurisdictions, builders or developers are required to post a bond, generally determined by the square footage of the project, which is returned once the building achieves compliance with the energy code requirements. For example, as part of the Arlington County Green Building program, the county established a Green Building Fund to encourage builders to attain a LEED certification. While the green program is not mandatory, builders that do not commit to achieving a LEED rating contribute to the fund at a rate of \$0.045 per square foot. The calculation is based on the fees assessed by the USGBC for registration and evaluation of a formal LEED application. Furthermore, since a LEED certification relies on the performance after a building is

occupied, developers must post a bond or letter of credit to ensure the building is compliant before a certificate of occupancy is issued. If a project receives LEED certification, the fund contribution is refunded in full. If three LEED points are missed, 50% of the bond is forfeited to the county. If four or more points are missed, the entirety of the bond is forfeited to the county. The Green Building Fund is used by Arlington County to provide education and outreach to developers and the community on green building issues.

The Arlington, Virginia, Green Building Fund was established to encourage builders to commit to obtaining LEED certification. Builders who do not commit to a LEED rating contribute to the fund at a rate of \$0.045 per square foot, a rate based on the registration and evaluation of a typical LEED application. For builders that do commit to a LEED rating, a certificate of occupancy will only be issued upon receipt of a bond or letter of credit covering the total fee. If the project receives LEED certification, the fund contribution is refunded to the builder. If three LEED points are missed, the builder only receives 50% of the fund contribution. Four or more missed LEED points leads to a complete forfeiture of the fund contribution to the county. The Green Building Fund is used as a resource for green building education for developers and the greater community.

- **Permit Variances.** Energy code compliance or compliance with beyond code programs can increase a building's allowable FAR or unit density. Greater FAR values allow builders to increase a project's size in relation to its location. For example, the City of Seattle, Washington offers a density bonus to provide greater heights and/or greater floor area for commercial and residential buildings for projects that meet or exceed LEED Silver certification. Similarly, an additional market-rate dwelling unit is offered as a density bonus in Bar Harbor, Maine for construction projects in which all dwelling units meet LEED standards. This bonus applies to projects within a planned unit development, and compliance is determined by either application or by affidavit for adherence during construction. Many other cities across the nation offer FAR incentives, including Nashville, Tennessee; Arlington, Virginia; Bloomington, Minnesota; and Charlotte County, Florida.



Chicago, Illinois offers a Green Roof Improvement Fund, a 50-percent grant match for the cost of placing a green roof on an existing building, and the Green Roof Grant Program, which awards \$5,000 grants for green roof projects on residential and small commercial projects. Chicago's Cool Roofs Grant Program provides up to \$6,000 to residents and small business owners to install roofs that meet or exceed the cool roof standards of the Chicago Energy Conservation Code. <http://www.sustainable-chicago.com/2008/04/23/green-building-and-climate-in-chicago/>

Greater access to resources and support: Chicago Green Homes Program

The Chicago Green Homes Program (CGHP) is a voluntary program available to Chicago residential developers, builders and homeowners.

The program offers residential projects a flexible framework for incorporating green building design practices into residential design and construction. Program participants not only receive expedited permitting and discounted consultant fees, but greater access to resources and comprehensive support as well.

Expedited Permits: Homes participating in the program have an expedited permitting goal of less than 30 days through the Chicago Green Permit Program. Participants are also eligible for a partial permit fee waiver up to \$25,000 and discounted consultation fees as well.

Access to Resources: CGHP participants are encouraged to work with green building professionals. The CGHP also promotes the sharing of ideas and best practices.

Comprehensive Support: Participants receive assistance from all entities involved with green building, including city department support and CGHP organization help, as well as access to the Chicago Center for Green Technology's Green Building Resource Center.

Source: http://www.cityofchicago.org/city/en/depts/doi/supp_info/chicago_green_homesprogramoverview.html

2.5.2.1 Recommendation

Determine which financial incentives will motivate builders in specific jurisdictions the most. Focus groups, stakeholder processes, and market surveys can be effective ways to assess the market. Ensure that incentives are realistic from a funding standpoint. Ideal incentives are cost effective or cost neutral to the responsible agency or have a reliable funding mechanism. Provide program participants with access to information on available third-party rebates and incentives (this can be done at little cost to the agency).

Financial Incentives: Eagle County ECObuild, Colorado

Eagle County's ECObuild program is a unique mandatory residential and commercial program that offers financial incentives. Like many other programs, it is comprehensive and points-based. Unlike others, the county charges a fee to projects in both the residential and commercial sector that fall short of the prescribed number of points.

Implementation Agency: Building Department

Voluntary vs. Mandatory: Mandatory

Types of Buildings:

Residential – all new single family homes, duplexes, and townhouses; additions/reconstruction over 50% of floor area; and certain snowmelt projects, spas and pools.

Commercial – all new non-residential, mixed use, and/or multi-family construction; additions/reconstruction over 50% of floor area, and certain snowmelt projects, spas and pools.

Size of Buildings:

Square footage of residential project determines number of points required and potential costs of in-lieu fees. Size does not impact commercial compliance.

Incentives and Fees:

Cash rebates up to \$5,000 are offered for residential projects that exceed the number of points required. The cash-in-lieu fee is calculated as **(Project Square Footage x Number of Points Short x \$10)/Number of Points Required**. Funds collected from in-lieu fees are deposited in a separate Renewables and Efficiency Fund, which offers financial incentives for energy efficiency and renewable power installation in Eagle County.

Commercial projects of any size are required to attain a minimum of 70 points. Projects exceeding 100 points receive rebates on building permit fees up to \$5,000. The cash in-lieu fee is calculated as **Project Square Footage x Number of Points Short x \$0.15**.

Program Elements Included:

Site/Water Conservation, Recycling and Reuse, Framing and Materials, Energy, Renewable Energy, Indoor Air Quality, and Innovation.

Documenting and Verifying Compliance:

ECObuild checklist is submitted with the building permit application, points are verified by building staff and ECObuild specialist, upon approval the building permit is released, appropriate documents are prepared for the inspection/plan review, points total/rebate/in-lieu fee determined.

Enforcement:

The elements of the ECObuild checklist are enforced as part of the permitting process. The rebate offer and potential for in-lieu-fees spur discussion, adjustments to plans, and assist in compliance.

2.5.3 Education

Most jurisdictions offer a variety of educational opportunities, ranging from design assistance in the permitting process to workshops and seminars. For example, participants in the City of Scottsdale's green building program and members of the community can attend green building-related lectures throughout the year. The monthly lectures cover a variety of topics, including energy efficient technologies, successful water harvesting, and strategies for improving indoor air quality. A copy of Scottsdale's 2011-2012 lecture series is included in Appendix C. As another example, New York has implemented a mandatory 15-hour builder-training requirement for New York State Energy Research and Development Authority's Green Residential Building Program. Builders may fulfill the requirement by receiving green building credits from an accredited educational institution or by participating in green building training from a professional builders association, such as NAHB, the National Association of the Remodeling Industry, and the Building Performance Institute.

Several cities provide participants with online resources to help ensure compliance with program requirements. Seattle Online Coaching, for example, is an interactive tool for builders and designers constructing single-family homes in the Seattle area. Seattle Online Coaching provides guidance for compliance with the Seattle residential code in an easy to follow format that generally takes no more than 30 minutes.

2.5.3.1 Recommendation

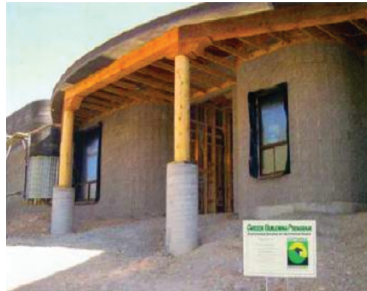
Provide education for the public, design and building communities. Develop a lecture series and provide program-specific training for the design-build community. The lecture series should include benefits to consumers of the program, as well as a variety of sustainability topics. Offer assistance in working through a comprehensive approach to bring the project in compliance with the program.

2.5.4 Marketing

“Developers indicated that they wanted support in helping them create a market preference for green buildings. **”**

Seattle Green Building
Communications Plan

A variety of jurisdictions use marketing techniques as an incentive for going beyond code. Publicity increases consumer awareness, creates a market for green building, and ultimately transforms development patterns and methods. Effective marketing efforts by jurisdictions and builders educate the public about the benefits of the program and create a stronger market for green-built homes. Jurisdictions can raise the profile of green building by publicly applauding the efforts of beyond code builders through strategies such as a print ad in a local newspaper or business publication, a press release on local television or radio stations, a ribbon cutting with the mayor, prominent signage, or subsidized marketing through city or county web sites.



Meeting the requirements of the Scottsdale Green Building Program, Desert Sky Development uses the Integra Wall System in this Scottsdale mountain home. Desert Sky Development offers their custom home clients the choice of masonry or traditional wood framed construction. Images courtesy Mike Frat, Desert Sky Development; Scottsdale, AZ.

Charlotte County, Florida, has developed an enticing marketing program as part of their green building program. Incentives apply to all projects that receive LEED certification and include an outdoor sign to promote the project during the construction phase, inclusion of the builder on the program website, press releases, a permanent affixed sign post-construction, a green building award, and special recognition in the building community.

2.5.4.1 Recommendation

Develop a marketing program that will educate the public on the value of homes or businesses built to the program's standards. Help provide visibility for program participants through website coverage, press releases, newspaper advertisements, or announcements on municipal websites, and signage at building sites.

2.6 Communication and Partnerships

Communication and partnerships are closely related facets of beyond code programs. Communicating the program's vision to the community is a significant step toward gaining community support. It can be helpful to have a variety of outlets, venues, and voices to reach all constituents with a consistent message. Collaborating and forming partnerships with various entities is also important to promoting the goals and vision of the program. Partnerships can be formed with local utilities, universities, and libraries, to name a few. Successful examples include sustainability learning centers such as the Utah State University's Utah House demonstration center; existing public programs such as Boulder Climate Smart; college and university programs such as Arizona's Yavapai College Residential Building Technology Program; local botanical gardens; public libraries for lecture series; and schools.

A jurisdiction's partners can influence, financially support, or deliver a lecture series or other educational opportunity that relates to a specific expertise or mission. For example, utilities could present information about weatherization or the local native plant society could offer a workshop on native and drought-tolerant plants.

Outreach efforts by multiple partners must be coordinated, however, to convey a clear and consistent message to the public. It is important that the permitting agency be perceived as the primary source of authoritative information. Details about the program that are provided by other agencies could be seen by the public as an

“extra” or “alternative” program and not part of the program vision. This may be misinterpreted as an indication that the permitting department has not taken ownership of the new program. Finally, program information should be readily available to builders; if builders do not learn about the program directly from the permitting department, chances of participation are reduced.

See the City of Seattle's campaign profile at <http://www.buildgreennw.com/campaign.htm> for sample outreach materials, Power Point displays, and more.

In 2003, the City of Seattle created a communication campaign to increase awareness of the importance of green building. Details and the outcome of the program are highlighted below. Partnerships between local and regional associations and organizations were especially crucial to the mission of the campaign. To encourage partnerships with organizations with an interest in green building, a unique set of guidelines were outlined in the Green Building Communications Program and include:

- Networking at local chapter meetings/events
- Placing articles in chapter newsletters
- Conducting green building presentations
- Gaining access to members' mailing lists for direct mail
- Presenting at conferences and workshops
- Creating a speakers bureau

The tools outlined by the City of Seattle to establish successful partnerships can be altered for other cities and jurisdictions.

City of Seattle 2003 Green Building Communications Campaign

Led by the Department of Planning and Development, the City of Seattle raised \$300,000 in partnership with King County, BetterBricks, the USGBC, and local developers to develop and launch a green building communication campaign. The goal of the 2003 campaigning effort was to demonstrate the business case for green building to developers, increase awareness of green building among commercial tenants, strengthen market valuation and the green building brand, and to support the city's economic development strategy. Key messages targeted developers, building owners and tenants, providing evidence that green buildings 1) offer a higher net operating income, which increases building value; 2) provide a marketing advantage that helps lease space in a competitive market; 3) improve the corporate image in the community; and 4) offer lower operating costs (Seattle 2005).

In 2005, a survey was conducted to measure the effects of the 2003 communication campaign on the attitudes of commercial developers, building owners and tenants. The survey conducted prior to the campaign showed that more than half of the participants were familiar with green building, the majority being developers. **Familiarity with green building increased by 9% following the campaign and participation in green building increased by 11% overall.** Building owners had the largest increase in participation (22%), although developers remained the most involved in green building. Prior to the campaign, tenants were most likely to agree that health and environmental issues were important when considering their next purchase or lease; following the campaign, building owners were most likely to agree. In general, health and environmental attributes are less important to developers than tenants or building owners. Additional survey results are available in the report *Green Building Pre & Post Campaign Testing 2005* (Seattle et al. 2005)



In 2006, the City of Bellingham collaborated with Sustainable Connections and Puget Sound Energy to implement the Green Power Community Challenge. In just six months, Bellingham's Green Power purchases grew from 0.5% to nearly 12% of the total power used. The challenge has positioned Bellingham as one of the top EPA certified Green Power Communities. http://sustainableconnections.org/energy/index_html

➤ The University of Idaho Integrated Design Lab in Boise (IDL) is dedicated to the development of high performance energy-efficient buildings in the Intermountain West. This is approached through research, education, and outreach efforts with students, owners, and professional design and construction teams to transform practice and keep pace with the milestones of the 2030 Challenge. Those who utilize the resources available through the IDL will design and construct buildings that are more comfortable, require less energy to maintain and operate, and enhance the health and productivity of inhabitants. Funded by Idaho Power, the Northwest Energy Efficiency Alliance, the Idaho chapters of the Association of General Contractors and USGBC, and local businesses, the IDL offers technical expertise, design consultation, university and professional education and serves as a hub for regional design and construction professionals interested in building performance and sustainability. (IDL 2011)

Regional programs can form successful partnerships as well. For example, a partnership between the Northwest Energy Efficiency Alliance and BetterBricks, along with local universities and electric utilities, has developed the Integrated Design Lab Network.⁵ Integrated design labs provide engineers and architects in the Northwest with the resources to integrate green building practices and high performance building techniques into the design of commercial projects. Five labs are located in universities across the Northwest, including those in Boise, Idaho; Bozeman, Montana; Seattle and Spokane, Washington; and Portland and Eugene, Oregon. The universities supply information, education, design consultation, tools, and resources to building owners, developers, and design teams seeking assistance constructing high efficiency commercial buildings. Integrated design labs employ high-tech building tools such as energy modeling, building simulations, and model analysis to increase the efficiency of homes, address climate issues, optimize daylighting, and successfully integrate beyond code design practices.

2.6.1 Recommendation

Identify and establish relations with potential partners in your community. Consider civic and professional organizations, colleges and universities, libraries, utilities, and other organizations whose goals parallel those of your program. Collaboratively identify ways in which you can work together in support of mutual goals. Develop a coordinated communications plan for education and outreach efforts.

⁵ <http://www.betterbricks.com/design-construction/integrated-design-lab-network>.

3

Critical Issues

There are important issues to consider when selecting or developing a beyond code program, including the decision to create a locally developed program or adopt a national or regional program, implementation strategies, building size requirements, and the choice to make the program voluntary or mandatory. These decisions should be based on community goals and stakeholder input.

3.1 Locally Developed, National, or Regional Program

For the last 20 years, progressive jurisdictions have successfully developed, maintained, and enforced local green building and beyond code programs. Today, with the availability of ASHRAE 189.1, the ICC 700, CALGreen, and the pending 2012 release of the IgCC, jurisdictions have more options for adopting a state or nationally vetted program.

There are several benefits to adopting a national program. National programs have been vetted by industry professionals and are developed and maintained by an outside agency, increasing the availability of jurisdiction funds for implementation and enforcement.

The City of Longmont, Colorado adopted the National Green Building Standard (NGBS) in 2009. Longmont is requiring the base level, bronze to meet the minimum requirements for a residential building permit. The program is intended to subtly transform the community and builder perspectives on green building. The city intentionally adopted the base level, bronze so that achieving the minimum requirements would be relatively easy for a builder to comply with. The builder uses the NAHB's free Green Scoring Tool to input data on each project. The builder can hire a verifier which might cost a couple hundred dollars, or they can score the project themselves and submit the paperwork to the building department for verification of compliance. The in-house plan reviewers and inspectors then verify compliance. Since the program's inception, over sixty projects have been completed. The City of Longmont, Colorado adopted the National Green Building Standard (NGBS) in 2009. Longmont is requiring the base level, bronze to meet the minimum requirements for a residential building permit. The program is intended to subtly transform the community and

“Green building programs have provided a stage for the fringe and early green building adopters which evolved over time into local mainstream building markets. Local green building programs have helped to prepare the foundation for regional, state, and national green programs. In 1977, Scottsdale used the Austin and Colorado green building programs as a model in establishing its program. In turn, Pima County (Tucson area), Coconino (Flagstaff area), and Phoenix metro communities used the Scottsdale green building program as a model. Green building programs have served as a catalyst to spur sustainability at a grass roots and regional levels. This process was repeated in various regions around the country from the northwest to the southeast.”

Anthony Floyd
AIA, LEED AP
Green Building Program

Office of Environmental
Initiatives - Advanced
Planning, Neighborhoods and
Transportation Division
City of Scottsdale, AZ

“It is Longmont’s perspective that points-based systems are best for flexibility. The builders like it best and it gives the customers options. Most importantly, it gets the builder and customer discussing their green building options to choose what is most important to them and most cost-effective. Getting them to engage in that discussion is integral to achieving a cultural shift towards green building and ultimately, market transformation.”

Chris Allison
Chief Building Official
City of Longmont , Colorado



builder perspectives on green building. The city intentionally adopted the base level, bronze so that achieving the minimum requirements would be relatively easy for a builder to comply with. The builder uses the NAHB’s free Green Scoring Tool to input data on each project. The builder can hire a verifier which might cost a couple hundred dollars, or they can score the project themselves and submit the paperwork to the building department for verification of compliance. The in-house plan reviewers and inspectors then verify compliance. Since the program’s inception, over sixty projects have been completed.

However, jurisdictions may find that none of the national programs address their community goals. In such cases, the national programs can be adapted to reflect the needs of the jurisdiction, or a locally developed program may be implemented instead. Pima County assessed available national programs before continuing with the development of their own program, and the recent development of the Pinoleville Pomo Nation’s (PPN’s) draft Tribal Green Building Code illustrates their need for a locally developed plan:

PPN’s citizens wished to design homes that were expressions of Pinoleville Pomo culture, and which furthered tribal goals of political sovereignty and environmental care. The Uniform Building Code⁶ (UBC) represented a barrier to pursuing these goals, with its many prescriptions slow to respond to new research into building strategies. The state and county codes are evolving more quickly, but still do not facilitate the degree of design freedom that the tribe would like.

This approach is an effort for the tribe to create its own standards that permit the highest degree of design freedom, while also protecting health, safety and well-being of its multiple constituencies: current residents and neighbors, to be sure, but also future generations of people and non-humans that share local ecosystems with us (PPN 2011).

6 The Pinoleville Pomo Nation (PPN) Housing Director refers to the Universal Building Code as his reference for on-reservation construction. The California Building Code is a secondary reference for the PPN.

Voluntary Program in Transition from Locally-Developed to National Standard: City of Scottsdale, Arizona Green Building Program

Scottsdale's green building program was established in 1998 to reduce the environmental impact of building. The concept of green building involves a whole-systems approach, which uses design and building techniques to minimize environmental impact and reduce energy use while improving the health of its occupants. A green building rating checklist was developed and used to qualify projects by requiring a minimum of 50 points selected from over 135 green building options in the areas of site use, energy, building materials, indoor environmental quality, water, and solid waste. Besides meeting locally adopted building and energy code requirements, there are a number of prerequisites for energy efficiency, water conservation, and indoor environmental quality. Both the prerequisites and checklist options are consistent with nationally recognized green building programs, including the NAHB's green building standard and the USGBC's LEED green rating program. The Scottsdale program was a pioneer in municipal, voluntary, beyond code building programs. It successfully transformed a substantial portion of the market. By 2005, the city reached a milestone with one-third of all new single-family permits adhering to the green building standards. As of 2007, the city reported that 1,123 green single-family and 20 multi-family homes had been completed (AIA 2007).

In the most recent program update, the Scottsdale City Council recently adopted the International Green Construction Code Public Version 2 as the core of the city's voluntary commercial green building program. The city continues to evaluate the most appropriate update for the residential checklist (Floyd 2011).

Implementation Agency: Green Building Staff, Building Department

Voluntary vs. Mandatory: Voluntary

Types of Buildings: Residential and commercial

Size of Buildings: N/A

Incentives: Fast track plan review, marketing, education

Enforcement: Projects not able to maintain qualification as a green building will be required to resubmit plans for revisions as a non-participating project

“In addition to promoting the use of voluntary, beyond code green building rating systems such as LEED, USGBC and its partners across the building industry are committed to advancing incremental and advanced regulatory change now available with the advent of green building codes and standards. Alongside these codes, rating systems play an important, distinct and complementary role and together, they are enabling truly sustainable buildings and communities.”
(USGBC 2011)

Development of new codes does not make programs such as LEED or California's GreenPoints obsolete. Instead, codes and progressive beyond code programs form a complementary means of transforming the face of sustainability.

3.2 Sustainability: Beyond Code, Beyond the Building Department

Integration is an issue in both adoption and enforcement. The broad scope of the comprehensive programs makes it essential to involve planning, zoning, transportation, water, and other affected departments in the planning and adoption process as well as enforcement. Plan review and inspection can either be integrated into the standard code enforcement process—moving through the affected departments—or be held as a separate action. Integration yields significant benefits compared to separate processes, such as an increased potential for cross training personnel, a streamlined process for both staff and applicants, and a greater likelihood that better building practices become the norm.

Many jurisdictions have successfully integrated green programs into the standard code inspection process.

Many jurisdictions have successfully integrated green programs into the standard code inspection process. All city staff members in Tampa, Florida, involved with plan reviews, building permitting, and inspections are provided training and materials on green building and sustainable practices, an effort that helps distinguish Tampa as a Florida Green Local Government and increases the level of integration of the Tampa green building program.

Pima County identifies for both staff and applicants what to expect in the permitting and inspection process in the standard operating procedures (Appendix D) of the county. Additionally, Pima County outlines recommendations for how staff should handle a new question or unusual technologies. Although the residential program is voluntary, permitting and inspection processes have been fully integrated into the county's standard processes. Each project is assigned an ombudsman, who serves as the key contact throughout the permitting and inspection processes and assists the applicant as questions arise between departments and agencies. This relationship is especially important in instances where the developer is proposing a non-standard method in areas such as water delivery, waste disposal, and the treatment and handling of graywater. Rather than having the applicant working independently with the appropriate department, the ombudsman is available to assist in project coordination and helps provide education to other departments and agencies as needed.

Other jurisdictions separate the code minimum and beyond code plan review and inspection elements, as well as the personnel that handle them. The City of Albuquerque, for example, uses this separation as an incentive. Applicants taking part in Albuquerque's Green Path program receive special, highly visible service at a separate counter by staff dedicated to that program. In other cases, however, when not explicitly addressed, separations of code minimum and beyond code elements can lead to marginalizing the beyond code elements, as they continue to be viewed as "extra."

3.3 Building Size

Building size can impact water and energy use and materials and resources. Although typically addressed within the residential programs, building size can also be used as a tool in commercial programs, with more stringent requirements for larger buildings.

House size is one of the first factors in most residential programs. Size can affect how many points need to be accumulated, and/or how energy efficient the structure must be. The size of the average American home increased from 1,100 square feet in 1950 to 2,240 square feet in 2002, while average household size shrank from 3.67 persons in 1940 to 2.62 in 2002. This leads to a decreased efficiency per square foot per occupant (Prahl 2003) and increased materials and resources per occupant.



Average American house size doubled between 1950 and 2002.

With few exceptions, the beyond code programs highlighted in this guide link house size to the HERS Index rating, overall points required, or both. While most programs require more points for larger homes, Pima County has gone further—establishing a “point neutral” house of 2,300-2,800 square feet, dwellings under 2,300 square feet earn one point for every 200 square feet under 2,300 square feet and dwellings over 2,800 square feet lose one point for every 200 square feet over 2,800 square feet.

➤ With few exceptions, the beyond code programs highlighted in this guide link house size to the HERS Index rating, overall points required, or both.

LEED for Homes and jurisdictions such as Santa Fe (Table 3.1) adjust their HERS Index requirements for larger homes, consistent with research by Duncan Prah, Integrated Building and Construction Solutions (IBACOS), and others that indicates that size can and should be used for determining HERS ratings (Prah 2003).

Table 3.1 – Required HERS Indices

Heated Square Footage	HERS Requirement
0 - 3,000	70
3,001 - 3,500	65
3,501 - 4,000	60
4,001 - 4,500	55
4,501 - 5,000	50
5,001 - 5,600	45
5,601 - 6,200	40
6,201 - 6,800	35
6,801 - 7,400	30
7,401 - 8,000	25
8,001 - 8,500	20
8,501 - 9,000	15
9,001 - 9,500	10
9,501 - 10,000	5
10,001 +	0

Building size can also be a criterion in commercial beyond code programs. For example, the City of Evanston, Illinois, requires that all commercial, multi-family, and city-owned or city-financed buildings over 10,000 square feet receive a LEED Silver rating or higher. All commercial, multi-family, and city-owned buildings seeking interior renovations must either receive a LEED for Commercial Interiors certification of Silver or higher or incorporate elements of the City of Evanston Sustainable Building Measures for Interior Renovations (ESBMIR). Projects less than 5,000 square feet must integrate three ESBMIR measures, projects 5,000-20,000 square feet must integrate five measures, and projects over 20,000 square feet must incorporate seven measures.

3.4 Voluntary vs. Mandatory

Jurisdictions often evaluate the benefits and costs associated with voluntary and mandatory programs. With strong consensus and broad stakeholder support, many communities choose to adopt mandatory programs for new homes, new commercial buildings, or both. Adopting programs collaboratively with neighboring jurisdictions also allows for mandated programs. Jurisdictions without strong support can begin with a voluntary program, with or without a plan for eventually transitioning to mandatory requirements. Unless the voluntary program has a strong market transformation component, mandatory programs may ultimately be necessary to achieve the desired improvements in building design and construction practices.

The most common concern about making a program mandatory is that small communities may lose development to nearby communities with lower standards. Education and demonstrating the marketability of higher quality development is crucial to alleviating this concern. Small communities may also ease the concern of losing development by collaborating with nearby communities to develop regional standards.

3.4.1 Example: City of Santa Fe's Residential Green Building Code

Santa Fe adopted a unique method for transitioning the community from a voluntary to a mandatory program. While the task force worked out the details of their mandatory plan, they required all homes to have a HERS Index rating. Since January 1, 2008, all new residential single-family units built within the City of Santa Fe have been required to post a confirmed HERS Index rating (Ordinance 2007-38). Initially, there was no required target for those HERS indices. However, since adoption of the Residential Green Building Code on July 1, 2009, specific HERS indices are required based on the size of the residence. This transitional stage provided an opportunity for builders who were not previously making use of HERS Index ratings to become accustomed to them, and for homeowners to become aware of the value of a HERS rating. When the new mandatory standards came into effect, the building community had 18 months to become accustomed to using the third-party providers and have a good understanding of what the index means and how to use it.



4

Elements of Beyond Code Programs

Beyond code programs, whether voluntary or mandatory, generally incorporate all six elements of construction and performance of new buildings, including:

- Site selection and development
- Energy efficiency
- Water conservation
- Materials and resources
- Indoor air quality, or environment
- Owners' building operations manuals

Including all of these elements strengthens the program and maximizes benefits to the community. At this time, most beyond code programs are focused on new construction, with the exception of LEED for Existing Buildings, and some renovation and replacement requirements by adopting jurisdictions. The full potential for beyond code programs focused on operations of existing building has yet to be realized. The elements included in this guide primarily focus on new construction.

4.1 Site Selection and Development

Site selection and development have broad environmental and community impacts. They determine access to public transportation, parks and recreation, bike paths and walkways; whether environmentally sensitive areas are avoided; how water can be conserved; and how buildings are oriented to reduce heating and cooling demands.

Site selection and development measures provide for comprehensively addressing impacts, without one being at the cost of another. For example, **consider a scenario that includes development of 1,000 highly energy-efficient ranchette style homes, with small acreage, located 10 miles from the freeway, far from employment centers, in the heart of active agricultural land.** The local volunteer fire department cannot provide service; the roads are inadequate for the increased traffic, which could interfere with local farm equipment; the rural school district can't absorb the increase in enrollment; and vehicle miles travelled will increase as

Cumulatively, compact development could save 8% in development costs and reduce local government deficits by 10% by 2025. (Burchell et al. 2005)

residents face a longer commute without access to public transportation.

Despite being highly energy-efficient, these homes will have a number of negative environmental impacts.

Compare the first scenario to a mixed-use development located near established infrastructure in either an existing urban or rural community, with convenient access to public transportation, bike paths, major arterials, employment centers, schools, and shopping. These homes will not only be highly efficient, but will also minimize impacts on infrastructure and natural resources.

Smart siting and shading can decrease a building's cooling and heating loads, creating a more efficient structure. In colder climates, unobstructed solar access can reduce the heating load on the building by allowing solar gain in the winter months to offset the heating load. Shading on south, east, and west-facing glazing will reduce the cooling load in cooling-dominated climates. Also, providing shading as part of the landscaping will reduce the outside temperature around the building, resulting in a lower cooling load.

The Florida Green Home Standard (FGHS) provides an example of addressing climate-specific concerns. In addition to points for access to public open and green space, community resources, etc., FGHS includes native tree and plant preservation, on-site use of cleared materials, erosion control/topsoil preservation, and drainage retention.

Eagle County's ECObuild provides a model for assessing site selection and development in its Sustainable Community Index (SCI) (Eagle County 2008). Eagle County defines a sustainable community as "a community which fosters economic opportunity and social capital while protecting and restoring the natural environment upon which people and economies depend." The index is a tool used to assess all planned unit developments (PUDs), PUD amendments, final plats, major special use permits, and zone changes.

The SCI promotes mixed use, transit-oriented, new urbanist, form-based, pedestrian- and environmentally friendly, clustered, infill development, and is a required finding for new development proposals reviewed by the board of county commissioners.

25 to 33% of potential buyers prefer infill, mixed-use, and transit-oriented neighborhoods, and this demand is expected to grow as the population ages. (*Ewing et al. 2007*)

The SCI received the American Planning Association Colorado Chapter's Sustainability Award in 2009, and it is an integral part of Eagle County's Sustainable Communities Plan (*Eagle County 2010*).

4.1.1 Recommendation

Develop and implement a program for encouraging sustainable development. Use Eagle County's SCI as a model to address these issues at the project approval stage, rather than the building permit stage. Incorporate measures that address site and location, connections and uses, transportation, and resource efficiency.

Table 4.1 illustrates how site selection and site development can be incorporated into beyond code programs.

Table 4.1 – Site Selection in Beyond Code Programs

Jurisdiction <i>Program Name</i> • Year Adopted • Voluntary, Mandatory, or As Adopted • Verification Method	Siting Elements
Eagle County, CO <i>ECObuild</i> • 2006 (updated in 2008) • Mandatory • County, Self, and Third Party	RESIDENTIAL Point options: • Select site with access to public transportation and services or in a redevelopment area COMMERCIAL Point options: • Select site in redevelopment or brownfield location • Select site which is walkable and/or bikeable
State of Florida <i>Florida Green Home Standard</i> • 2011 • As Adopted • Third Party	RESIDENTIAL Points Based: • Lot choice • Site development: native tree and plant preservation, on-site use of cleared materials, erosion control/topsoil preservation, drainage/retention
Pima County, AZ <i>Residential Green Program</i> • 2008 • Voluntary • County and Third Party	RESIDENTIAL Point options: • Location: outside conservation land, infill development, access to public transportation and services, within LEED Neighborhood Development or Enterprise Green Community, exceeding open space requirement
Redmond, WA • 2009 • Mandatory • City	RESIDENTIAL • Site plans must be prepared identifying the following: – Areas of predominantly native, non-invasive vegetation – General vegetation characteristics (healthy, suitability to existing location, naturally occurring, density, etc.) – Natural water features, including streams, springs, wetlands, seeps – Slope characteristics – Wellhead Protection Zone numbers • A report must be attached that describes how the features of the site lend themselves to green infrastructure, such as low impact development • Points are earned for various site elements. Incentives, such as priority permit processing, lot size reduction, and density bonus, among others, are awarded based on the number of points achieved

Table 4.1 – Site Selection in Beyond Code Programs (continued)

Jurisdiction	Siting Elements
Santa Fe, NM <i>Santa Fe Residential Green Building Code</i> • 2009 • Mandatory • City and Third Party	RESIDENTIAL Point options: • Siting: Avoid environmentally sensitive areas, infill site, grayfield site, brownfield site
Pinoleville, CA <i>Green Building Code of the Pinoleville Pomo Nation</i> • Draft 2011 • Mandatory	RESIDENTIAL OR BUILDING WITH HUMAN PURPOSE Performance requirements include: • Limitation of impermeable surfaces, target should be less than 50% impermeability of developed area • Limited negative impact on view sheds of neighboring properties • Limited negative impact on existing walking and biking paths • Preservation of existing landscape features important to the tribe, including animal and plant communities, water features, and cultural structures
Scottsdale, Arizona <i>Green Building Program</i> • 1998 (update in progress) • Voluntary • City, Self, and Third Party	RESIDENTIAL Point options: • Infill development
ANSI/ASHRAE/USGBC/IES Standard 189.1-2009 <i>Green Building Program</i> • 2009 • As Adopted • As Adopted	COMMERCIAL • Site selection: allowable site selection (existing envelope, brownfield, etc.), prohibited development activities • Mitigate heat island effect: hardscape, shaded exterior walls, cool roofs or vegetated roofing systems • Reduce light pollution: backlight and glare ratings, uplight requirements • Site development: effective pervious area, use of native plants and manage rainfall on site

Table 4.1 – Site Selection in Beyond Code Programs (continued)

Jurisdiction	Siting Elements
International Code Council, ICC 700-2008 <i>National Green Building Standard</i> • 2008 • As Adopted • As Adopted	RESIDENTIAL • Site selection: Infill site, grayfield/brownfield site • Site design: Natural resources, orientation, slope disturbance, soil disturbance and erosion, stormwater management, landscape plan, wildlife habitat, existing buildings, existing and recycled materials, density • Innovative practices: Driveways and parking areas, street widths, cluster development, zoning, wetlands, mass transit
International Living Building Institute <i>Living Building Challenge 2.0</i> • 2010 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Limits to growth • Urban agriculture • Habitat exchange • Car free living
U.S. Green Building Council <i>LEED 2009 for Green Building Design and Construction, LEED for Homes</i> • 2009 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Site selection: Development density and community connectivity, brownfield redevelopment • Alternate transportation: Public transportation access, bicycle storage and changing rooms, low-emitting and fuel-efficient vehicles, parking capacity • Site development: Protect or restore habitat, maximize open space • Stormwater design • Heat Island effect: Nonroof, roof • Light pollution reduction

4.2 Energy Efficiency

Having a fundamental impact on people's lives, these effects include the economic well-being of the nation, the United States' dependence on foreign oil, and national security. On an individual basis, even human health can be affected by building energy use when rising energy costs render a conditioned, comfortable, healthy indoor environment unaffordable. On a larger scale, carbon emissions, which are directly tied to building energy use, affect the health of our planet. Some sobering statistics drive home the reality of building energy use:

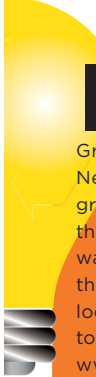
- Nearly 5 million commercial buildings and 115 million residential households in the United States consume nearly 40% of the nation's total primary energy (EIA 2007a).
- Buildings consume 70% of electricity in the United States (EIA 2010a).
- In 2007, carbon dioxide emissions attributable to lighting, heating, cooling, cooking, refrigeration, water heating, and other building services totaled 2517 million metric tons (EIA 2007b)—40% of the U.S. total and 8% of the global total.

The adoption and enforcement of the most recently published versions of the IECC and ASHRAE 90.1 in communities across the country is a critical step forward. However, more can be done. Beyond code programs offer an opportunity to increase energy efficiency further. Jurisdictions face several decisions for increasing energy efficiency in their community:

1. Adopting an energy efficiency standard through either:
 - a. Limiting focus to the building energy, or
 - b. Developing a comprehensive program that includes measures beyond the building.
2. Determining whether to include residential or commercial construction (or both) in the program
3. Selecting a standard of measurement (IECC, HERS, etc.) and energy efficiency goal or performance target
4. Determining who is responsible for verification and enforcement

Beyond code programs offer an opportunity for transformation. The value of building energy efficiency has been known for some time, but the beyond code programs integrate efficiency into a better building, the use of best practices and industry innovations serve to maximize energy efficiency and conservation, a key component of overall sustainability.





In 2010, the Town of Cornwall, Connecticut became the first EPA Green Power Community in New England. Cornwall's green power campaign, through a grassroots effort, was able to motivate more than 30 percent of the local households to switch to green power. <http://www.epa.gov/greenpower/communities/cornwall.htm>

4.2.1 Comprehensive Approach vs. Building Structure

Jurisdictions must determine whether the program will address only the building structure or will include site layout, orientation, and other features that reduce the heating and cooling loads on the structure. Factors that influence this decision include staffing levels, training of both staff and the building community, and verification methods. An approach that addresses only the building structure is simpler and can be tied directly to the IECC or ASHRAE 90.1. Broader approaches require developing local criteria and/or referencing a national certification program or standard such as LEED or ASHRAE 189.1.

4.2.1.1 Example – Massachusetts “Stretch Energy Code”

Unlike many of the comprehensive programs described in this guide, the Massachusetts Stretch Energy Code (EOPS 2011) focuses solely on increased building energy efficiency. Adopted in 2009, the Stretch Energy Code is an optional appendix to the Massachusetts building energy code that allows cities and towns to choose a more energy-efficient option. This option increases the efficiency requirements in any municipality that adopts it, for all new residential and many new commercial buildings.

This optional Stretch Energy Code was developed in response to the call for improved building energy efficiency in Massachusetts. Towns and cities in the Commonwealth may adopt Appendix 120.AA in place of the energy efficiency requirements of the base building code. In addition, the base building energy code in Massachusetts was updated in 2010 to the IECC 2009 energy code. The Stretch Energy Code is similarly based on the IECC 2009 energy code, but with approximately 20% greater building efficiency requirements, and a move toward third-party testing and rating of building energy performance. It included many of the provisions that were anticipated and subsequently included in the 2012 IECC (ICC 2009a).

4.2.2 Residential or Commercial Construction

Jurisdictions must decide whether the program will address residential or commercial construction, or both. This decision depends on the interests and abilities of the community. Many communities begin with higher standards for municipal buildings, then move on to commercial. Some begin with residential development. Jurisdictions also determine whether the size of the commercial or municipal building dictates coverage. See Section 3.3, Building Size.

4.2.3 Standard of Measurement and Target Level of Efficiency

Jurisdictions must also address the question of how the efficiency will be measured. Will the jurisdiction use a national code or standard as a benchmark, and require a percent above that benchmark, or will there be a prescriptive path of locally developed measures? Some jurisdictions use a combination of percent above a national standard and additional prescriptive requirements. Common national standards, benchmarks, and certification programs include:

- IECC
- HERS Index rating
- ENERGY STAR
- LEED Rating System
- ASHRAE Standard 189.1 or 90.1
- IgCC (available 2012)

Each is described briefly here, with more detailed information provided in Chapter 6.

IECC. The IECC residential and commercial energy code has been adopted by most states, and is enforced in tandem with provisions from the IBC and IRC. DOE recognizes the IECC as the minimum residential code but references ASHRAE 90.1-2007 as the minimum commercial energy code. The level of energy efficiency, when tied to the IECC, is typically a percentage above the IECC. In beyond code programs, this is most often used for residential development.

HERS Index. A more comprehensive approach for residential development requires a specific HERS Index (RESNET 2011). The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2004 IECC) scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's HERS Index, the more energy efficient it is compared to the HERS Reference Home. Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home. Thus, a home with a HERS Index of 85 is 15% more energy efficient than the HERS Reference Home, and a home with a HERS Index of 80 is 20% more energy efficient.

The HERS Index rating takes into account heating, cooling, water heating, lighting, appliances, and potential on-site power generation. The ratings are established using trained, certified inspectors, who provide third-party verification of installations and specifications, such as whole house air leakage.



Pacific Northwest National Laboratory in Richland, Washington is the first national laboratory to pioneer the use of a geothermal system as a secondary heat source to support the primary strategy of heat recovery from one building to the other. This has resulted in an energy use savings of over 30 percent, as well as 38 percent less CO2 emissions. http://sustainable.pnnl.gov/report/success_stories.stm

The commercial green building program in Frisco, Texas requires that all roofs comply with the Energy Star Cool Roof Program and that shade trees are planted along the front of the building to create a pedestrian environment and to mitigate heat. <http://www.friscotexas.gov/departments/planningdevelopment/greenbuilding/pages/default.aspx>

> A comprehensive comparison of the LEED for Homes, ICC 700, and ES to the 2009 IECC provisions is available at www.energycodes.gov/greenbuilding.



Oregon legislature passed House Bill 2620, which requires that public entities spend 1.5% of the total price of a public improvement contract for new construction or major renovation of a public building on solar energy technology. Source: http://www.oregon.gov/ENERGY/LOANS/EEAST/about_us.shtml

ENERGY STAR. Under the ES Version 3 (ES v3) program for residential construction, homes may earn ES certification by following the Prescriptive Path or Performance Path in all states except those with an energy code exceeding the 2009 IECC and for which EPA regional program requirements have been developed (EPA 2011a).

LEED. Each LEED program for commercial buildings includes points addressing energy with points for a percent savings above ASHRAE 90.1, on-site renewables, heat island effects, enhanced commissioning, etc. Several beyond code programs specify the number of Energy and Atmosphere points that must be acquired in LEED to ensure it goes beyond minimum LEED certification. LEED for Homes is focused on ES and HERS ratings for minimum compliance.

NBI's Core Performance Guide. The *Core Performance Guide* (NBI 2007) provides a guided path to achieving energy performance that is up to 25% above the performance called for in ASHRAE 90.1-2007. This fee-based program is available nationally, and is designed for commercial buildings 10,000-70,000 square feet. In Version 1.11, the prescriptive requirements have been updated to align with AIA/DOE/NBI's joint proposals for the 2012 IECC code cycle.

ASHRAE/IESNA Standard 90.1-2007. This standard provides minimum efficiency requirements for the building envelope and mechanical and lighting systems for all commercial buildings and residential buildings of four stories or more. Standard 90.1-2007 is recognized by DOE as the reference commercial energy code.

Table 4.2 illustrates the relationship between the national codes and programs, the levels of efficiencies possible with each of them, and their compliance paths. In residential construction, if more than 15% above the IECC is desired, the typical compliance path would be performance based. In commercial construction, modeling has often been needed to demonstrate more than 15% above ASHRAE 90.1-2004, particularly for large buildings (> 20,000 square feet) or complex designs.

Table 4.2 – National Standards and Programs and Options for Achieving Above Code

National Standard or Program	Efficiency	Prescriptive Verification Method	Performance Verification Method	Residential or Commercial
IECC	Any percent above code can be specified	Prescriptive form	REM/ <i>Design</i> , REM/ <i>Rate</i> , and RES <i>check</i> Energy Gauge and others	Both
ENERGY STAR	15% above 2006 IECC plus checklist and performance tests	n/a	REM/ <i>Design</i> and REM/ <i>Rate</i> Performance Calculations and Home Performance Tests	Typically Residential
HERS Index	Any designated percent above 2006 IECC plus performance tests	n/a	REM/ <i>Rate</i> Performance Calculations and Home Performance Tests	Residential
NBI Core Performance Guide	30% above ASHRAE 90.1-2004	Checklist used with the Core Performance and Enhanced Performance Requirements	Appendix G in ASHRAE 90.1-2004 referenced in Core Performance as an alternative to the Core and Enhanced Performance Strategy	Commercial
Advanced Energy Design Guides (AEDGs)	50% above ASHRAE 90.1-1999 or 2004	The AEDGs are intended as guidance and are not written in code-enforceable language.		Commercial
ESV3	20% more efficient than the 2009 IECC	Both prescriptive and performance options are verified by the completion of four inspection checklists.		Residential
LEED for Homes	Requires a HERS of 85– 0, generally meets or exceeds 2009 IECC	For certification, must provide specified documentation to the USGBC.		Residential
LEED 2009	Minimum 10% above ASHRAE 90.1-2007	For certification, must provide specified documentation to the USGBC.		Commercial

Table 4.2 – National Standards and Programs and Options for Achieving Above Code (continued)

National Standard or Program	Efficiency	Prescriptive Verification Method	Performance Verification Method	Residential or Commercial
ASHRAE 189.1	30% weighted average energy savings across all building types over Standard 90.1-2007 (9% from renewable and 21% from efficiency)	Written in code-enforceable language with both prescriptive and performance options for most measures. Intended primarily for adoption within building codes.		Commercial
ICC 700	Lowest threshold (Bronze) is at least 15% more efficient than 2006 IECC	For verification, projects must use the Green Scoring Tool, hire an accredited verifier, and undergo several inspections.		Residential

4.2.4 Verification and Enforcement

Verification and enforcement poses a challenge to adopting any new code. One benefit of using a national standard is often third-party verification. HERS Index ratings, ENERGY STAR certification, and

LEED certification all allow the jurisdiction to increase standards, with the knowledge that trained and certified inspectors are providing third-party verification. It saves labor within the jurisdiction by reducing the time required for energy plan review and inspection, and provides quality control on site. However, it does take quality control out of the hands of the jurisdiction. Enforcement techniques, checklists, and protocols will be needed for the new national programs.

Pima County has integrated the green building plan review and inspection process into the mainstream permit process. Third-party verified HERS Index ratings are part of their process; however, their staff is HERS trained and knowledgeable on the inspection and rating requirements. The county is also a LEED for Homes Provider—a unique distinction for a jurisdiction that indicates a high level of training and integration of the inspection process.

4.2.4.1 Recommendation

Develop a verification program, working with jurisdiction staff and local building professionals. Ensure verification standards and procedures are reasonable and enforceable. Ensure they are assigned to the appropriate department or party. Identify those items that must be verified prior to bringing the plans to the building department.

4.2.5 Residential Best Practices

Highly efficient homes are often identified by ES as at least 15% more efficient than the IECC, and Net Zero Capable Energy Homes are 40-60% more efficient than the IECC. Locally developed programs, the ICC 700, and LEED for Homes include measures to reduce building energy consumption.

These levels of efficiency have been successfully constructed by production homebuilders across the country, as demonstrated in the Building America portfolio of case studies. Nationwide, over 42,000 homes have been built under the Building America program that are at least 30-90% more efficient than industry-standard construction.

Visit the Building America website for case studies and comprehensive best practice guides for each climate zone. http://www1.eere.energy.gov/buildings/building_america/

4.2.5.1 Example: G.W. Robinson Homes, Gainesville, FL

The 2,081-square-foot production home with 16-SEER heat pump and ducts in conditioned space, radiant barrier in the attic with over R-38 blown cellulose to keep inside air cool has a HERS index of less than < 60 without photovoltaics (PV), -3 HERS with 6.6 kW PV.



Photo credit: G.W. Robinson

Key Features

- HERS Score: -3
- HVAC: 16-SEER right-sized heat pump, air handler in conditioned space
- Ducts: In conditioned space
- Water Heating: Solar
- Wall insulation: R-13 GreenFiber blown-in cellulose
- Roof: TechShield 7/16-inch OSB radiant barrier roof sheathing, R-38 GreenFiber blown-in cellulose
- Air sealing: ENERGY STAR Thermal Bypass checklist
- Windows: Double-pane, low-e, SHGC=0.21
- Appliances: ENERGY STAR appliances
- Lighting: CFL light bulbs; recessed, sealed, and insulated CFL light fixtures
- Solar: 6.6 kW roof-mounted solar photovoltaic

(EERE 2011)

Standard of Measurement and Target Efficiency: Austin Net-Zero Homes Plan

The Austin City Council adopted the first in a series of code amendments in 2007 that by 2015 will make all new single-family homes in Austin zero energy capable. A zero-energy home is one capable of producing as much energy as it consumes over the course of a year.

Code changes were planned to incrementally increase efficiency so that, on average, homes built in 2015 will require 65 percent less energy than those built today.

According to the city, “The savings... are staggering - over the next 10 years these policies will save homeowners almost \$125 million on utility bills and have the same greenhouse gas reduction effect as taking almost 200,000 cars off the road.”

“The city brought together a broad coalition representing the housing industry, business, non-profits, and government. The final product is much better for having sought and followed the advice from a diverse group,” said Eric Perkins, President of the Home Builders Association of Greater Austin.

The second set of code amendments in the series, adopted in 2010, increase the energy-efficiency of each newly constructed home starting this summer by 1,650 kWh of electricity a year, saving \$165 annually (based on a 2,300 ft² home). Combined with energy code amendments adopted 3 years ago, the efficiency of new homes will increase by 31% compared with 2007 and save each homeowner 3,630 kWh of electricity and \$363 annually.

Key amendments include requiring a duct blaster and blower door test of each new home to check for duct leakage and leakage from within the structure of the home. Other amendments include increasing the high-efficiency lighting in the home from 25% to 90%, which can be achieved by installing ENERGY STAR rated compact fluorescent bulbs, light emitting diode (LED) technologies, indirect lighting, and other high-efficiency lighting that replaces incandescent bulbs.

This second series of code amendments also increases the efficiency of new commercial buildings by between 13% and 17% over the current code. New significant commercial amendments include requiring timers for electric water heaters in multi-family properties, heating and air conditioning shut off switches when overhead doors such as bay doors are open, and commissioning of heating and air conditioning systems. Commissioning is the process of verifying that systems are installed as designed and that they function according to design and manufacturer's specifications.

For more information, visit www.austinenergy.com.

Case studies for high performance homes can be found via DOE's Commercial Building Initiative¹ project, the National Institute of Building Science's Whole Building Design Guide,² NBI's Advanced Buildings High Performance Database,³ and ASHRAE's High Performance Magazine,⁴ among others.

4.2.6 Commercial Best Practices

Highly efficient commercial buildings are usually identified by their percent more efficient than ASHRAE 90.1 2004 or 2007, typically 30-50% beyond code or better. The New Buildings Institute defines high performance as 50% beyond (NBI 2010), and the new ASHRAE Advanced Energy Design Guide 50% Series offers tools and recommendations for practical products and off-the-shelf technologies to help achieve a 50% energy savings compared to buildings that meet the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1-2004.

4.2.6.1 Example: Newport Beach Environmental Nature Center, CA

Highlighted in the Advanced Buildings High Performance Database, this LEED Platinum, net zero building had a net export of energy in 2009.



Energy Efficiency Measures (NBI 2010)

- Orientation of the building's long axis in the east-west direction to facilitate well controlled daylighting and optimal orientation of rooftop solar panels
- Installation of a 40 kW rooftop solar array
- Reliance on natural ventilation instead of mechanical heating and cooling for thermal comfort
- Efficient electrical lighting that is controlled with daylight sensors and dimmable ballasts
- Use of recycled materials and a minimalist design to reduce the embodied construction energy and provide a healthy indoor environment

1 http://www1.eere.energy.gov/buildings/commercial_initiative/

2 <http://www.wbdg.org/references/casestudies.php>

3 <http://www.advancedbuildings.net/information-resources/high-performance-buildings-database>

4 <http://www.hpbmagazine.org/>

Table 4.3, Energy Efficiency in Beyond Code Programs, describes the energy elements of each program highlighted in this guide.

Table 4.3 – Energy Efficiency in Beyond Code Programs

Jurisdiction <i>Program Name</i> • Year Adopted • Voluntary, Mandatory, or As Adopted • Verification Method	Energy Efficiency Elements
Albuquerque, NM <i>Green Path Program</i> • 2008 • Voluntary • City and Third Party	RESIDENTIAL References Build Green New Mexico and LEED for Homes. Meet requirements of either: • LEED Gold, or LEED Silver with 21.5 points in Energy, or • Build Green New Mexico Gold COMMERCIAL References LEED for New Construction for new buildings and major alterations. Meet requirements of either: • LEED Gold, or • LEED Silver with 6 Points from – Optimize Energy Performance – On-site Renewable Energy
Eagle County, CO <i>ECObuild</i> • 2006 (updated in 2008) • Mandatory • County, Self, and Third Party	RESIDENTIAL The square footage of the home dictates the number of points required on a scale ranging from 40 points for buildings ≤ 2,000 square feet to 100 points for homes > 8,000 square feet. Points are possible from the following categories: • High efficiency heating system, thermostat, and duct systems • High efficiency water heating system • HERS rating of 80 or less • Increased insulation and glazing efficiency • Efficient light system and controls • ENERGY STAR appliances • Blower door testing • In lieu of meeting minimum scores, points can also be purchased at a rate of \$10 per point per square feet divided by the total number of points needed. Rebates are available for projects that exceed minimum point requirements

Table 4.3 – Energy Efficiency in Beyond Code Programs (continued)

Jurisdiction	Energy Efficiency Elements
EEagle County, CO <i>ECObuild</i> (continued)	COMMERCIAL Mandatory measures required: • Combustion analysis report • Blower door test All buildings are required to achieve a total of 70 points. Points can be achieved under energy for the following types of measures: • Building commissioning • Air sealing measures • High efficiency heating systems • Evaporative cooling or compressionless air conditioning • No ducts in unconditioned space • High efficiency water heating • Duct leakage testing • Reduction in exterior lighting • Efficient interior lighting and controls • Building shell insulation • Efficient windows
Massachusetts <i>Stretch Energy Code</i> • 2009 • Optional • Third Party submitted by local building code official (residential) and energy modeling approved by the Board of Building Regulations and Standards (commercial)	RESIDENTIAL Performance requirements are based on home size: • Homes greater than 3,000 square feet must achieve a HERS index of 65 or less • Homes less than 3,000 square feet must achieve a HERS index of 70 or less • Home renovations above 2,000 square feet must achieve HERS index of 80 or less • Home renovations below 2,000 square feet must achieve HERS index of 85 or less • Home renovations may instead choose to utilize a prescriptive approach that incorporates elements of ENERGY STAR and the 2009 IECC COMMERCIAL • Performance requirements are based on building size: - Buildings less than 5,000 square feet and specialty buildings less than 40,000 square feet are subject to the base code with no additional requirements - Buildings over 100,000 square feet must be 20% more efficient than ASHRAE-90.1-2007 - Buildings greater than 5,000 square feet and less than 100,000 square feet must be 20% more efficient than ASHRAE 90.1-2007 OR use the prescriptive alternative based on the 2009 IECC with more stringent envelope, lighting control, HVAC, air leakage, and commissioning requirements

Table 4.3 – Energy Efficiency in Beyond Code Programs (continued)

Jurisdiction	Energy Efficiency Elements
Pinoleville, CA <i>Green Building Code of the Pinoleville Pomo Nation</i> • Draft 2011 • Mandatory	RESIDENTIAL OR BUILDINGS FOR HUMAN PURPOSES Performance submittal must be prepared for the following: • Assessment of site renewable energy resources • Estimated 12-month energy production from on-site renewable energy sources • Maintenance and operations cost estimates over 10 year period for all renewable energy systems • The use of mechanical system energy under routine and extreme conditions • Appliance energy use • Energy use measurement, monitoring and/or display of real-time energy use data in the building • Energy conservation through peak load shifting, occupancy sensors, and use sensors • Appliances must meet minimal EPA ENERGY STAR requirements • A minimum percentage of annual energy needs must be met from on-site renewable energy sources • Energy consumption reduction by the minimum percentage or higher when load management is not practiced • Combined heating and cooling, water pumping, ventilation, and/or mechanical systems that achieve a reduction in energy use compared to average PPN household energy use • Electrical outlets that measure energy use in real time, or sub-metering system for plug loads • Petroleum and natural gas shall not be used as a fuel source • Methods to maintain electrical demand in residential buildings below 0.25 kWh per person per month • A viable plan to obtain 100% of the building's energy need from local and/or renewable sources through a combination of conservation and generation
Santa Fe, NM <i>Santa Fe Residential Green Building Code</i> • 2009 • Mandatory • City and Third Party	RESIDENTIAL Mandatory requirements that apply to all buildings: • HVAC sizing, design and selection based on Air Conditioning Contractors Association • Thermal bypass checklist • Blower door and duct blaster testing • PV systems or other renewable electric source required for all heat pumps used for heating

Table 4.3 – Energy Efficiency in Beyond Code Programs (continued)

Jurisdiction	Energy Efficiency Elements
Santa Fe, NM <i>Santa Fe Residential Green Building Code</i> (continued)	Meet required HERS Index based on square footage and level of Green Building Certification: • Silver – HERS 70 • Gold – HERS 50 • Platinum – HERS 25 • Emerald – HERS 0 Each level also requires additional points that are attained from the following categories: • Lower HERS rating • HVAC design, installation, and commissioning • Water heating system design, equipment selection, and installation • Lighting efficiency • Passive solar space heating and cooling design • Solar water and space heating • On-site renewable energy sources • Third-party verification of energy-related features
ANSI/ASHRAE/USGBC/IES Standard 189.1-2009 <i>Green Building Program</i> • 2009 • As Adopted • As Adopted	COMMERCIAL On-site renewable energy systems Energy consumption management: • Consumption management • Consumption data collection • Data storage and retrieval Building envelope: • Building envelope requirements • Roof insulation • Single-rafter roof insulation • Vertical fenestration area • Permanent projections • SHGC of vertical fenestration • Vestibules • Building trade-off options • Fenestration orientation • Continuous air barrier

Table 4.3 – Energy Efficiency in Beyond Code Programs (continued)

Jurisdiction	Energy Efficiency Elements
ANSI/ASHRAE/USGBC/IES Standard 189.1–2009 <i>Green Building Program</i> (continued)	Heating, ventilation, and air conditioning: • Minimum equipment efficiencies • Ventilation controls for densely occupied spaces • Duct and plenum leakage • Economizers • Zone controls • Fan system power limitation • Controls • Exhaust air recovery • Variable-speed fan control for commercial kitchen hoods • Duct insulation • Pipe insulation • Automatic control of HVAC and lights in hotel/motel guest rooms Service water heating: • Equipment efficiency • Service hot-water piping insulation • Insulation for spa pools Power: • Peak load reductions Lighting: • Power allowance • Occupancy sensor controls • Occupancy sensor controls with multi-level switching or dimming • Automatic controls for egress and security • Automatic controls for lighting in daylight zones • “Manual on” occupancy sensors • Controls for outdoor lighting Other Equipment: • Insulation for spa pools Energy cost budget Annual energy cost Annual carbon dioxide equivalent Annual load factor/peak electric demand

Table 4.3 – Energy Efficiency in Beyond Code Programs (continued)

Jurisdiction	Energy Efficiency Elements
International Code Council, ICC 700–2008 <i>National Green Building Standard</i> • 2008 • As Adopted • As Adopted	RESIDENTIAL Minimum energy efficiency equipment: • HVAC systems • Duct systems • Insulation and air sealing • Fenestration Prescriptive path: • Building envelope • Insulation and air sealing • Fenestration • HVAC equipment efficiency • Water heating design, equipment, and installation Additional practices: • Lighting and appliances • Renewable energy and solar heating and cooling • Ducts • HVAC design and installation • Installation and performance verification
International Living Building Institute <i>Living Building Challenge 2.0</i> • 2010 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Net zero energy
U.S. Green Building Council <i>LEED 2009 for Green Building Design and Construction, LEED for Homes</i> • 2009 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Fundamental commissioning of building energy systems • Minimum energy performance • Fundamental refrigerant management • Optimize energy performance • On-site renewable energy • Enhanced commissioning • Enhanced refrigerant management • Measurement and verification • Green power

4.3 Water Efficiency

Water consumption in the United States continues to rise. With the increased demand and changes in the climate, water in the aquifers has dropped and supplies are becoming a concern. Addressing the water issue by designing buildings to be as water conservative as possible is becoming imperative for both residential and commercial construction, as is defining water conservation practices. Jurisdictions have several options for including water efficiency in their beyond code programs. LEED includes water efficiency measures, but currently only includes plumbing fixtures and outdoor water use. An alternative to LEED is the International Association of Plumbing and Mechanical Officials (IAPMO) Green Plumbing and Mechanical Code Supplement (GPMCS)—a supplement to IAPMO's Uniform Plumbing Code that has comprehensive provisions for indoor water efficiency. ASHRAE Standard 189.1 and the IgCC both incorporate a comprehensive approach to water efficiency for both indoor and outdoor water use. The EPA New Single Family Home WaterSense Labeling program provides specification for water efficient homes for residential construction.

The focus of most beyond code water efficiency should include:

- Indoor water use reduction through use of high efficiency plumbing fixtures, fittings, and appliances
- Increased water efficiency of equipment such as HVAC, commercial kitchen, and medical/laboratory equipment
- Outdoor water use reduction through water efficient landscaping and high efficiency irrigation systems
- Alternative water sources such as rainwater harvesting
- Water metering and automatic controls

Water efficiency measures in residential and commercial buildings offer tremendous potential. According to the EPA's WaterSense program, water efficient homes using both indoor and outdoor water efficient equipment can reduce water use by 20%, saving between 7,600 to over 14,000 gallons annually compared to conventional new homes.⁷ A typical 100,000 square foot office building can reduce indoor water use by 20% (500,000 gallons annually) by using low-flow fixtures, efficient landscaping, and efficient appliances and equipment.⁸

The City of Bellingham, Washington has approved the use of composting toilets as a means to reduce water usage. Composting toilets cut water costs by 60% when combined with wastewater re-utilization and other household water reduction techniques.
<http://www.cob.org>



⁷ Water savings potential of new homes is taken from the Environmental Protection Agency's WaterSense New Home Program, http://www.epa.gov/watersense/spaces/new_homes.html (EPA 2011b).

⁸ Reduction is based on several resources that provided data on water savings potential in the commercial sector (Gleick et al. 2003; Vickers 2001; Dziegielewski, et al. 2000).

4.3.1 Examples – LEED Based Programs

LEED-based programs address water efficiency, providing optional points for water efficient landscaping, wastewater technology, and building water use reduction. However, many policy makers in arid and semi-arid climates feel that LEED certification does not adequately address their concerns. For example, LEED NC 2.2 does not address a holistic approach to indoor water efficiency that includes kitchen and process water use. Currently, LEED points can be earned only for reducing landscaping irrigation demands by 50-100%, reducing indoor water use in plumbing fixtures (toilets, urinals, faucets, and showers) by 20-30%, and implementing innovative wastewater technology. It should be noted that future iterations of LEED plan to include a more comprehensive approach to indoor water efficiency.

Cary, North Carolina requires that all irrigation systems be installed with a rain water sensor. The sensor will override the irrigation system to ensure landscapes are not being watered in the rain. <http://www.ci.valparaiso.in.us/DocumentView.aspx?DID=740>

No national standards currently exist for the design and installation of rainwater-harvesting systems. However, the following jurisdictions have developed or are considering developing state and local ordinances to address them: Arizona, Hawaii, Kentucky, New Mexico, Ohio, Texas, Washington, West Virginia, and the U.S. Virgin Islands. Source: www.savetherain.info

4.3.2 Recommendations

Water efficiency is a highly important issue for many regions across the United States and localities should consider including interior and exterior water efficiency measures in their beyond code programs. It is recommended that jurisdictions establish the minimum requirements for water efficiency:

- Interior water use: equipment water efficiency requirements in EPA WaterSense New Single Family Homes Specification, ASHRAE 189.1, IgCC, or GPMCS
- Exterior water use: 50% reduction in potable water consumption for landscaping; limited turf area, efficient irrigation design, and advanced controls

Jurisdictions adopting a LEED-based program should specify a minimum number of credit points in the Water Efficiency category and also provide requirements for other indoor water using equipment such as kitchens, medical and laboratory equipment, and cooling towers to achieve the water efficiency targets specified above.

Table 4.4, Water Efficiency in Beyond Code Programs, summarizes how jurisdictions have incorporated water efficiency in their beyond code programs, and specific requirements that are incorporated as mandatory or optional elements of their code or green building program.

Table 4.4 – Water Efficiency in Beyond Code Programs

Jurisdiction <i>Program Name</i> • Year adopted • Voluntary, Mandatory or As Adopted • Verification Method	Water Elements
Boulder County, Colorado <i>BuildSmart Program</i> • 2008 • Mandatory • County and Third Party	RESIDENTIAL • Mandatory low flow appliances and fixtures
State of California <i>California Green Building Standards</i> • 2011 • Mandatory • City/County	RESIDENTIAL Point Options • Efficient toilets • Efficient faucets • Efficient showerheads • Efficient irrigation design COMMERCIAL Point Options • Submeters for buildings over 50,000 ft² • Efficient toilets • Efficient urinals • Submeters for irrigation • Efficient irrigation design
Eagle County, Colorado <i>ECObuild</i> • 2006 (updated in 2008) • Mandatory • County, Self, and Third Party	RESIDENTIAL Point Options • Reduce irrigated turf, use drip where appropriate • Water efficient landscaping • Building water use reduction – appliances, and fixtures COMMERCIAL Point Options • Water efficient landscaping • Rainwater channeling • Building water use reduction

Table 4.4 – Water Efficiency in Beyond Code Programs (continued)

Jurisdiction	Water Elements
State of Florida <i>Florida Green Home Standard</i> • 2011 • As Adopted • Third party	RESIDENTIAL Point Options • Fixtures • Graywater re-use • Rainwater harvesting • Reclaimed water re-use • Installed landscape • Installed irrigation • Additional water certification requirements
City of Fort Collins, CO <i>Green Building Code</i> • 2011 • Mandatory • City	RESIDENTIAL Point Options • Efficient faucets • Efficient toilets • Efficient showerheads COMMERCIAL Point Options • Efficient faucets • Efficient toilets • Efficient urinals • Efficient pre-rinse spray valves
City of Greensburg, KS <i>Sustainable Comprehensive Master Plan</i> • 2009 • Voluntary, Mandatory • City, Third Party	RESIDENTIAL, VOLUNTARY ICC 700 Point Options • Rainwater harvesting • Efficient irrigation system • High efficiency fixtures and fittings • Automatic shutoff water devices COMMERCIAL, MANDATORY (CITY BUILDINGS) LEED PLATINUM Points Options • Municipal recycled water system • Efficient irrigation system • High Efficiency fixtures and fittings • Automatic shutoff water devices

Table 4.4 – Water Efficiency in Beyond Code Programs (continued)

Jurisdiction	Water Elements
Las Vegas Region, Nevada <i>Southern Nevada Homebuilders Association (SNHBA)</i> • 2006 • Voluntary • Third party	RESIDENTIAL • Water efficient landscaping – turf reduction, mulching • High efficiency irrigation • Building water use reduction – plumbing, appliances, and fixtures
Pima County, Arizona <i>Residential Green Program</i> • 2008 • Voluntary • County & Third Party	RESIDENTIAL • Mandatory: Reduce impervious surfaces Point Options • Rainwater harvesting • Graywater reuse • Building water use reduction – plumbing, appliances, and fixtures • Maximize pervious surfaces • Install vegetative roof system • Water efficient landscaping and • High efficiency irrigation system
Environmental Protection Agency, Nationwide <i>WaterSense Single-Family New Home Specification</i> • 2009 • Voluntary • Third Party	RESIDENTIAL Point Options • Water efficient landscaping • Water efficient irrigation • Water efficient plumbing fixtures • Water efficient appliances • Homeowner education
ANSI/ASHRAE/USGBC/IES Standard 189.1 – 2009 <i>Standard for the Design of High-Performance Green Buildings</i> • 2009 • As Adopted • As Adopted	COMMERCIAL Site water use reduction: • Landscape design • Irrigation system design • Controls Building water use reduction: • Plumbing fixtures and fittings • Appliances • HVAC systems and equipment • Roofs • Cooling towers • Commercial food service operations • Medical and laboratory facilities Special water features • Water consumption measurement: • Consumption management • Consumption data collection • Data storage and retrieval

Table 4.4 – Water Efficiency in Beyond Code Programs (continued)

Jurisdiction	Water Elements
International Code Council, ICC 700-2008 <i>National Green Building Standard</i> • 2008 • As Adopted • As Adopted	RESIDENTIAL • Indoor hot water usage • Water conserving appliances • Food waste disposers • Showerheads • Faucets • Water closets and urinals • Irrigation systems • Rainwater collection and distribution • Water filters Innovative practices: • Graywater • Composting or waterless toilets and/or urinals • Automatic shutoff water devices
International Living Building Institute <i>Living Building Challenge 2.0</i> • 2010 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Net zero water • Ecological water flow
U.S. Green Building Council <i>LEED 2009, LEED for Homes</i> • 2009 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Water efficient landscaping • Innovative wastewater technologies • Water use reduction

4.4 Materials Conservation and Waste Avoidance

According to the EPA's 2009 annual report on municipal solid waste in the United States, although waste generation has gone down from a high in 2000 of 4.72 pounds per person per day, the recovery of materials in 2009 was also down from the previous years, as shown in the Table 4.5 (EPA 2009a).

Table 4.5 – Generation, Materials Recovery, Composting, Combustion with Energy Recovery, and Discards of Municipal Solid Waste, 1960–2009 (in pounds per person per day)

Activity	1960	1970	1980	1990	2000	2005	2007	2008	2009
Generation	2.68	3.25	3.66	4.57	4.72	4.67	4.63	4.52	4.34
Recovery for recycling	0.17	0.22	0.35	0.64	1.03	1.10	1.15	1.11	1.09
Recovery for composting*	Neg.	Neg.	Neg.	0.09	0.32	0.38	0.39	0.40	0.37
Total materials recovery	0.17	0.22	0.35	0.73	1.35	1.48	1.54	1.51	1.46
Combustion with energy recovery†	0.00	0.01	0.07	0.65	0.66	0.58	0.58	0.57	0.52
Discards to landfill, other disposal‡	2.51	3.02	3.24	3.19	2.71	2.61	2.51	2.44	2.36
Population (millions)	180	204	227	250	281	296	302	304	307

* Composting of yard trimmings, food scraps, and other municipal solid waste (msw) organic material. does not include backyard composting.

† Includes combustion of MSW in mass burn or refuse-derived fuel form, and combustion with energy recovery of source separated materials in MSW (e.g., wood pallets and tire-derived fuel).

‡ Discards after recovery minus combustion with energy recovery. Discards include combustion without energy recovery. Details may not add to totals due to rounding.

Waste reduction strategies such as reuse and recycling, as promoted in green buildings, divert some waste from being disposed of in landfills. Diversion strategies save money on disposal costs and reduce societal costs of landfill creation and maintenance. In addition to diverting waste from landfills, recycling and reuse can catalyze further economic growth in industries that reprocess diverted waste and use recycled raw materials. Landfill diversion rates are typically at least 50–75% in green buildings (SWEET 2008a).

Each of the beyond code programs highlighted in this guide includes materials conservation and waste avoidance activities.

The basic pollution prevention hierarchy of “reduce, re-use, and recycle” is a foundation for each program.

Reduce, or source reduction, refers to designing policies, procedures, and products to reduce the amount of generated waste that will later need to be disposed. This includes the design, manufacture, purchase, or use of materials, such as products and packaging, to reduce their amount before they enter the municipal solid waste (MSW) management system. **Re-use** pertains to using an item multiple times in the same form that it was obtained (e.g., furniture used over and over in office buildings or reusing existing products or packaging, such as refillable bottles, reusable pallets, and reconditioned barrels and drums). **Recycling** is the recovery of useful materials, such as paper, glass, plastic, and metals, from the trash to make new products, reducing the amount of new raw materials needed. Residential and commercial recycling turns materials and products that would otherwise become waste into valuable resources. Materials are collected, separated, and sent to facilities that can process them into new materials or products.

Pollution prevention programs for both residential and commercial projects consider each of the following phases of the building lifecycle:

Techniques include:

- Designing with less material
- Deconstruction and demolition
- Material selection
- Managing construction waste
- Facilitating and encouraging occupant recycling

4.4.1 Design with Less Material

Different techniques can be used to encourage less material use—value engineering, the use of structural insulated panels (SIPS), or the ultimate—building re-use. Advanced framing techniques in wood framed buildings (stud spacing at 24 inches on center, proper header sizing, eliminating shoulder studs/cripples in certain cases, and the use of two stud corners, etc.) can all add up to saving materials, money, and time.

According to a technology fact sheet from the DOE Office of Building Technology, State and Community Programs, “[f]ully implementing advanced framing techniques can result in materials cost savings of about \$500 or \$1000 (for a 1,200- and 2,400-square-foot house, respectively), labor cost savings of between 3 and 5 percent, and annual heating and cooling cost savings of up to 5 percent” (EERE 2000).

The Pima County green building program made the news in 2008 when the Arizona Daily Star (Beal 2008) reported on the then trend setting practice of points for what isn’t done—laying carpet, painting walls, adding a garage or swimming pool, etc. The elimination of any of these features reduces the materials that enter the construction stream.

Value engineering is an established practice within the commercial construction industry and not unique to beyond code programs. Instead, these programs focus on building re-use strategies to avoid unnecessary material use.



4.4.2 Deconstruction and Demolition

When removing old structures, deconstruction techniques allow re-use and recycling of materials rather than demolishing the structure, which can often destroy potential resources. Much of the waste generated during construction can be recycled or re-used, and can reduce costs for transporting waste and reduce strains on landfills. Re-use of materials can include renovating an existing building rather than building an entirely new structure.

Los Angeles, California has banned the use of plastic bags by retailers; paper bags will be available for ten cents per bag. <http://articles.latimes.com/2011/jan/27/local/la-me-0127-santa-monica-bags-20110127>

Deconstruction reduces waste, promotes reuse and recycling, and minimizes the impact on natural resources. Deconstruction can also help a project qualify for the LEED certification.

Deconstruction of an average 2000 ft² house can have significant benefits:

- Preserves 2,400 gallons of clean water
- Saves 33 mature trees
- Provides 907 additional hours of work at a living wage
- Reduces greenhouse gas emissions equivalent to taking 2.9 cars off the road for a year

Example – Deconstruction Benefits

In Portland, Oregon, a company called Our United Villages offers deconstruction services as an affordable and sustainable alternative to conventional demolition.⁹ Their DeConstruction Services crew works by hand to salvage for re-use up to 85% of a building's major components. The re-usable materials can then be donated to the ReBuilding Center for sale to the public.

4.4.3 Managing Construction Waste

Optimizing the volume of materials required is key for construction; this includes coordinating efforts to ensure excess materials are not purchased when they are not needed. Re-using materials from other on-site projects, whether excess or from deconstruction activities, will limit the amount of materials purchased. Material re-use also includes using existing materials when possible for building components. Recycling and salvaging waste materials from the construction process is also a vital element of a beyond code program. To ensure successful recycling practices are implemented, local recycling and salvage operations that could process site-related construction and demolition materials should be identified during a project's planning stage. If such operations are available locally, consider requiring that the materials be recycled or salvaged.

Example – Diversion, Clarke Distribution Corporation, Milford, Massachusetts

A wholesale supplier of kitchen equipment, Clarke Distribution Corporation completed a renovation and expansion in 2004 of its distribution center, located in a rural area of central Massachusetts. The project included renovation of 60,000 ft² of space and addition of a 40,000 ft² warehouse. The project achieved a 98% diversion rate through recycling and re-using construction materials: over 2,000 tons of material was recycled, over 7,000 tons of material was re-used, and only 233 tons of material was disposed. Identifying waste reduction opportunities early in the design process and developing a plan that was followed throughout planning, development,

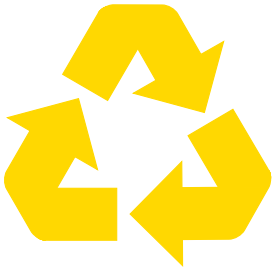


The Florida Green Home Standard awards site selection points towards green building certification for all removed trees greater than four inches in diameter that are milled into lumber when there is no opportunity for the trees to be replanted or donated. Points are also awarded for the use of mulch that is generated from the cleared site. <http://floridagreenbuilding.org/files/1/file/HomeRefGuide5.pdf>

⁹ <http://rebuildingcenter.org>

and construction was important to the project's successful recycling rates (MassDEP 2004).

4.4.4 Occupant Recycling



When occupying and/or operating a facility, all elements of pollution prevention should be considered. Although more specific to commercial-sized buildings, the principles can be applied in residential facilities as well. The practices that should be considered when developing policies for waste avoidance during occupation/operation include:

- Source reduction
- Recycling
- Re-use/re-purposing
- Composting

Source reduction

Examples of source reduction activities related to building operation are:

- Design/purchase products or packaging to reduce the quantity of the materials used
- Choose products that are designed for re-use
- Design for longer product life so fewer products need to be produced and therefore fewer products need to be disposed
- Purchase only what is needed, do not overstock
- Choose products made from readily recyclable materials to ensure that diversion is possible once the life of the product is complete

Because source reduction works at the front end of the waste generation process, it should be treated as the primary defense against waste disposal issues. The less material brought into an operation, the less that will need to be handled for diversion and disposal.

Re-use/Re-purpose

Re-use and re-purposing are similar concepts. Re-use pertains to using an item multiple times in the same form that it was obtained before disposing. Re-purposing refers to re-using an item, or parts of an item, after modifications. The re-purposed use will be different than the item's original purpose, and re-purposing will only be done after the item's re-use life has been completed. One example of re-purposing is grinding up glass bottles to make sand for wastewater treatment, additives in construction activities, or other purposes at a facility.

Re-use and re-purposing reduce the quantity of material that needs to be procured. Less material coming into a building equates to less material requiring diversion and disposal. Re-use and re-purposing are effective in both commercial and residential environments, but are best when done at a larger, community-wide, level.

Re-use programs require resources for collecting, storing, and redistributing items. As with recycling, re-use also requires occupant/tenant training and engagement. Re-purposing requires equipment for processing/deconstructing, as required by the initial structure of the item and the intended re-purpose.

Recycling

To support operation, each facility should have an easily accessible, dedicated area or areas for the entire building's collection and storage of materials for recycling. Building design should include adequate space, equipment, and transport accommodations for recycling by building occupants. Plans should be developed for recycling of specific materials, such as paper, metals, plastics, cardboard, and electronics (and associated products) by building occupants.

Although recycling has significant benefits, programs face limitations based on location. It is challenging to find recycling markets in some parts of the U.S., especially for hard-to-recycle items such as mattresses and Styrofoam. Each jurisdiction looking to set up a beyond code program must assess the hurdles in their areas and solve market problems accordingly.

Participation is another barrier to successful recycling. A recycling program is only as good as the public involvement. Whether the program is being implemented in a residential area or a commercial building, the tenants must be educated and engaged.



Recycled glass can be repurposed in many ways. Glass can be crushed and used as a base in road construction, mixed with asphalt to produce a durable road surface, or finely crushed and used as a substitute for sand in sandblasting activities. Recycled glass can also be used as a filter media for water systems, a replacement for sand and small gravel in concrete, or as backfill for sewer, gas, and water pipe trenches. http://www.ehow.com/how_2309666_use-crushed-recycled-glass-construction.html

Example - Stamford, Connecticut

The State of Connecticut has had mandatory recycling for a number of items in effect since January 1, 1991. The City of Stamford, Connecticut went a step further and set a goal to recycle 40% of all solid waste by 2010. To meet this goal, the city introduced a single-stream, curb-side, recycling program in July 2009 and offered more frequent recycling of electronics.

To support the program, the state will also expand efforts to educate citizens on the benefits of recycling. The city offers tours of sites such as landfills and recycling centers to help educate the public and has detailed information about the program and the materials that can be recycled, with drop off location information, on their web site.¹⁰

The single-stream bin accepts the typical household items:

- All plastics containers, toys, buckets, etc.
- Plastic grocery bags
- Milk, juice, and yogurt cartons
- Paperboard, including boxes such as cereal and facial tissue boxes
- Newspapers and mixed paper
- Cans
- Aluminum foil (without grease or food debris)
- Corrugated cardboard
- Wire hangers

Additional items that are accepted in the bins are listed on the website. A shredder is provided at the recycling center for personal papers. Other household wastes that do not fit into the bins are collected at specific sites, with information provided by the website.

Stamford recycling centers accept all electronics for recycling, which is done at no cost to the city at their e-Steward certified recycling facility, where they are recycled using a combination of manual and mechanical sorting and separation technology to convert used electronics into clean commodity streams.

Stamford also offers a day each year for hazardous waste recycling. In addition to recycling programs, Stamford encourages donations of used clothing and furniture to charitable organizations. Boxes are placed at the recycling facilities for convenience.

¹⁰ <http://www.cityofstamford.org/content/25/52/138/164/188/default.aspx>

Composting

Composting involves collecting organic waste, such as food scraps and yard trimmings, and storing it under conditions designed to help it break down naturally. This resulting compost can then be used as a natural fertilizer. Yard trimmings and food residuals together constitute 26% of the U.S. municipal solid waste stream (EPA 2009a). Diverting this material to composting not only saves money in disposal costs and unnecessary volume in the landfill, it also creates rich material that increases the nutrient content in soils and helps soils retain moisture. Compost has also been shown to suppress plant diseases and pests, reduce or eliminate the need for chemical fertilizers, and promote higher yields of agricultural crops.

Composting can be done large scale for communities or small scale in individual homes, with the same benefits.

4.4.4.1 Examples – LEED Based Programs

Many states are adopting LEED as their beyond code program. The following tables show how LEED points map to the project elements discussed above.

New commercial buildings can qualify for LEED points by implementing pollution prevention activities. Providing a space for storage and collection of recyclables for building tenants is a prerequisite; points can be earned for re-using existing elements of the building such as walls, floors, roofs, and interior non-structural elements, practicing construction waste management, and re-using materials. Table 4.6 lists the applicable credits and potential points.

Table 4.6 – LEED New Construction Pollution Prevention Points (Commercial)

Credit #	Credit Name	Possible Points
Prereq 1	Storage and Collection of Recyclables	
Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
Credit 2	Construction Waste Management	1 to 2
	50% Recycled or Salvaged	1
	75% Recycled or Salvaged	1
Credit 3	Materials Reuse	1 to 2
	Points Possible	8

Source: LEED for New Construction 2009,
<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222>

Similar to commercial projects, residential projects can also earn points for pollution prevention activities, including minimizing framing material waste by following a variety of best practices, and reducing construction waste. Table 4.7 lists the applicable credits and potential points in LEED for homes.

Table 4.7 – LEED for Homes Pollution Prevention-Related Points

Credit #	Credit Name	Possible Points
Prereq 1.1	Material-Efficient Framing – Framing Order Waste Factor	
Credit 1.2	Material-Efficient Framing – Detailed Framing Documents	1
Credit 1.3	Material-Efficient Framing – Detailed Cut List and Lumber Order	1
Credit 1.4	Material-Efficient Framing – Framing Efficiencies	1 to 3
Credit 1.5	Material-Efficient Framing – Off-Site Fabrication	4
Prereq 3.1	Waste Management – Construction Waste Management Planning	
Credit 3.2	Waste Management – Construction Waste Reduction	1 to 3
	Points Possible	8

Source: LEED for Homes,
<http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222>

Although LEED addresses minimizing construction and demolition waste and specifies the availability of recycling areas to tenants, the focus is not on waste diversion programs for the operation of the building. There are many other options for waste diversion that should be considered when developing a beyond code program. Each jurisdiction should evaluate the potential for purchasing policies, re-use centers, composting, and other innovative diversion opportunities. The more waste diverted, the lower the disposal cost and environmental impact during all phases of the building life.

ASHRAE Standard 189.1, Green Globes, ICC 700, and IgCC are additional green building systems that can guide the development of beyond code pollution prevention programs.

4.4.5 Going Even Further

Some are taking their waste diversion programs to the next step: net-zero waste (NZW). The philosophy of NZW is to divert all waste materials as resources, such that nothing goes to the landfill. The Army has recently engaged eight pilot sites to tackle this challenge, with a goal to be NZW by 2020. These sites will develop strict policies for waste minimization during procurement as well as extensive diversion through re-use, re-purposing, composting, and recycling (anticipated approximately 80% diversion). The final MSW stream ultimately will be treated in a waste-to-energy plant. Information on this program is available at <http://army-energy.hqda.pentagon.mil/netzero/>.

Recommendation

At a minimum, adopt the measures included in a LEED certified program. Establish a program that encourages reducing waste throughout the life cycle of the project. Where possible, consider renovation of existing buildings before constructing a new facility. If demolition is required, consider following deconstruction techniques to ensure maximum material recovery and reuse. Collaborate with local waste haulers, recyclers, other organizations such as Habitat for Humanity centers for potential recycling and donation options.

During operation, provide for access to recycling for all tenants. Consider a plan for minimization during procurement. Make re-use of items preferable to purchasing new, and make drop offs and pick ups for used items accessible.

It should be kept in mind that public awareness and training will be essential when implementing waste minimization practices in a community. Public involvement is key for the success of re-use and recycling programs.

Table 4.8 illustrates how jurisdictions incorporate material conservation and waste avoidance into their programs.

Table 4.8 – Materials and Resources in Beyond Code Programs

Jurisdiction <i>Program Name</i> • Year adopted • Voluntary, Mandatory or As Adopted • Verification Method	Materials and Resource Elements
Eagle County, Colorado <i>ECObuild</i> • 2008 • Mandatory • County, Self, and Third Party	RESIDENTIAL – OPTIONS INCLUDE: • Use pine beetle salvage wood • Donate excess materials • Recycle construction waste • Use materials with recycled content • Use certified wood products • Advanced framing techniques, optimal value engineering, SIPS and insulated concrete forms (ICFs) • Commercial – Options include: • Use pine beetle salvage wood • Donate excess materials • Recycle construction waste • Use materials with recycled content • Use certified wood products • Advanced framing techniques, optimal value engineering, SIPS and ICFs
Pima County, Arizona <i>Residential Green Program</i> • 2008 • Voluntary • County & Third Party	RESIDENTIAL • Options include: • Advanced framing techniques, SIPS and ICFs • Products certified as Environmentally Preferable Products (EPP) or Indoor Advantage Gold, or substitute • Use Forestry Stewardship Council (FSC) Wood • Use wood certified by the Sustainable Forest Initiative (SFI) • Use materials with recycled content • Avoid material use (exposed concrete flooring, etc.) • Construction waste management • Establish indoor recycling station

Table 4.8 – Materials and Resources in Beyond Code Programs (continued)

Jurisdiction	Materials and Resource Elements
Santa Fe, New Mexico <i>Santa Fe Residential Green Building Code</i> • 2009 • Residential • Mandatory • City and Third Party	RESIDENTIAL – OPTIONS INCLUDE: • Reuse existing buildings or disassemble for recycling • Use recycled materials • Recycle construction waste • Advanced framing techniques, SIPS and ICFs • Use certified wood products • Use regional materials
ANSI/ASHRAE/USGBC/IES Standard 189.1 – 2009 <i>Standard for the Design of High-Performance Green Buildings</i> • 2009 • As adopted • As adopted	COMMERCIAL Construction waste management: • Diversion • Total waste Extracting, harvesting and/or manufacturing Storage and collection of recyclables and discarded goods
International Code Council, ICC 700-2008 <i>National Green Building Standard</i> • 2008 • As adopted • As adopted	RESIDENTIAL Enhances durability and reduced maintenance: Recycling Reused or salvaged materials: • Reuse of existing building • Salvaged materials • Scrap materials Recycled-content building materials Recycled construction waste: • Construction waste management plan • On-site recycling • Recycled construction material
U.S. Green Building Council <i>LEED 2009, LEED for Homes</i> • 2009 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL Storage and collection of recyclables Building reuse Construction waste management Materials reuse

4.5 Indoor Environmental Quality

Efficiency is not the only concern for buildings; the tenants must also have a safe and comfortable indoor environment. Indoor environmental quality, or IEQ, refers to both the air quality inside the building and the physical comfort of the tenants while in the building. It is estimated that Americans spend an average of 90% of their time indoors, with 30% of that time typically spent in the work environment. If the quality of the indoor environment is not controlled, it can lead to significant effects on the health and productivity of the building residents due to exposures to pollutants or physical discomfort.

Many things can contribute to the IEQ and need to be considered from the earliest design stages to building occupancy. These variables are consistently addressed by beyond code programs and include:

- Indoor air quality including elements of ventilation rates, filtration, outdoor air delivery, and tobacco smoke controls
- Thermal comfort of occupants, regulating both temperature and humidity
- Specifying less harmful materials, minimizing the harmful chemicals and potentially irritating emissions
- Acoustical control from both external and internal sources
- Daylighting to provide additional controlled lighting of areas
- Isolation of the building from pollutants in the soil

As awareness of IEQ and its effects increases, buildings become healthier. The beyond code programs seek to minimize toxins and dust in the buildings and increase occupant comfort and satisfaction.

New ES v3 requirements for indoor air quality have potential to be transforming, due to the widespread use of ES certification. In 2008, over 17% of all homes built were qualified as ENERGY STAR (ENERGY STAR 2009). Version 3 allows Indoor airPLUS verification in lieu of the Water Management Systems Checklist (ENERGY STAR 2011), which addresses moisture and mold prevention, combustion gasses and other airborne pollutants (EPA 2011c).

4.5.1 Example – The City of Santa Fe’s Residential Green Building Code

The City of Santa Fe’s Green Building Code has a triple focus: (1) minimizing the potential for pollutants in the home; (2) managing the potential pollutants; and (3) managing moisture. (Moisture can lead to indoor environmental hazards such as mold.)



Minnesota Green Communities has developed a Choosing a Healthy Home checklist for individuals looking to rent or buy an apartment or home. The checklist is used to help identify which of the homes is the healthiest option for the individual. The checklist is also available as a form that realtors or property managers can complete and provide to prospective residents prior to showing the property. <http://www.mngreencommunities.org/>

Minimizing Potential Pollutants

Exposure to potential pollutants is managed through measures such as:

- Seal combustion appliances or locate them in isolated, sealed rooms with outdoor combustion air
- Install no central HVAC
- Build attached garage, or exhaust garage to outside
- Use low or non-toxic products
- Install carbon monoxide detector
- Eliminate or seal particle board

Managing Potential Pollutants Generated in the Home

The second part of Santa Fe's program focuses on managing potential pollutants likely to be generated in the home. Measures include:

- Specified mechanical ventilation rates
- Installation of high minimum efficiency reporting value (MERV) HVAC filters
- Installation of HEPA filters
- Installation of radon mitigation

Managing Moisture (vapor, rainwater, plumbing)

- Control bathroom fans with timers, occupancy sensors, etc.
- Install a vapor retarder under slab or on crawlspace floor or wall
- Insulate cold water pipes in unconditioned spaces to prevent condensation

Similar measures in each of these three categories can be applied in commercial buildings as well.

4.5.2 Example – ASHRAE Standard 62.1

ASHRAE 62.1 provides ventilation rates for commercial buildings based on occupancy and use of the building. The purpose this standard is to “specify minimum ventilation rates and indoor air quality that will be acceptable to human occupants and are intended to minimize the potential for adverse health effects.”

Recommendation

Establish a program that promotes healthy indoor air quality. For customized programs, require the EPA Indoor airPLUS program or ASHRAE 62.1.

Table 4.9 illustrates how communities include indoor environmental quality in their programs.

Table 4.9 – Indoor Environmental Quality in Beyond Code Programs

Jurisdiction <i>Program Name</i> • Year adopted • Voluntary, Mandatory or As Adopted • Verification Method	Indoor Environmental Quality Elements
State of Florida <i>Florida Green Home Standard</i> • 2011 • As Adopted • Third party	RESIDENTIAL – POINTS BASED Combustion Moisture control Source control Cleanability Universal design Ventilation
Pinoleville, California <i>Green Building Code of the Pinoleville Pomo Nation</i> • Draft 2011 • Mandatory	RESIDENTIAL OR BUILDINGS FOR HUMAN PURPOSES: Performance submittal must be prepared for the following: • Ventilation rates under conditions of prolonged cold and heat • Emissions of any chemicals listed in the EPA substance registry service from structural support materials, finishing materials, flooring, roofing and major building systems • Potential reduction of allergens from structural support materials, finishing materials, flooring, roofing and major building systems • The amount of direct and indirect sunlight entering the building at different times of the day in summer and winter Performance submittal must be prepared for the following: • Ability of the design to maintain an indoor temperature • Sound control from outdoors to indoors, and from room to room, within allowable decibel rate • Sensors or alarms for carbon monoxide, volatile organic compounds, and carbon dioxide • Filtering capability of HVAC systems for particulate matter • Ability to meet any defined standards for carbon monoxide, volatile organic compounds, and carbon dioxide Performance submittal must be prepared for the following: • Air exchange rate per hour • Specification for operable windows • Documentation that no product or material emissions of EPA listed chemicals exceed safe limits • Documentation that production of allergens does not exceed rate defined in the performance standards list including cumulative and synergistic impacts of allergens

Table 4.9 – Indoor Environmental Quality in Beyond Code Programs (continued)

Jurisdiction	Indoor Environmental Quality Elements
EPA Indoor airPLUS 2009 • As Adopted • Third Party	RESIDENTIAL Moisture control Radon control Pest management HVAC • Minimize condensation problems • Dilute and exhaust pollutants • Remove airborne particulates Combustion Venting Building Materials (reduce source pollutants)
ANSI/ASHRAE/USGBC/IES Standard 189.1 – 2009 <i>Standard for the Design of High-Performance Green Buildings</i> • 2009 • As Adopted • As Adopted	COMMERCIAL Indoor air quality: • Minimum ventilation rates • Outdoor air delivery monitoring • Filtration and air cleaner requirements • Environmental tobacco smoke • Building entrances Thermal environmental conditions for human occupancy Acoustical sound: • Exterior sound • Interior sound • Outdoor-indoor transmission class and sound transmission class Daylighting by toplighting: • Minimum daylight zone by toplighting • Skylight characteristics Daylighting by sidelighting: • Minimum effective aperture • Office space shading Daylighting simulation Isolation of the building from pollutants in soil Materials: • Adhesives and sealants • Paints and coatings • Floor covering materials • Composite wood, wood structural panel and agrifiber products • Office furniture systems and seating • Ceiling and wall systems

Table 4.9 – Indoor Environmental Quality in Beyond Code Programs (continued)

Jurisdiction	Indoor Environmental Quality Elements
International Code Council, ICC 700-2008 <i>National Green Building Standard</i> • 2008 • As Adopted • As Adopted	RESIDENTIAL Pollutant source control: • Space and water heating options • Fireplaces and fuel-burning appliances • Garages • Wood materials • Carpets • Hard-surface flooring • Wall coverings • Architectural coatings • Adhesives and sealants • Cabinets • Insulation • Carbon monoxide alarms • Building entrance pollutants control • Non-smoking areas Pollutant control: • Spot ventilation • Building ventilation systems • HVAC system protection • Central vacuum systems • Living space contaminants Moisture management: vapor, rainwater, plumbing, HVAC: • Tile backing materials • Capillary breaks • Crawlspace • Moisture control measures • Plumbing • Duct insulation • Relative humidity
International Living Building Institute <i>Living Building Challenge 2.0</i> • 2010 • As Adopted • As Adopted	CRESIDENTIAL AND COMMERCIAL Civilized environment Healthy air Red list (<i>materials</i>) Embodied carbon footprint

Table 4.9 – Indoor Environmental Quality in Beyond Code Programs (continued)

Jurisdiction	Indoor Environmental Quality Elements
U.S. Green Building Council <i>LEED 2009,</i> <i>LEED for Homes</i> • 2009 • As Adopted • As Adopted	RESIDENTIAL AND COMMERCIAL • Minimum indoor air quality performance - Environmental tobacco smoke control - Outdoor air delivery monitoring - Increased ventilation - Construction indoor air quality management plan: • During construction • Before occupancy - Low-emitting materials: • Adhesives and sealants • Paints and coatings • Flooring systems • Composite wood and agrifiber products - Indoor chemical and pollutant control - Controllability of lighting and thermal comfort systems - Thermal comfort - Daylight and views

4.6 Operation, Maintenance, and Owner Education

While operations and maintenance manuals have been standard in the commercial building sector for years, the benefits of residential applications are just now being realized. Most jurisdictions with beyond code programs require an owner's manual for homes. A manual can consist of a simple binder containing the operating instructions for all major systems installed in the house. It includes information on when to have a heating and cooling system serviced to ensure the system is running at its highest efficiency. Additional features required in other jurisdictions include piping diagrams for any in-slab plumbing, photos of the insulation installation, filter specifications and schedules, resources, and more.

Example – The City of Scottsdale, Arizona, has developed a green home buyers brochure that identifies energy efficiency and green building features to look for in new homes. Builders can also receive LEED points for providing an owner's manual to homeowners or commercial building tenants.

Recommendation

Include a requirement for an owner's manual in both residential and commercial programs. The builder provides this to the owners when they take possession. This should be a mandatory element, not an optional point. The manual should contain all the information from the compliance documents including:

- Certificate of compliance with beyond code requirements
- Beyond code program checklist
- HERS rating certificate

- Insulation installation certificate
- Piping diagrams for in-slab plumbing
- Instructions for major systems in the house
- Filter specifications and schedules

Table 4.10 illustrates how communities include operation, maintenance, and owner education in their programs.

Table 4.10 – Operations and Owner’s Manuals in Beyond Code Programs

Jurisdiction <i>Program Name</i> • Year adopted • Voluntary, Mandatory or As Adopted • Verification	Owner’s Manual Elements
State of Florida <i>Florida Green Home Standard</i> • 2011 • As Adopted • Third Party	RESIDENTIAL • Homeowner’s manual given to homeowner
Redmond, Washington <i>2009</i> • Mandatory • City	RESIDENTIAL • A maintenance agreement must be prepared and distributed to property owners for projects with on-site stormwater management systems that must be privately maintained, such as a green roof or rain garden.
International Code Council, ICC 700-2008 <i>National Green Building Standard</i> • 2008 • As Adopted • As Adopted	RESIDENTIAL • Operation and maintenance plan • Building owner’s manual for one- and two-family dwellings • Construction, operation, and maintenance manuals and training for multi-unit buildings

5

Benefits, Savings, and Cost Effectiveness

Studies have shown that sustainable planning and development have many benefits, financial and otherwise. The benefits and savings of going beyond code are enjoyed at many levels by individuals, households, businesses, communities, etc. The benefits are financial, social, and environmental. The benefits of energy, water, materials resources, and indoor air quality are illustrated here.

5.1 Financial Benefits

Green buildings have greater value in the market place. Analysis of LEED and ES certified buildings, rental rates and sales data confirmed the value of green building certification. The results of recent analysis suggest that there is a rental premium of approximately 3-5% for LEED and ES certification and a sale price premium of approximately 28-29% (Fuerst and McAllister 2011).

Additionally, a study by CoStar Group showed highly efficient commercial buildings have lower operating costs and increased occupancy rates compared to conventional buildings (Burr 2008).

While there may be a general perception that high performance buildings are significantly more expensive to build, according to Kats in *The Costs and Financial Benefits of Green Buildings*:

Sustainable buildings generally incur a “green premium” above the costs of standard construction. They also provide an array of financial and environmental benefits that conventional buildings do not. These benefits, such as energy savings, should be looked at through a life cycle cost methodology, not just evaluated in terms of upfront costs. From a life cycle savings standpoint, savings resulting from investment in sustainable design and construction dramatically exceed any additional upfront costs (Kats 2003).

Most of the data on increased cost of beyond code commercial buildings has been gathered on LEED. The latest research shows no significant cost difference between LEED and non-LEED commercial buildings, and that energy-efficient design can actually cut construction costs due to reduced heating and cooling loads (Davis Langdon 2007). Other studies of LEED buildings show an additional first cost of about \$2 per square foot, along with additional “soft costs” such as expenses for LEED documentation, energy modeling, and commissioning of the building (Nicolow 2008). These costs, however, are typically paid back through reduced energy costs, higher lease rates and occupancy levels, lower tenant turnover, etc. (Burr 2008).

A study by the Building Industry Research Alliance of GrupeGreen home sales in Rocklin, California, showed that sales of 4.6 homes per month, compared to the competition’s 1.9 homes per month (BIRA 2008). Not incidentally, this resulted in savings to the builder of \$14 million, due to the 45 months saved in selling out the development, compared to the competition. This is parallel, or compatible with, the results of the 2007 study by Ewing et al., which shows 25-30% of buyers prefer mixed-use, transit-oriented development.

The mortgage and banking industry is clearly taking notice. An article in the periodical Mortgage Banking refers to sustainable building as “Class G—The New Class A” (Woodwell 2008). The article attributes the popularity to higher rents, lower operating costs, higher resale, and/or goodwill.

5.2 Energy

Highly efficient new homes can be built to achieve net savings in utility and mortgage costs. Similarly, commercial property owners can reduce the energy costs of new buildings.

5.2.1 Residential Savings

Homeowners save money with high performance homes. Studies in Boulder and Sacramento both show a net savings to homeowners from building above the baseline energy codes, ranging from a few hundred dollars annually to over a thousand, depending upon local utility costs (SWEEP 2008b; AEC 2007). Energy efficiency measures are more cost-effective to implement than renewable energy measures. Combinations of efficiency and renewables, however, are also cost-effective to the homeowner, and deliver valuable peak electricity savings for utilities.

5.2.1.1 Example: Rural Development, Inc., Wisdom Way Solar Village, Greenfield, MA

These affordable, high-efficiency duplexes received HERS Index ratings of 8-18. According to Building America, “compact, heavily insulated homes and adding solar water heating and photovoltaics on top, to net home owners an energy cost savings of at least \$2,500 per year per home. The homes are so well insulated, a small (10,000 to 16,000 Btu) gasfired space heater is all that is needed to heat them. Most homeowners are spending less than \$500 per year for natural gas. The space heaters cost builders about \$5,000 less per unit than a typical central gas or electric furnace” (EERE 2010a).

Energy Efficiency Features:

- Foundation: Full basement with R-40 dense-blown cellulose under first floor
- Walls: 12-inch double 2x4 wall with R-42 dense blown cellulose
- Attics: Vented attic with R-50+ loose blown cellulose
- Windows: East, north, and west: vinyl-framed, triple-pane, U = 0.18, SHGC = 0.23. South: double-pane, U = 0.26, SHGC = 0.37
- Doors: 0.20
- Infiltration: 200-350 cfm at 50 Pa, based on blower-door test



- Heating System: Small (10,200/16,000 Btu) space heater located in main living area; sealed combustion
- Gas-fired 83% AFUE (Monitor Products model GF1800)
- Cooling System: None
- Water Heater: Solar thermal system with tankless gas auxiliary
- ENERGY STAR Appliances: Refrigerators and dishwashers; 100% hard-wired fluorescent lights
- Ventilation: Continuous exhaust fan

The energy-efficiency features above resulted in a home using less than 25% of the typical annual oil heating in the region, with a net annual savings (after mortgage costs associated with the efficiency measures) of \$1,142.

5.2.2 Commercial Savings

In addition to increased commercial property values, owners are realizing significant decreases in energy use and subsequent operating costs of high performance commercial buildings.

5.2.2.1 Example: Fossil Ridge High School – Commercial Cost Savings

This 1,800 student capacity building was certified LEED Silver. At just under 300,000 square feet, the building was designed for comfort, productivity, and learning. Project features include:

- High-performance building envelope
- Extensive daylighting and dimming controls
- Ice storage tanks
- Natural ventilation
- On-site renewable energy
- Shared community infrastructure

Natural lighting, energy efficiency, on-site power generation, and water conservation are hallmarks of the building. In the school's first 3 years of operation, the cumulative energy savings was \$271,791 and water savings totaled \$27,852. The integrated design process involved a wide range of stakeholders, including students and building maintenance staff. At approximately \$126 per square foot, the building was constructed within a typical school construction budget.

The photos below illustrate the extensive use of daylighting, and the placement of photovoltaics for both on-site power generation and shade (RMI 2008).

5.2.3 Potential Nationwide Energy Savings



Fossil Ridge High School. © David Patterson.

A high-level estimate of the technical potential by 2030 of new, more energy-efficient buildings can be calculated as projected amount of new construction in the United States times the per unit energy savings. Following the projections in the DOE Energy Information Administration's (EIA's) *Annual Energy Outlook* (AEO), new residential construction is measured by the number of new housing units built (single-family, multi-family, and manufactured home). Construction activity in the commercial sector is measured in billions of square feet. Over the period from 2012 through 2030, 34.1 million new housing units are projected to be built. For the same period, 41.3 billion square feet of new commercial floor space is projected to be added.¹¹

New housing units built today are estimated to use about 94.5 MMBtu of *delivered* energy per year. Thus, 30% savings results in annual savings per housing unit of 28.4 MMBtu. As a broad average, 30% savings in new commercial buildings would save about 26.7 kBtu of delivered energy per square foot.¹² If savings in all end uses were reduced proportionately, the *primary* energy savings (i.e., including losses in electricity generation and transmission) would be 53.5 MMBtu per new housing unit and 57.3 kBtu per square foot of new commercial floor space.

11 The residential and commercial projections of new construction are derived from the reference case in the 2011 *Annual Energy Outlook* (EIA 2011), Tables 4 and 5 in Appendix A. The new housing unit projections were scaled down from 5.4 million new units in the AEO over the 2012-2014 time period to 3.9 million units to better reflect the continuing weakness in the new residential construction sector. New floor space additions were taken from the AEO 2011, without adjustment.

12 The estimates of energy intensity in new buildings started with the 2012 average consumption per unit (housing unit or square foot) as shown in AEO 2011. For the residential sector, the 2005 Residential Energy Consumption Survey (EIA 2005) indicated that the most recent vintage of newly constructed homes used almost the same amount of energy as the average home in the stock. Thus, no adjustment was made to the AEO 2011 stock value as a representation of the energy intensity of the average new home. However, the 2003 Commercial Building Energy Consumption Survey (EIA 2008) indicated that the most recent vintage of new commercial buildings was about 15% lower than the overall stock of floor space. Thus, the stock average intensity shown in the AEO 2011 was adjusted downward by 15% to reflect this relationship. It should be noted that new housing units are considerably larger than the stock average home; thus, improvements in energy efficiency in new homes have largely been offset by the larger average size of these home. The normalization to square footage in the commercial sector helps to better reflect improvements in the underlying structures and equipment.

Four quads of primary energy annually is equivalent to the annual electricity delivered from 952 coal-fired power plants (200 MW each). (EERE 2010b)

Table 5.1 shows the estimated energy savings in 2030 applying this simple approach, in terms of both delivered and primary energy, and in terms of the value of these energy savings. **By 2030, total annual energy savings would be more than 4 quadrillion British thermal units (quads) of primary energy, saving building owners more than \$40 billion in energy expenditures.**¹³

Table 5.1 – Potential Energy and Cost Savings from 30% Improvement in New Building Energy Use, 2030

Building Sector	New Construction Activity	Unit Savings: DELIVERED	Unit Savings: PRIMARY	2030 Savings DELIVERED	2030 Savings PRIMARY	Energy Cost Savings (2009 \$)
Residential	34.1 million housing units	28.4 MMBtu per housing unit	53.5 MMBtu per housing unit	0.97 quads	1.83 quads	\$21.3 billion
Commercial	41.3 billion square feet	26.7 kBtu per square foot	57.3 kBtu per square foot	1.11 quads	2.37 quads	\$22.5 billion
Total				2.08 quads	4.22 quads	\$43.8 billion

5.3 Water

Including water efficiency in beyond code programs not only conserves water resources but also has a financial benefit to the building owner/operator. The cost associated with the water-use reductions depends on the U.S. region. Regional variations are based on differences in irrigation requirements for landscape and regional cost differences for water and wastewater. Cost savings associated with indoor water efficiency measures are a combination of reducing the water consumed and reducing the amount of wastewater discharged. Water consumed outdoors does not incur wastewater charges; therefore, only costs associated with water supply are included.

5.3.1 Residential Construction

Residential construction that incorporates water efficient technology can significantly reduce water and wastewater costs. Water efficient homes can reduce overall residential water use by at least 15% compared to an average new home.¹⁴

Water efficient technologies and practices that gain this efficiency include the following:

- No detected leaks from any water-using fixture, appliances, or equipment
- Hot water delivery systems that minimize water waste

¹³ Average cost per MMBtu of delivered energy consumption was derived from Table 2 in Appendix A of AEO 2011 (EIA 2011).

¹⁴ Water savings potential of new homes is taken from the Environmental Protection Agency's WaterSense New Home Program (EPA 2011b).

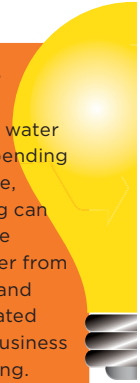
- WaterSense labeled high efficiency toilets that use no more than 1.28 gallons per flush (gpf)
- WaterSense labeled high efficiency urinals that use no more than 0.5 gpf
- WaterSense labeled high efficiency bathroom sink faucets that use no more than 1.5 gallon per minute (gpm)
- WaterSense labeled high efficiency showerheads that use no more than 2.0 gpm
- ENERGY STAR qualified clothes washers with a water factor of 6.0 gallons per cycle per cubic feet of capacity or less
- ENERGY STAR qualified dishwashers
- Evaporative cooling systems that do not exceed 3.5 gallons of water per ton-hour cooling
- Water softeners that are certified to meet NSF/ANSI 44 standards
- Drinking water treatment systems that are certified to meet applicable NSF/ANSI standards
- Outdoor water use that meets the requirements set in the 2009 WaterSense Single-Family New Home Specification, which includes efficient landscape design, limited turf area, efficient irrigation equipment, and smart controllers

Table 5.2 shows average household utility cost savings by region. These savings are estimated for a typical 2,400 ft² new home that is built to reduce water use by at least 15% indoors and 20% outdoors compared to baseline plumbing codes and other conventional water using equipment.¹⁵ It is assumed that the average household consumes the same amount of water for indoor tasks across the nation such as showering, dishwashing, and laundry. The range of potential water savings for a water efficient home is 7,600 and 14,200 gallons annually.

Table 5.2 – Potential Annual Savings for a Single Household Water and Wastewater Cost at 15% Indoor and 20% Outdoor Reduction

Region	Water Savings (Kgal)	Annual Water and Wastewater Cost Savings
Northeast	7.6	\$63
South	9.1	\$62
Midwest	7.8	\$47
West	14.2	\$77

¹⁵ Water savings potential of new homes is taken from the Environmental Protection Agency's WaterSense New Home Program (EPA 2011b).



Why are we flushing drinkable water down the toilet? Depending on your normal usage, rain-water harvesting can save 30 to 50% of the treated drinking water from the mains in houses and up to 80% of the treated drinking water in a business or commercial building. <http://www.savetherain.info/media-centre/rainwater-harvesting-faqs.aspx>

The added cost to a new home that incorporates water efficient features is minimal. High efficiency bathroom fixtures can have little or no incremental costs because these products are readily available on the market at a variety of different price points. In some cases, there may be a reduction in cost for water efficient landscaping. If a home includes native landscaping, irrigation equipment can be downsized or even eliminated. Based on information from EPA's WaterSense Program on incremental costs associated with WaterSense Homes, it is estimated that for new homes ranging between \$150,000 and \$250,000, the marginal cost of water efficient equipment varies between 0.4 and 1.7%.¹⁶

Taking into account average water and wastewater rates across the country and projected housing completions for single-family units,¹⁷ the table below shows projected regional utility savings from 2012 through 2020 if all new single-family homes are built to reduce water by 15% indoors and 20% outdoors compared to an average new home.

Table 5.3 – Cumulative Regional Water and Wastewater Savings from Reducing Residential Water Use by 15% Indoors and 20% Outdoors: 2012-2020

Region	Estimated Number of Homes Built	Total Water Savings by 2020 (Mgal/yr)	Total Water and Wastewater Cost Saved by 2020
Northeast	1,045	7,904	\$66 million
South	4,987	45,249	\$311 million
Midwest	1,585	12,341	\$75 million
West	1,990	28,326	\$153 million
TOTAL	9,608	93,820	\$605 million

5.3.1.1 Example: Vanguard Homes, Chapel Hill, North Carolina

Several examples of high efficiency home builders can be found on the WaterSense website. These builders illustrate that high performance homes can be built in a range of sizes, costs, and styles to match local demand.

The first home to be certified as WaterSense was built in Chapel Hill, North Carolina, by Vanguard Homes (shown in the figure below). In the first month,

Find WaterSense New Home Pilot Projects at http://www.epa.gov/watersense/spaces/home_pilot.html

¹⁶ Incremental cost information was developed from WaterSense Single-Family Home Specification Supporting Statement (EPA 2009b).

¹⁷ Projected housing completions are based on a 2010 baseline housing completion from the U.S. Census Office (http://www.census.gov/const/www/newresconstindex_excel.html (U.S. Census 2011)) and a slow recovery of the housing market through 2015 and then reflect escalation from the Energy Information Administration's Annual Energy Outlook through 2020 (<http://www.eia.gov/oiaf/archive/aeo10/index.html> (EIA 2010b)).

the homeowners only used 1,000 gallons of water, compared to 2,500 gallons per month in a typical Chapel Hill home.

Water efficiency features of this home include:

- High efficiency WaterSense labeled faucets
- High efficiency shower heads
- WaterSense labeled dual-flush toilet
- Recirculating hot water delivery system
- ENERGY STAR qualified dishwasher and clothes washer
- Efficient landscape design and irrigation

5.3.2 Commercial Construction

Water efficiency in commercial buildings is gaining ground through sustainable building codes and standards. ASHRAE 189.1, IgCC, and GPMCS are examples of codes and standards that incorporate a comprehensive approach to building water efficiency, including the following areas:

- High efficiency plumbing products:
 - High efficiency toilets
 - High efficiency urinals
 - High efficiency faucets
 - High efficiency showerheads
- High efficiency commercial kitchen equipment:
 - High efficiency pre-rinse spray valves
 - ENERGY STAR qualified commercial dishwashers
 - ENERGY STAR qualified ice makers
 - Efficient combination ovens and food steamers
- High efficient medical and laboratory equipment:
 - Steam sterilizers with tempering water controls
 - Efficient x-ray film processing equipment
 - Efficient vacuum pumps
- Sub-metering
- Efficient landscape and irrigation:
 - Limited turf
 - Native and climate appropriate landscape
 - Efficient landscape design
 - Efficient irrigation equipment
 - Advanced controls
- Cooling tower water management requirements

> A conservative estimate of savings potential for a new commercial office building is 20% compared to a conventionally constructed office building.

Unlike residential construction, there is limited comprehensive data on water use and savings in commercial construction. Therefore, the savings potential of a typical medium-sized commercial office building (50,000 ft²) and a typical large commercial office building (100,000 ft²) are presented here as examples of possible water savings for water efficient commercial buildings. The savings potential is based on indoor water-consuming equipment, water used in cooling, and landscape irrigation. Based on these uses, a typical office building consumes between 26 and 35 gallons of water per square foot per year.¹⁸

A conservative estimate of savings potential for a new commercial office building is 20% compared to a conventionally constructed office building. The annual water savings potential of a medium-sized office building is 260,000 gallons. A typical large size office building can save 520,000 gallons annually. Table 5.4 shows the potential cost savings associated with this annual water and wastewater savings for regions in the U.S. Energy used by heating water in commercial buildings is minimal compared to other energy load demands; therefore, energy cost savings are not included in Table 5.3.

Table 5.4 – Potential Water and Wastewater Cost Savings for Medium and Large Size Commercial Office Buildings with 20% Water Reduction Compared to a Standard New Building

Region	Medium Size Annual Cost Savings	Large Size Annual Cost Savings
Northeast	\$1,356	\$2,711
South	\$1,280	\$2,559
Midwest	\$1,018	\$2,036
West	\$1,249	\$2,498

Recycling one glass bottle saves enough energy to light a hundred-watt light bulb for 4 hours, power a computer for 30 minutes, or power a TV for 20 minutes. Every ton of paper made from recycled materials saves roughly 7000 gallons of water. Source: Glass Packaging Institute <http://www.gpi.org/>, EPA <http://www.epa.gov/>, Worldwatch Institute <http://www.worldwatch.org/>

5.4 Materials Conservation and Waste Avoidance

In addition to energy and environmental benefits, material conservation and waste avoidance can have economic benefits to builders and building occupants by reducing construction and demolition costs in new buildings or renovations (for both purchase of materials and disposal of construction waste) and waste disposal costs from building operations. For example, Boulder Community Hospital incorporated a waste minimization and recycling plan when it built a new hospital and was able to divert 64% of its construction waste. The hospital also has a strong recycling plan, which is achieving significant cost savings through waste minimization and recycling programs (SWEEP 2004).

¹⁸ Water use estimate for office buildings is from Dziegielewski, B. et al. 2000.

5.4.1 Cost of Disposal

The cost of disposing MSW varies greatly depending on location in the United States. Landfills typically charge fees for waste disposal, commonly referred to as “tipping fees” or “gate rates.” In 2008, the national average landfill tipping fee was \$42 per ton; Oklahoma had the lowest with a tipping fee of \$15 per ton, and Virginia had the highest reported rate at \$96 per ton (Arsova et al. 2008). Recycling programs are sometimes funded in part by landfill tipping fees, so waste diversion may not result in avoiding the entire tipping fee; however, institutionalizing a comprehensive pollution prevention program will likely result in cost savings from avoided landfill tipping fees, especially in areas with high tipping fees.

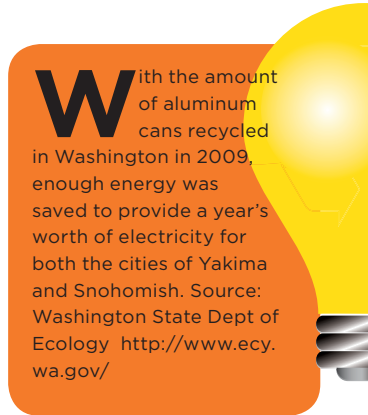
Waste diversion programs become especially important in communities where landfills are filling up and nearing end of life. While expanding or building new landfills is an option, it is often expensive. For example, in Defiance, Ohio, costs to expand an existing landfill were estimated at \$400,000 per acre, or approximately \$6 million for the planned initial six-acre expansion (Defiance County 2007). Especially in urban communities, space may not be available for landfill expansion or construction; instead, waste would have to be hauled to rural areas, which would result in high transportation costs and additional environmental impacts.

5.4.2 MSW Diversion through Recycling

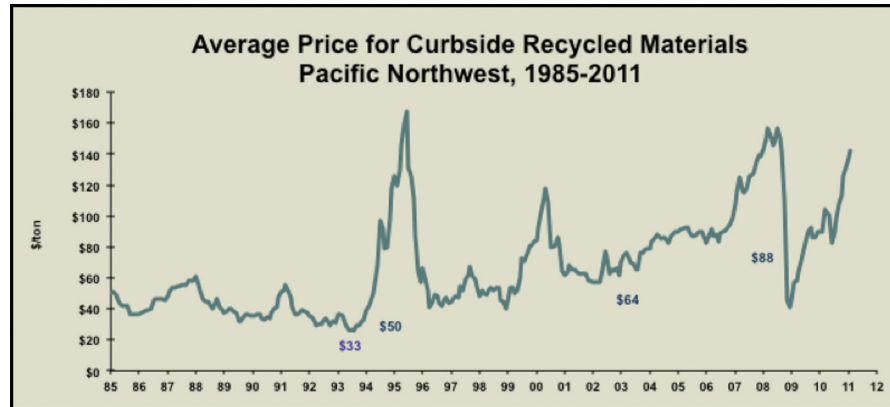
Recycling has environmental benefits at every stage in the life cycle of a consumer product—from the raw material with which it’s made to its final method of disposal. Aside from reducing greenhouse gas emissions, which contribute to global warming, recycling also reduces air and water pollution associated with making new products from raw materials. Recycling can also benefit the economy and create jobs (EPA 2011d).

Nationally, 82 million tons of MSW were recycled and composted in 2009 (EPA 2009a). Benefits from these practices include reduced costs for landfill disposal and reduced greenhouse emissions. Additional benefits from recycling include cleaner land, air, and water, overall better health, and a more sustainable economy.

In addition to savings through disposal avoidance, recycled material can be sold as a resource, providing a revenue stream to help pay recycling program costs. Depending on location, type of material, and market demand, the value of these resources will vary. The figure below shows the average yearly market value for curbside recycled materials in Washington State (SRMG 2011).



With the amount of aluminum cans recycled in Washington in 2009, enough energy was saved to provide a year's worth of electricity for both the cities of Yakima and Snohomish. Source: Washington State Dept of Ecology <http://www.ecy.wa.gov/>



While the price risk to recyclers has been significantly reduced over the past 25 years, recycling markets will always be vulnerable to system-wide economic shocks such as the one that occurred in late 2008. Improved resiliency against cyclical downturns is primarily due to upward trends in market prices for recycled materials such as mixed paper and plastic bottles.

As mentioned in Chapter 4, the success of recycling programs depends on the available markets in a community. In remote locations that do not have easy access to recycling markets, transportation costs can make recycling of some materials cost-prohibitive. Collaborating as a community to bring more markets into the area and/or to gain economies of scale is one solution that could help to overcome this barrier.

5.5 Health Benefits

The health benefits of green building can include improved IEQ and healthy active lifestyles due to siting options. The measures, included in green building, contribute to improved health and healthier lifestyles through development of walkable and bike-friendly communities and an increased focus on IEQ.

Although the benefits of improved IEQ are harder to quantify than the benefits of elements such as energy or water, studies have shown that buildings with good overall environmental quality can reduce the rate of respiratory disease, allergy, asthma, and sick building symptoms, and enhance worker performance. The potential financial benefits of improving indoor environments exceed costs by a factor of 8 and 14 (CalRecycle 2011).

Furthermore, as discussed in the *LEED Reference Guide for Green Building Design and Construction* (2009 Edition), IEQ overview, a few additional statistics warrant listing:

- Improved ventilation affects employee attendance and productivity, which could result in ~283% return on investment associated with increased ventilation in less than 6 months.

Studies have shown that residents of walkable communities are 2.4 times more likely to get 30 minutes a week of physical activity than residents of neighborhoods without walkable features. (Ewing & Kreutzer, 2006)

- Allowing the building occupants to control individual lighting and area thermostats can improve their comfort and productivity, while saving energy.
- Natural daylight can increase productivity and decreases absences and illness.
- Building occupants with views to the outside can have an increased sense of well-being, increased productivity, and increased job satisfaction.

Both the indirect cost savings and the physical and mental benefits to the building occupants make the IEQ elements an important consideration for all beyond code programs.

6

Resources

> USGBC's 12 Steps to a Greener Community states, "As the green movement continues to gain momentum, cities across the country are asking what they can do to become greener and more sustainable. There are many ways to define a sustainable city, but it is up to each community to create its own vision of what sustainability means to the people who live there and which specific goals they wish to achieve."

This chapter provides a list of resources for states and jurisdictions working with beyond code programs, providing an opportunity to learn from those who have gone before and from other established resources.

A comprehensive list of all programs referenced in this guide, including contact information, is included in Appendix E. For a current list of programs adopted nationwide, visit www.energycodes.gov/greenbuilding.

Technical Resources

COMMUNITY PLANNING

For information and guidance on getting started, we recommend the following resources:

EPA Sustainable Design and Green Building Toolkit for Local Governments

<http://www.epa.gov/region4/recycle/green-building-toolkit.pdf>

The toolkit addresses the local codes or ordinances that affect the design, construction, renovation, and operation and maintenance of a building and its immediate site. It contains an assessment tool, a resource guide, and a guide to developing an action plan for implementing changes to the permitting process.

Developing Green Building Programs: A Step-by-Step Guide for Local Governments by Global Green USA

<http://www.globalgreen.org/docs/publication-71-1.pdf>

Key questions to consider are identified: What general policies already support or are complementary to green building?

SITE SUSTAINABILITY - AN ESSENTIAL FIRST STEP

Site selection will determine access to public transportation, parks and recreation, bike paths and walkways, and whether environmentally sensitive areas are avoided. Site sustainability is a major consideration in planning, and there are several resources available at a national and regional level:

EPA Sustainable Redevelopment of Brownfields Program

<http://www.epa.gov/brownfields/>

This is a comprehensive website on brownfields that includes projects, initiatives, tools, tax incentives, and other resources to address brownfield remediation and redevelopment.

Environmental Law Institute, Brownfields Center

<http://www.brownfieldscenter.org/big/about.shtml>

The Environmental Law Institute's Brownfields Center provides information on brownfields cleanup and redevelopment, with a focus on the concerns and needs of community groups across the country.

Prince George County LID Manual: Low-impact Development Design Strategies

<http://www.epa.gov/owow/nps/lid/lidnatl.pdf>

The Prince George's County, Maryland, Department of Environmental Resources pioneered several tools and practices in this field, which strive to achieve good environmental designs that also make good economic sense. The purpose of this manual is to share some of their experiences, and show how low-impact development can be applied on a national level.

EPA - Green Infrastructure/Low Impact Development

<http://www.epa.gov/owow/NPS/lid/>

The EPA has a number of tools and resources that are useful when considering low-impact development approaches to site designs.

Low Impact Development Center

<http://www.lowimpactdevelopment.org/about.htm>

The Low Impact Development Center is a non-profit organization dedicated to the advancement of low-impact development technology. Low-impact development is a comprehensive land planning and engineering design approach with a goal of maintaining and enhancing the pre-development hydrologic regime of urban and developing watersheds.

ENERGY, WATER, AND INTEGRATED DESIGN

Energy Performance of LEED® for New Construction Buildings

http://www.newbuildings.org/sites/default/files/Energy_Performance_of_LEED-NC_Buildings-Final_3-4-08b.pdf

This New Buildings Institute report “analyzes measured energy performance for 121 LEED New Construction (NC) buildings, providing a critical information link between intention and outcome for LEED projects. The results show that projects certified by the USGBC LEED program average substantial energy performance improvement over non-LEED building stock.”

ENERGY STAR

<http://www.energystar.gov/>

ENERGY STAR is a joint program of the EPA and DOE that promotes energy-efficient buildings, products, and practices. Learn about Versions 2.5 and 3.0 and the new integration of energy, water, and indoor air quality.

ENERGY STAR Tools and Resources

http://www.energystar.gov/index.cfm?c=tools_resources.bus_energy_management_tools_resources

Building America

http://www1.eere.energy.gov/buildings/building_america

This is an industry-driven research program, sponsored by DOE, designed to accelerate the development and adoption of advanced building energy technologies in new and existing homes.

Advanced Energy Design Guide Series

<http://www.ashrae.org/technology/page/938>

The AEDG series provides a sensible approach to easily achieving advanced levels of energy savings without having to resort to detailed calculations or analysis. The four-color guides offer contractors and designers the tools, including recommendations for practical products and off-the-shelf technology, needed for achieving a 30-50% energy savings compared to buildings that meet the minimum requirements of ANSI/ASHRAE/IESNA Standard 90.1-1999. The energy savings targets of 30 and 50% are the first step toward achieving a net-zero energy building, which is defined as a building that, on an annual basis, draws from outside resources equal or less energy than it provides using on-site renewable energy sources.

Alliance for Water Efficiency

<http://www.allianceforwaterefficiency.org/>

This stakeholders-based national organization serves as an authoritative advocate for water efficiency and sustainable use of water. The Alliance promotes water efficiency through educational outreach and technical resources.

American Water Works Association (AWWA)

<http://www.awwa.org/>

This international nonprofit scientific and educational society is dedicated to the improvement of drinking water quality and supply. AWWA also runs the Water Wiser website (<http://www.awwa.org/Resources/Waterwiser.cfm?navItemNumber=1561&showLogin=N>), which provides comprehensive information on water efficiency to consumers and utilities.

EPA WaterSense

<http://www.epa.gov/WaterSense/>

WaterSense is partnership labeling program, sponsored by the EPA, that helps consumers identify water efficient products.

The Texas Manual on Rainwater Harvesting

http://www.twdb.state.tx.us/publications/reports/RainwaterHarvestingManual_3rdedition.pdf

This manual explains the methods to capture, store, and use rainwater.

Whole Building Design Guide

<http://www.wbdg.org/>

This website provides significant guidance on integrated design and specific design elements for the whole building.

NAHB Research Center - TOOLBASE.ORG

<http://www.toolbase.org/index.aspx>

The NAHB Research Center's ToolBase.org is a resource for technical information on building products, materials, new technologies, business management, and housing systems.

National Green Building Codes and Programs Contacts and Resources

International Code Council (ICC)

500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001
1-888-ICC-SAFE (1-888-422-7233)

<http://www.iccsafe.org>

The International Code Council (ICC) is a membership association dedicated to building safety and fire prevention. ICC develops the codes and standards used to construct residential and commercial buildings, including homes and schools. ICC is the publisher of the International Energy Conservation Code. They are a resource for code books and training. Local chapters are active in most states. ICC is the publisher of the ICC 700-2008 National Green Building Standard and the International Green Construction Code, currently under development in conjunction with the American Society for Testing and Materials (ASTM) and the American Institute of Architects.

The ICC 700-2008 National Green Building Standard defines green building for single- and multi-family homes, residential remodeling projects, and site development.

The International Green Construction Code (IgCC) is currently under development. The IgCC will be applicable to all new construction and renovations to existing buildings other than residential structures. It will effectively mesh with the other ICC codes for ease of adoption with building regulations based on the ICC codes. It is performance-based and allows adopting entities to determine which provisions of the code are applicable to their needs. Covered issues are siting, materials, energy, air quality, and water, not only in the design and construction phase, but through commissioning and actual operation of the building.

ASHRAE

1791 Tullie Circle, NE
Atlanta, GA 30329
1-800-527-4723 (customer service, toll-free in U.S. and Canada only)
404-636-8400

<http://www.ashrae.org>

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is an international membership organization for advancing heating, ventilation, air conditioning, and refrigeration through research, standards writing, publishing, and continuing education. They are a resource for standards, education, research, and training. Local chapters are active throughout the country. ASHRAE is the publisher of Standard 90.1 and 189.

ASHRAE 189, Standard for the Design of High-Performance, Green Buildings Except Low-Rise Residential Buildings, was published in January 2010. The standard was developed in conjunction with the Illuminating Engineering Society of North America (IES) and USGBC and is applicable to new commercial buildings and major renovation projects. This code addresses energy efficiency, a building's impact on the atmosphere, sustainable sites, water-use efficiency, materials and resources, and indoor environmental quality. ASHRAE/IES/USGBC Standard 189 was developed for inclusion into building codes.

U.S. Green Building Council

2101 L Street NW
Suite 500
Washington, DC 20037

<http://www.usgbc.org>

U.S. Green Building Council (USGBC) is a nonprofit organization responsible for LEED, or Leadership in Energy and Environmental Design, the internationally-recognized green building certification system. LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations, and maintenance solutions. The LEED rating systems are developed through an open, consensus-based process led by LEED committees, diverse groups of volunteers representing a cross-section of the building and construction industry. Key elements of the process include a balanced and transparent committee structure, technical advisory groups that ensure scientific consistency and rigor, opportunities for stakeholder comment and review, member ballot of new rating systems, and fair and open appeals.

The USGBC website provides research on a wide range of topics related to sustainable construction and development, not limited to those associated with LEED.

New Buildings Institute (NBI)

White Salmon Office
P.O. Box 2349 (USPS)
142 East Jewett Boulevard (shipping)
White Salmon, WA 98672
509-493-4468
509-493-4078 (fax)

Vancouver Office
1601 Broadway Street
Vancouver, WA 98663-3435
360-567-0950
360-213-1065 (fax)

<http://www.newbuildings.org>

<http://www.advancedbuildings.org>

New Buildings Institute (NBI) is a nonprofit organization working to improve the energy performance of commercial buildings. NBI works collaboratively with commercial building market players—governments, utilities, energy efficiency advocates, and building professionals—to remove barriers to energy efficiency, including promoting advanced design practices, improved technologies, public policies, and programs that improve energy efficiency.

NBI, in partnership with Advanced Buildings, publishes the Core Performance Guide. Core Performance is a direct, simplified approach to achieve predictable energy savings in small- to medium-sized buildings without the need for modeling. Core Performance brings together over 30 criteria defining high performance in building envelope, lighting, HVAC, power systems, and controls. With its well-organized and easy-to-use guide, building design and construction professionals will gain access to quantitative and descriptive specifications for exceeding state and national energy standards such as ASHRAE 90.1-2007 by up to 25%.

DOE Building Energy Codes Program (BECP)

<http://www.energycodes.gov>

DOE Building Energy Codes Program is an information resource on national energy codes and green building programs. They work with other government agencies, state and local jurisdictions, national code organizations, and industry to promote stronger building energy codes and help states adopt, implement, and enforce those codes.

National Contacts and Resources

American Council for an Energy-Efficient Economy

529 14th Street NW
Suite 600
Washington, DC 20045
202-507-4000
202-429-2248 (fax)

<http://www.aceee.org>

American Council for an Energy-Efficient Economy (ACEEE) is a nonprofit, 501(c)(3) organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security, and environmental protection. Projects are carried out by ACEEE staff and collaborators from government, the private sector, research institutions, and other nonprofit organizations.

Building Codes Assistance Project (BCAP)

<http://www.bcap-ocean.org>

Building Codes Assistance Project (BCAP) is an initiative of the Alliance to Save Energy, ACEEE, and the Natural Resources Defense Council that provides states with code advocacy assistance on behalf of DOE.

Regional Energy Efficiency Partnerships

Most states belong to a regional code organization that will support their efforts to advance building codes.

Southwest Energy Efficiency Project (SWEET)

2260 Baseline Road, #212
Boulder, CO 80302
303-447-0078
info@swenergy.org (for general requests)

<http://www.swenergy.org>

Southwest Energy Efficiency Project (SWEET) is a regional non-profit organization that promotes greater energy efficiency in a six-state region that includes Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming and facilitates regional partnerships. Their programs include buildings and energy codes, utilities, transportation, industrial efficiency, and combined heat and power.

Northeast Energy Efficiency Partnerships (NEEP)

91 Hartwell Avenue
Lexington, MA 02421
781-860-9177

<http://www.neep.org>

Northeast Energy Efficiency Partnerships (NEEP) is a regional non-profit organization that facilitates regional partnerships to advance the efficient use of energy in homes, buildings, and industry in the Northeast states of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont, and the Mid-Atlantic states of Pennsylvania, Delaware, and Maryland, and Washington, DC.

Midwest Energy Efficiency Alliance (MEEA)

645 North Michigan Avenue
Suite 600
Chicago, IL 60611
312-587-8390

<http://www.mwalliance.org>

Midwest Energy Efficiency Alliance (MEEA) is a regional non-profit organization that facilitates regional partnerships. As a central source for information and action, MEEA raises awareness, facilitates energy efficiency programs, and strengthens policy across the Midwest region, including the states of Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

Northwest Energy Efficiency Alliance (MEEA)

529 SW Third Avenue
Suite 600
Portland, OR 97204
1-800-411-0834 (toll-free)
503-827-8416

<http://www.nwalliance.org>

Northwest Energy Efficiency Alliance (NEEA) is a regional non-profit organization that facilitates regional partnerships. NEEA's mission is to mobilize the Northwest to become increasingly energy efficient for a sustainable future. NEEA works with the states of Washington, Idaho, Montana, and Oregon.

Southeast Energy Efficiency Alliance (SEEA)

P.O. Box 13909
Atlanta, GA 30324
1-866-900-7332 (toll-free)
404-931-1518

<http://www.seealliance.org>

Southeast Energy Efficiency Alliance (SEEA) is a regional non-profit organization that facilitates regional partnerships to promote and achieve energy efficiency through networking, program activities, and education. SEEA is active in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

Appendix A: Acronyms & Abbreviations

AEDG	Advanced Energy Design Guide
AEO	Annual Energy Outlook
AFUE	annual fuel utilization efficiency
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BCAP	Building Codes Assistance Project
CGHP	Chicago Green Homes Program
DOE	U.S. Department of Energy
ESBMIR	City of Evanston Sustainable Building Measures for Interior Renovations
EPA	U.S. Environmental Protection Agency
ES	ENERGY STAR for New Homes
FAR	floor-area-ratio
FGHS	Florida Green Home Standard
GPMCS	Green Plumbing and Mechanical Code Supplement
GRBP	Green Residential Building Program
HERS	Home Energy Rating System
HVAC	heating, ventilation, and air-conditioning
IAPMO	International Association of Plumbing and Mechanical Officials
IBACOS	Integrated Building and Construction Solutions
IBC	International Building Code
ICC	International Code Council
IDL	Integrated Design Lab
IECC	International Energy Conservation Code

IEQ	Indoor Environmental Quality
IES	Illuminating Engineering Society of North America
IgCC	International Green Construction Code
IMC	International Mechanical Code
IRC	International Residential Code
LEED AP	LEED Accredited Professional
LEED	Leadership in Energy and Environmental Design
MERV	minimum efficiency reporting value
MSW	municipal solid waste
NAHB	National Association of Homebuilders
NBI	New Building Institute
NEAA	Northwest Energy Efficiency Alliance
NGBS	National Green Building Standard
NZW	net-zero waste
PPN	Pinoleville Pomo Nation
PUD	planned unit development
PV	photovoltaic
RESNET	Residential Energy Services Network
SCI	Sustainable Community Index
SEER	seasonal energy efficiency ratio
SHGC	solar heat gain coefficient
SIPS	structural insulated panels
SWEEP	Southwest Energy Efficiency Project
USGBC	U.S. Green Building Council

Appendix B: Sample Checklist

City of Hayward, CA

For All Non-Residential Projects That Exceed 1,000 Square Feet

http://www.hayward-ca.gov/news/pdf/2009/COH_Green_Building_Checklist.pdf



Attachment XIII

City of Hayward Green Building Checklist for Private Non-Residential Development

For All Non-Residential Projects That Exceed 1,000 Square Feet

Energy Efficiency

For all non-residential projects entailing 1,000 square feet or more of new or remodeled space, and where at least half of the light fixtures are new or replaced, one of the following must be met:

- ☐ 1. the lighting load for such fixtures shall be reduced by at least 15% below 2008 Title 24 Building Energy Efficiency Standards, or
- 2. 15% of the lighting loads of such fixtures shall be provided by solar, wind, or other renewable energy source, as approved by the Building Official, or
- 3. the project must show compliance for overall energy budget at 5% below 2008 Title 24 Building Energy Efficiency Standards, using the performance method.

Note:

When tailored method is used for retail sales lighting compliance, such 15% reduction shall apply only to LTG-6-C part 1, but not to LTG-6-C parts 2 & 3 for display lighting.

Background on Energy Efficiency:

According to the U.S. Department of Energy, buildings use about 68% of the electricity generated in the country on an annual basis. The California Energy Commission estimates that about one third of the energy used in commercial buildings is dedicated to lighting. This makes commercial lighting one of the single biggest energy users nationally. Reducing lighting power demand is an essential step in making buildings "green".

The California Energy Commission establishes the maximum allowed lighting power for commercial buildings and the city enforces this through the T-24 energy report. All designers and contractors are familiar with the process of calculating the allowed lighting power for a project.

This measure is based on *LEED Energy and Atmosphere Credit 2*. In the LEED system, however, the renewable energy percentage is only based on the total electricity demand of the building.

Water Conservation

For non-residential projects entailing 1,000 square feet or more of new or remodeled space, and where a new bathroom is proposed or a bathroom is proposed to be remodeled and involves new water closets or urinals:

- ☐ Reduce indoor water use by 20% below baseline, per 2007 California Plumbing Code, for each water closet or urinal that is installed or replaced

Note of the design process:

Instead of 1.6 gallons per flush (gpf) toilets/water closets, 1.28 gpf units shall be installed. For urinals, either 0.5 gpf or waterless units shall replace the standard 1.0 gpf units.

Background on Water Efficiency:

Reducing water use in commercial buildings is relatively easy to achieve. Technologies such as waterless urinals*, occupant sensors and ultra low-flow toilets are available and provide instant savings. This measure is based on the LEED Water Efficiency Credit 2. In the LEED system additional credit is given for a 30% reduction as well. For the Hayward ordinance it will probably be sufficient to start with a 20% reduction initially and see if a higher threshold is appropriate at a later time.

Waterless Urinals: These units utilize a trap insert filled with a sealant liquid instead of water. The lighter-than-water sealant floats on top of the urine collected in the U-bend, preventing odors from being released into the air. Although the cartridge and sealant must be periodically replaced, the system saves anywhere between 15,000 and 45,000 gallons of water per urinal per year.

January 2009

Appendix C: 2011-2012 Lecture Series City of Scottsdale, AZ

Anthony Floyd, *senior building consultant*, (480) 312-4202, afloyd@ScottsdaleAZ.gov
<http://www.scottsdaleaz.gov/Assets/Public+Website/greenbuilding/GB+Lecture+Series+2011-2012.pdf>



Green Building Lecture Series

Anthony Floyd, senior building consultant, (480) 312-4202, afloyd@ScottsdaleAZ.gov

- September 1, 2011 – What Happens When Green Becomes Code? Scottsdale City Council recently adopted the International Green Construction Code (IgCC) as the core of the city's voluntary Commercial Green Building Program. Learn about the IgCC and how it will make it easier for developers of commercial and multi-family housing to "go green."
- October 6, 2011 – Energy Efficiency Technologies: Can advances in technologies reduce or even reverse negative impacts on our natural resources and environment? Hear about new and cutting-edge technologies that reduce our energy consumption, curtail our reliance on external energy sources and lower our energy bills.
- November 3, 2011 – Sustainable Cities: Can cities exist in balance with our Sonoran desert ecosystem? Scottsdale planning staff will discuss on-going efforts to protect our desert ecology, mitigate the urban heat island effect, increase pedestrian connectivity, enhance bicycle mobility, support urban compact development, and minimize nighttime light pollution.
- December 1, 2011 – Rainwater and Graywater: Is there enough annual rainfall in the desert to collect and reuse? Is rainwater the same as stormwater? What is graywater and what can we do with it? Learn about successful rainwater harvesting and graywater projects and what you can do to reduce demand on the desert's most precious resource.
- February 2, 2012 – Green Neighborhoods: Green isn't just about buildings. Hear about efforts to create compact, walkable, mixed-use neighborhoods and spaces that encourage social interaction. Explore community gardens that promote a sense of community and physical activity while providing access to fresh, locally grown produce.
- March 1, 2011 – Cooling and Heating Options for Your Home: Did you know that 43% of all electricity consumed in Phoenix metro area homes is used for air conditioning? How can you improve the comfort of your home and reduce the energy required to cool and heat? Find out about new and alternative cooling and heating systems. Learn how to improve your existing system.
- April 5, 2012 – Water Saving Technologies: Did you know that 70% of city-supplied potable water is used primarily for landscape irrigation and 30% of the remainder is used for flushing toilets? Learn about EPA's WaterSense plumbing products and irrigation technologies that can reduce your water consumption by 20-30%. Obtain landscaping tips to reduce irrigation needs while providing a healthy and beautiful environment.
- May 3, 2012 – Indoor Environmental Quality and Healthy Homes: Air pollutant levels inside an energy efficient tightly-sealed home can be six times higher than outdoor levels. Learn strategies to improve indoor environmental quality and well-being, including tips on material selection, green labeling, fresh air ventilation, filtration and daylighting.
- June 7, 2012 – Innovative Green Projects in the Valley: Are you ready for the future? Explore innovative and trendsetting projects that excel in energy efficiency, material resources, water reuse, and unique building design solutions.

The lectures are free and open to the public. RSVPs are not needed. For more information, call (480) 312-3111 or visit www.scottsdaleaz.gov/greenbuilding/lectures.

To receive a reminder about these and other Green Building Events, subscribe at <http://eservices.scottsdaleaz.gov/listserve/>

Appendix D: Standard Operating Procedures Pima County, AZ

<http://www.pimaxpress.com/Documents/Green/Permitting%20of%20Green%20Building%20structures.pdf>

	STANDARD OPERATING PROCEDURE BUILDING SAFETY & SUSTAINABILITY	Number: 410.4
Approval:	Yves Khawam 	Effective Date: March 1, 2008
Subject: Permitting of Green Building structures		Page 1 of 3

1.0 PURPOSE:

This document provides for permitting within Pima County *Green Building Programs* as well as facilitation of *sustainable projects*.

2.0 REVISION HISTORY:

Revised from March 19, 2007 to include criteria for the *Green Building programs*.

3.0 PERSONS AFFECTED:

Green Building Program and *sustainable projects* stakeholders, permitting and inspection staff.

4.0 ADMINISTRATIVE POLICY:

This document establishes procedures for *Green Building Programs*. Additionally, since *Green Building programs* and *sustainable projects* are in the best interest of Pima County, it is deemed a priority to identify potential conflicts between sustainable practices and adopted code text or interpretation. In order to facilitate this identification process, it is requested that all such conflicts be brought to the attention of the Green Building Program Manager prior to rejecting the project so as to coordinate facilitation. As such we will be able to leverage greater impact on mitigating conflicting interpretations or requirements.

5.0 DEFINITIONS:

Green Building Programs shall be defined as programs for which Pima County has created a rating system and through which buildings may obtain a green building certificate, issued by the County, upon successfully meeting certain established criteria. To date programs have been developed for new residential as well as residential remodeling.



BUILDING SAFETY & SUSTAINABILITY STANDARD OPERATING PROCEDURE
CONTINUATION SHEET

Number: 410.4

Page 2 of 3

Sustainable projects shall be defined as construction striving to enhance or mitigate: functionality, energy and water efficiency, quality of indoor environment, waste management, air emissions, site disturbance, and storm water management. These projects shall not be submitted for certification under the County Green Building programs but shall be aligned with nationally recognized green building standards.

6.0 RESPONSIBILITIES:

It is the responsibility of all permitting staff to report potential conflicts between sustainable practices and adopted code to the Green Building Program Manager.

7.0 PROCEDURES:

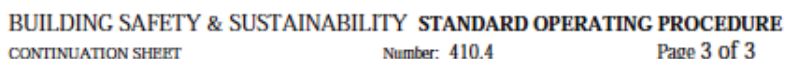
7.1 Public Service Staff

Upon client statement that the submitted project either qualifies for a *Green Building Program* or as a *sustainable project*, Public Service staff shall both select the appropriate "green/sustainable" Identifier in the permitting system base screen [GB Res New; GB Remodel; Sustainable Project] as well as enter a notice in L/H/N stating: "Contact Green Building Program Manager if code conflicts."

For permits enrolled in a *Green Building Program*, an electronic copy of the appropriate program rating system will need to be completed by the client and attached to the permit through OfficeDoc by Public Service staff. If the client has an electronic copy of the rating system at the time of permit application, staff will attach the file during the permit initiation transaction. If the client does not have an electronic copy with him/her, it will be requested that one be emailed to WPermit@DSD.Pima.Gov. This email box will be checked daily and files will be attached to the permit upon receipt.

7.2 All permitting review staff

Prior to rejecting or requesting corrections on a project for reasons which may pertain to code conflicts regarding a sustainable item, the reviewer is requested to contact the Green Building Program Manager in order to document the type of code conflicts and implement proactive strategies to minimize impacts to clients.



Upon successful approval of final inspections, receipt of contractor submittals and signed verification statements, the Green Building Program staff shall issue a green building certificate, authorize the client to purchase a plaque if so desired, and post the final green building rating system on the County web site for public access.

Appendix E: Program Reference Matrix

Includes all programs listed in this guide, for a more comprehensive list of programs adopted nationwide, visit www.energycodes.gov/greenbuilding.

	Description	Sustainability Elements Addressed	Incentives
Arizona, Chandler Green Building Program 2008 http://www.chandleraz.gov/default.aspx?pageid=873 Commercial, Multi-Family, Municipal Voluntary	Modification of building and zoning codes, creation of green building standards, incentives for green building certification, and city commitments. This program focuses on whole community. Changes to the general plan and zoning, requirements for LEED municipal buildings, and adoption of the 2006 IECC will result in mandatory changes, while incentives to promote LEED in private commercial developments encourage voluntary changes.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☒ Money ☒ Education ☒ Marketing
Arizona, Pima County Residential Green Program http://www.pimaxpress.com/green/ Residential Voluntary	Pima County's comprehensive, point based program is voluntary. Home size determines the number of points needed to achieve each level of certification. Plan review and inspection of program elements are fully integrated into the standard permitting and inspection process. The program is designed to coordinate with ENERGY STAR, utility incentive programs, and EPA's Home program. A parallel commercial program is under development. Pima County adopted an amended 2006 IECC.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☐ Money ☐ Education ☒ Marketing
California California Green Building Standards Code, EFFECTIVE www.bsc.ca.gov Commercial, Multi-Family, Municipal, Residential Both	The new California Green Buildings Standards Code, published as Part 11 of the California Code of Regulations, Title 24, covers residential and commercial buildings, schools, health facilities, and state buildings. It includes standards for planning and design, energy efficiency, water efficiency and conservation, material conservation and resource efficiency, and environmental quality. The Code includes both performance-based and prescriptive elements, such as requiring a 15% reduction in energy use compared with current standards and requiring the use of ENERGY STAR appliances. The code also requires new buildings to be dual plumbed for potable and recycled water systems for toilet flushing when recycled water is available. These requirements are currently optional. Following the next building code revision cycle in 2010, many of the optional standards will become mandatory. This adjustment period is intended to allow for industry and local enforcement agencies to prepare for, comply with, and test the new standards. After 2010, the Code will be updated annually to incorporate the latest construction methods and technology.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing

	Description	Sustainability Elements Addressed	Incentives
California, Hayward Private Development Green Building Ordinance of the City http://www.hayward-ca.gov Commercial, Multi-Family, Municipal, Residential Mandatory	Single-family and multi-family projects must be GreenPoint Rated, remodels and additions greater than 500 ft ² must submit GreenPoint Rated Existing homes checklist. Commercial projects must follow Hayward's checklist for Private Non-Residential Development.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
California, Palo Alto Green Building Ordinance, 2008 Commercial, Multi-Family, Residential Mandatory	Palo Alto's mandatory program address residential and non-residential projects. Residential projects achieve Build it Green/Green Points Certification and be certified by Build it Green/Green Points Rater, or verified by the city, depending on project size. Non-residential projects must achieve LEED certification - smaller projects are verified by the city, larger must be registered and verified with USGBC.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Colorado, Boulder County BuildSmart Program, 2008 http://www.bouldercounty.org/live/property/build/pages/buildsmarthome.aspx Mandatory	This mandatory program focuses on energy and water efficiency as well as recycling and reuse of building materials. Level of compliance is tied to the square footage of the residence. A commercial program is under development	☒ House Size ☐ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Colorado, Eagle County EcoBuild Checklist http://www.eaglecounty.us/departments/content.aspx?id=921&terms=Ecobuild Commercial, Multi-Family, Residential Mandatory	Eagle County's comprehensive, point based program is mandatory. Home size determines the number of points needed to achieve each level of certification. Plan review and inspection of program elements is fully integrated into the standard permitting and inspection process. Buildings exceeding minimum standards are eligible for rebates.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☒ Money ☒ Education ☐ Marketing
Colorado, Eagle County Sustainable Community Index http://www.eaglecounty.us/departments/content.aspx?id=3394&terms=sustainable%20community%20index Commercial, Multi-Family, Residential Mandatory	The index is a tool used to assess all planned unit developments (PUD), PUD amendments, final plats, major special use permits, and zone changes. The points based index addresses: Site and location, Connections and uses, Transportation, and Resource efficiency. Each project must meet a pre-determined point threshold for approval. The SCI promotes mixed use, transit-oriented, new urbanist, form-based, pedestrian- and environmentally-friendly, clustered, infill development, and is a required finding for new development proposals reviewed by the Board of County Commissioners.	☐ House Size ☐ Site Selection ☒ Landscaping ☒ Water Conservation ☐ Energy Conservation ☐ Materials and Resources ☐ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education ☐	☐ Time ☐ Money ☐ Education ☐ Marketing ☐
Colorado, Fort Collins Green Building Code, 2011 http://www.fcgov.com/greenbuilding/codes/ Commercial, Residential Mandatory	Fort Collins' Green Building Program was created to help align Fort Collins with the community's goals for carbon emission reduction, energy efficiency, and water conservation. The city has developed green building amendments for commercial and residential projects that will increase resource, energy and water efficiency and conservation, indoor environmental quality, outdoor environmental quality, operations and maintenance education for the building owner (residential) and commissioning (commercial).	☐ House Size ☐ Site Selection ☐ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☒ Money ☒ Education ☐ Marketing

	Description	Sustainability Elements Addressed	Incentives
Connecticut, Stamford Solid Waste/recycling http://www.cityofstamford.org/content/25/50/105109/107752.aspx	Stamford adopted single stream recycling on July 1, 2009. Single stream allows residents to place all recyclable items in one bin, which simplifies the process vastly. Typically, single stream results in at least a 25% recycling rate increase in municipalities that switch from dual stream. By complementing the new system with public education, we hope to increase recycling from 10% (last fiscal year figure) to 40% by 2010.	☐ House Size ☐ Site Selection ☐ Landscaping ☐ Water Conservation Energy ☐ Conservation Materials and ☐ Resources Indoor ☐ Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Florida Florida Green Building Coalition Green Home http://floridagreenbuilding.org/homes Multi-Family, Residential Voluntary	The FGBC checklist is designed as a state wide tool. The point based rating system has been adopted by several jurisdictions, each with their own parameters. The FGBC Green Home Standards indicate the criteria by which a Florida home, new or existing, can be designated green. Certifying Agents can guide designers, builders or homebuyers through the process of qualifying and documenting green homes.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Florida Florida Green Home Certification Standard, 2011 Multi-Family, Residential Voluntary	The Florida Green Home Certification Standard is applicable to single-family and multi-family homes three stories or less and is effective July 1, 2011. The green building program helps effectively conserve water, reduce waste, manage stormwater, and decrease energy use.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☒ Money ☐ Education ☒ Marketing
Florida, Charlotte County Green Building Program, 2009 All residential and commercial buildings can be considered for the green building program. Commercial, Multi-Family, Residential Voluntary	Charlotte County Board of Commissioners adopted a Green Building Ordinance establishing a Green Building Program. New residential projects and residential renovation projects that are certified under the LEED for Homes Rating System and new commercial projects, commercial renovation projects that are certified under the appropriate LEED Rating System, and land developments that are certified under the LEED for Neighborhood Development Rating System, are all eligible to participate in this program. All program participants are eligible for fast-track permitting and will be included in a marketing program to promote green building in Charlotte County. The County Board may adopt at a later date a resolution providing monetary incentives for green building if County funds allow. Also, once the County Comprehensive Plan is adopted, the County Board will consider offering additional incentives including density bonuses for projects that are certified at LEED Silver and higher.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☐ Money ☐ Education ☐ Marketing
Florida, Tampa Tampa Green Fast Track Program, 2008 http://www.tampagov.net/dept_green_tampa/files/Chapter_17.5_Ordinance_Section_17.5 Commercial, Multi-Family, Municipal Both	Municipal buildings new and renovated 5000 ft ² + LEED Silver. All commercial 5000 ft ² + required to comply with 3rd party rating system - LEED or FGBC. Other systems evaluated on case-by-case basis. Grants are available to help with permitting costs.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☒ Money ☐ Education ☐ Marketing
Illinois, Evanston Green Building Ordinance, 2008 http://www.cityofevanston.org/sustainability/land-use-development/green-building-ordinance Commercial, Multi-Family, Municipal Mandatory	The City of Evanston requires that all commercial, multi-family, and city-owned or city-financed buildings over 10,000 square feet receive a LEED Silver rating or higher. All commercial, multi-family, and city-owned buildings seeking interior renovations must either receive a LEED-CI certification of Silver or higher or incorporate elements of the City of Evanston Sustainable Building Measures for Interior Renovations (ESBMIR). Projects less than 5000 square feet must integrate three ESBMIR measures, projects 5000-20000 square feet must integrate five measures, and projects over 20,000 square feet must incorporate seven measures.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing

	Description	Sustainability Elements Addressed	Incentives
Kansas, Greensburg <i>Sustainable Comprehensive Master Plan, 2008</i> http://www.bnim.com/work/greensburg-ks-sustainable-comprehensive-master-plan Commercial, Multi-Family, Municipal, Residential Both	Greensburg's Sustainable Comprehensive Master Plan was created in an effort to rebuild Greensburg after a devastating earthquake in 2007. The Master Plan provides a framework for the rebuilding of Greensburg based around the principles of environmental, economic, and social sustainability. As part of the plan, all municipal buildings must be constructed to LEED platinum standards and exceed the energy efficiency baseline code by 42%. The city also has a windfarm that produces 100% renewable energy for the town. It is voluntary for residential homes to comply with the ICC-700. The Master Plan incorporates all aspects of green building- from site selection to walkability to landscaping to hazard mitigation- every element is covered.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Maine, Bar Harbor <i>Density Bonuses</i> Multi-Family, Residential Voluntary	The City offers a density bonus of an additional market-rate dwelling unit for construction projects in which all dwelling units meet LEED standards. This bonus applies to projects within a Planned Unit Development and compliance is determined by either application or by affidavit for adherence during construction.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Maryland, Carroll <i>Green Building Tax Credit, 2009</i> http://ccgoverment.carr.org/ccg/attorney/ordinance/Adopt0903GBTC.pdf Commercial, Multi-Family, Residential Voluntary	The Green Building Tax Credit, which provides a 25% tax credit for new buildings that achieve LEED Silver certification or equivalent, a 50% tax credit for new buildings that achieve LEED Gold certification or equivalent, and a 75% tax credit for new buildings that achieve LEED Platinum certification or equivalent for a period of 5 consecutive years. This tax credit only applies to property that is principally used for business, commercial, or industrial purposes.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☒ Money ☐ Education ☐ Marketing
Massachusetts <i>NBI Core Performance Stretch Code, 2009</i> http://www.mass.gov/Eeops/docs/dps/inf/stretch_code_overview_jun05_09.pdf Commercial, Multi-Family, Municipal, Residential Mandatory	Appendix 120.AA known as the "stretch code", was adopted by the Massachusetts Board of Building Regulations and Standards in May 2009, as an optional appendix to the Massachusetts Building Code 780 CMR. The stretch code may be adopted by any town or city in the commonwealth, by decision of its governing body following a public hearing. The MA stretch code requires a HERS index of 65 or less for new homes of 3,000 ft2 or above, and 70 or less for new homes below 3,000 ft2 (this includes multi-family units in buildings of 3 stories or less). Home additions and renovations have two options to meet the stretch code. The stretch code also applies a performance-based code to commercial buildings, with the option of a prescriptive code for small and medium-sized commercial buildings. Buildings smaller than 5,000 ft2 are exempt, as are building renovations. "Specialty" buildings (e.g. supermarkets, laboratories, warehouses) below 40,000 ft2 in size are also exempt.	☐ House Size ☐ Site Selection ☐ Landscaping ☐ Water Conservation Energy ☒ Conservation Materials and ☐ Resources Indoor ☐ Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Minnesota, Bloomington <i>Zoning Area Bonus, 2005</i> http://www.ci.bloomington.mn.us/cityhall/dept/commdev/planning/regs/zoneproject/hxr/ Voluntary	Within the High Intensity Mixed Use With Residential HX-R Zoning District, FAR bonuses are awarded to LEED certified projects, based on level of certification.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Nevada, Las Vegas Region <i>SNHBA - Adopted 2006</i> www.snhba.com Residential Voluntary	This Homebuilders Association standard is comprehensive, voluntary, and completely separate from the jurisdiction's permitting and inspection process.	☐ House Size ☐ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☐ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☒ Education ☒ Marketing

	Description	Sustainability Elements Addressed	Incentives
New Mexico, Albuquerque Green Path Program and Resolution, 2007 http://www.cabq.gov/albuquerquegreen/ Commercial, Multi-Family, Municipal, Residential Voluntary	This high profile, voluntary program offers recognition for high performing, comprehensively sustainable buildings.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☒ Money ☒ Education ☒ Marketing
New Mexico, City of Santa Fe Project Water Use Offset http://www.water2conserve.com/index.html Mandatory	Any building permit or water hook-up shall be issued or granted only if it the applicant demonstrates that the water demands created by the use of the structures for which the building permit, water hook-up or development approval is sought will be entirely offset (Ord. No. 2003-36 § 11). In all cases, the amount of water offset by retrofits shall be equal to or greater than the estimated water usage of the proposed building as determined by the annual water budget procedures.	☐ House Size ☐ Site Selection ☐ Landscaping ☒ Water Conservation ☐ Energy Conservation ☐ Materials and Resources ☐ Indoor Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
New Mexico, Santa Fe Sustainable Santa Fe Plan, Residential Green Building Website: http://www.santafenm.gov Residential Mandatory	Beginning July 1, 2009 all new applications for single-family residential buildings in the City of Santa Fe are subject to the Residential Green Building Code. Home size determines the number of points needed to achieve each level of certification. Plan review and inspection of program elements will be fully integrated into the permitting and inspection process. The program is designed to coordinate with ENERGY STAR, utility incentive programs, and EPA's Home program.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☒ Marketing
New York New York State Energy Research and Development Website: http://www.nyserda.org/programs/Green_Buildings/default Commercial, Multi-Family, Municipal, Residential Voluntary	NYSERDA provides computer modeling, design charrette coordination, assistance in obtaining LEED certification, Executive Order 111 assistance, New York State Green Buildings Tax Credit assistance, green materials recommendations, commissioning and life cycle costing analysis to building design teams to help make new and rehabilitated commercial, industrial, and institutional buildings green. Green Building services are offered under the New Construction program PON 1155.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Ohio, Columbus Green Columbus Fund, 2010 http://development.columbus.gov/directoroffice/content.aspx?id=33512 Commercial, Multi-Family, Municipal Voluntary	Green buildings achieving LEED-NC certification in the City of Columbus, Ohio are eligible for LEED reimbursement ranging from a minimum of the certification fee to a maximum of three times the certification fee. All eligible projects must receive certification from the USGBC and credit for at least eight of twelve essential LEED-NC credits designated by the city. The funds for certification reimbursement are available through the Green Columbus Fund, a \$1 million grant program to encourage green building and brownfield redevelopment.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☒ Money ☐ Education ☐ Marketing
Oregon, Ashland 18.88.040 Performance Standards for Residential http://www.ashland.or.us/SectionIndex.asp?SectionID=423 Residential Voluntary	Developers in Ashland may increase the base density of units in residential developments by incorporating energy efficiency, architectural creativity and innovation, and the use of natural features of the landscape. Density may be increased up to a maximum of 15% based on bonus points earned for meeting the minimum requirements for certification as an Earth Advantage home, which includes an evaluation of energy usage, water usage, and air quality guidelines. Conservation features can also include passive solar design.	☐ House Size ☐ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing

	Description	Sustainability Elements Addressed	Incentives
Pinoleville Pomo Nation Green Building Code of the Pinoleville Pomo Nation, Commercial, Multi-Family, Municipal, Residential Mandatory	The Green Building Code of the Pinoleville Pomo Nation was created to provide tribal citizens guidance in the development and construction of green tribal buildings and housing. The code covers all new and renovated tribal projects on the Reservation and sets building goals in the form of "Performance Standards" and "Performance Requirements" rather than prescriptive design elements. The Green Building Code covers all aspects of buildings, including site sustainability, water use, energy use, indoor air quality, building materials, hazard prevention and mitigation, durability, and social and aesthetic suitability. The Tribal Council created this code to reflect the unique culture, needs, and goals of the tribe.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Tennessee, Nashville Green Permit and Zoning Incentives, 2008 http://www.nashville.gov/mc/ordinances/term_2007_2011/bi2008_217.html Commercial, Multi-Family, Municipal, Residential Both	Nashville has a voluntary green certificate program, offers density bonus incentives in designated neighborhoods, and has mandatory requirements for municipal buildings. In order to receive a green certificate of occupancy commercial buildings must earn LEED Certified, specifically requiring WEc3.1 (20% Water Use Reduction); residential buildings must submit proof of LEED or EarthCraft Homes certification. In the downtown area, development in the Central Business District is eligible to increase the Floor Area Ratio (FAR) cap from 15 to 17 if the project achieves LEED Silver. Projects in this district benefit from a FAR of 19 if the project achieves LEED Gold. In the SoBro neighborhoods, developments are eligible to increase the FAR cap from 5 to 7 if the project achieves LEED Silver. Projects in these neighborhoods benefit from a FAR cap of 9 if LEED Gold is achieved. All public and publicly-funded building projects of 5,000 ft2 or greater (or exceeding \$2M in project costs) be designed and built to LEED Silver certification of the most appropriate LEED Rating System.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Texas, Austin Austin Energy Green Building Rating System Version 2008 http://www.austineenergy.com Commercial, Multi-Family, Residential Both	The City of Austin has numerous green building provisions within the city building code, with requirements that vary according to location, zoning designation and building type. The building standards rely on the Austin Energy Green Building Rating system and the LEED certification system as metrics. In some cases developers have the option of achieving compliance under either of the two systems. Under the Austin Energy Green Building Rating System, buildings are awarded up to five stars depending on the number and breadth of green building elements that are incorporated into the design. In terms of energy efficiency, rated buildings are designed to exceed the Austin Energy Code.	☐ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation ☒ Energy Conservation ☒ Materials and Resources ☒ Indoor Environmental Quality ☒ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing
Virginia, Arlington County Green Home Choice http://www.arlingtonva.us/departments/EnvironmentalServices/epo/PDFfiles/GH_guideline Multi-Family, Residential Voluntary	Arlington developed the Green Home Choice program to provide a structure and support system for builders and homeowners. The Arlington Green Home Choice program is based on the Earthcraft House program, a green home rating system designed by the Southface Institute in Atlanta, Georgia. Participants in the program are offered front-of-the-line plan review, lawn signs indicating participation in the program, attendance at County-sponsored seminars, and recognition as "green" builders. IL	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☐ Money ☒ Education ☒ Marketing
Virginia, Fairfax Letter #09-07 Commercial, Residential Voluntary	All residential and commercial structures designed to achieve green building certification will receive priority plan review. Commercial buildings must be designed to achieve, at a minimum, LEED silver, which residential homes must be designed to achieve, at a minimum, LEED Homes silver, Nation Green Building Standards (NGBS) silver, Earthcraft select status, or Green Globes (3 to 5 green globes).	☐ House Size ☐ Site Selection ☐ Landscaping ☐ Water Conservation ☐ Energy Conservation ☐ Materials and Resources ☐ Indoor Environmental Quality ☐ Operation, Maintenance and Owner Education	☒ Time ☐ Money ☐ Education ☐ Marketing
Washington, Redmond http://www.redmond.gov/commmon/pages/UserFile.aspx?fileid=20364	Before residential homes may be built, a site plan must be prepared that identifies important features such as native vegetation and nearby water sources including streams and springs. The site plan must also contain a report on how the features of the site may be used to support green building and low impact development. Green certification may be attained by BuiltGreen or LEED.	☐ House Size ☐ Site Selection ☐ Landscaping ☐ Water Conservation ☐ Energy Conservation ☐ Materials and Resources ☐ Indoor Environmental Quality ☐ Operation, Maintenance and Owner Education	☐ Time ☐ Money ☐ Education ☐ Marketing

	Description	Sustainability Elements Addressed	Incentives
Washington, Seattle CITY Green Building http://www.seattle.gov/dpd/GreenBuilding/ Commercial, Multi-Family, Municipal, Residential Voluntary	In a broad partnership of City resources, Washington State Department of Energy, Puget Sound Electric and others, Seattle provides customized green building education, early design guidance, technical assistance, incentives, and recognition of sustainable building. They recognize and support a variety of third party verification programs including Built Green and LEED. They have published a series of green guides for various project types and resource lists. The City not only provides extensive information on external incentives, it also provide incentives such as FAR bonuses in certain areas, expedited review service, etc.	☒ House Size ☒ Site Selection ☒ Landscaping ☒ Water Conservation Energy ☒ Conservation Materials and ☒ Resources Indoor ☒ Environmental Quality ☒ Operation, Maintenance and Owner Education	☒ Time ☐ Money ☒ Education ☒ Marketing

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