A Comparative Overview of the ICC/ASHRAE 700-2015 National Green Building Standard & LEED v4 BD+C: Homes & Multifamily Lowrise

NAHB
National Association of Home Builders

Contents

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This document is intended to provide a review of the features, elements and key factors of the two nationally-recognized sustainability and green building rating systems: ICC/ASHRAE 700-2015 National Green Building Standard (NGBS), and the Leadership in Energy and Environmental Design Version 4 – Homes and Multifamily Lowrise (LEED Homes). It reviews the similarities and differences of the two rating systems and provide information for parties interested in integrating above-code, voluntary sustainable design and construction practices and programs into residential single-family and multifamily buildings.

Rating Systems Overview

ICC/ASHRAE 700-2015 National Green Building Standard

The ICC/ASHRAE 700-2015 National Green Building Standard, commonly referred to as the "NGBS" or simply "the standard," is a green building standard serving as a uniform national platform for the recognition and advancement of green residential construction and development. The 2015 edition is the third iteration of the standard, building upon the previous 2012 and 2008 editions. All editions were developed by consensus committees of industry and nonprofit individuals, and in partnership with the International Code Council (ICC) and the National Association of Home Builders (NAHB). The latest edition of the standard introduced a new partner in the development process: the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). Staff of these three organizations did not serve as committee members but instead helped facilitate meetings.

The standard remains the only residential-specific green building rating system to undergo the full consensus process and receive approval from the American National Standards Institute (ANSI). ANSI approval is critical because it is third-party confirmation of balance, representation, openness, consensus, and due process in the standard's development process. The consensus committee that developed the 2015 edition was composed of 42 individuals representing a variety of government agencies, municipalities, home building industry stakeholders, and non-profit organizations, including:

- Habitat for Humanity International
- National Multifamily Housing Council
- National Institute of Standards & Technology
- Northeast Energy Efficiency Partnerships
- Texas A&M University
- U.S. Department of Energy
- U.S. Department of Housing & Urban Development
- American Institute of Architects
- City of Des Moines, Iowa

The standard is a point-based system, wherein single-family or multifamily building(s) can attain certification by accumulating points for the sustainable and green practices included in design and construction, and planned for its operation and maintenance. Projects can qualify for four certification levels (Bronze, Silver, Gold or Emerald) by earning the required number of points for each level. NGBS Conformance is verified through construction documents, plans, specifications, in-field inspection reports and other data that demonstrate compliance with the points being pursued. Furthermore, Green Verifiers, who serve as independent, in-field representatives of the NGBS Green certification system, perform rough and final construction inspections to ensure compliance. All relevant information is provided to an adopting entity, such as the Home Innovation Research Labs, for technical review, verification and finally, certification.

As of the time of this report, there are over 100,000 homes certified to the National Green Building Standard. This includes over 11,000 single-family homes and units in more than 2,000 multifamily buildings.

LEED v4 BD+C: Homes and Multifamily Lowrise Overview

LEED v4 BD+C: Homes and Multifamily Lowrise is a green building certification system designed help building and home owners and operators be environmentally responsible and use resources efficiently. The United States Green Building Council (USGBC) developed all versions of LEED Homes, and the current version is its third iteration.

Similar to NGBS, LEED Homes is a point-based system, wherein a building can attain certifications depending on the green practices included in its design and construction. Conformance is verified through construction documents, plans, specifications, inspection reports, and other data which demonstrate conformance with points being pursued. The Green Business Certification Inc. (GBCI) administers the LEED certification system, performing third-party technical reviews and verification of LEED-registered projects to determine if they have met the standards set forth by the LEED rating system.

LEED Homes is used for single-family and lowrise multifamily buildings. A separate but very similar rating system, “LEED v4 BD+C: Multifamily Midrise”, is used for multifamily midrise buildings and contains similar if not identical green building practices.

A third rating system, titled “LEED v4 BD+C: New Construction”, is targeted to multifamily high-rises (more than eight floors) and commercial buildings, as well as buildings that do not primarily serve K-12 educational, retail, data centers, warehouses and distribution centers, hospitality, or healthcare uses. This rating system varies greatly from the LEED Homes rating system in how points are achieved and targeted green practices. It is important to differentiate these two rating systems. Please see the report “A Comparative Overview of the National Green Building Standard 2015 & LEED v4 BD+C: New Construction” for an overview of that program and how it relates to the NGBS.

Although the development of LEED for Homes was developed by industry professionals and involved a public comment period, it is not approved as an ANSI national standard by a national standards-making body.

As of October 2016, over 120,000 residential units had been certified using the LEED for Homes rating system.

NGBS & LEED Homes Scopes

Building Types

The standard was designed specifically for residential construction, development and renovation. Similarly, LEED Homes was designed for residential structures, focusing on single-family and lowrise multifamily buildings. NGBS can also be applied to high-rise residential buildings.

Project Types Eligible for NGBS Certification

- Single-family homes (new construction and remodels)
- Low-rise multifamily
- High-rise multifamily
- Residential areas of mixed-use buildings
- Land developments (*not covered in this report*)
- Renovations of existing homes and multifamily buildings (*not covered in report)*
- Renovations of functional areas (*not covered in this report*)

Project Types Eligible for LEED Homes Certification

- Single-family homes
- Low-rise multifamily

Categories of Green Practices

NGBS and LEED both have practices in five similar categories:

- Water Efficiency
- Energy Efficiency
- Location and Site Development
- Material and Resource Efficiency
- Indoor Environmental Quality

The NGBS has an additional category for “Building Operation, Maintenance, and Building Owner Education,” emphasizing the importance of the end users’ and occupants’ education of and interaction with the building and building systems. It contains such practices as hands-on training of home owners and building operators as well as preparation of operation and maintenance materials. Similar practices can be

found in the LEED Homes "Energy Efficiency" category and both rating systems mandate home owner education.

LEED Homes has an additional category, "Integrative Process," which contains one practice for up to two additional points. This emphasizes the importance of integrated design and construction practices within the project team, completing design charrettes, and training trade professionals in how they contribute to LEED certification.

LEED Homes offers a separate category for "Innovation in Design," in which a project team can earn points by either using an innovative and effective green practice not listed in LEED, completing a "Pilot Credit" from the USGBC's LEED Pilot Credit Library, or achieving exemplary performance in an existing LEED v4 prerequisite or credit. A mandatory practice under this category is that the project team conduct a preliminary LEED Homes meeting and identify the targeted LEED award level (Certified, Silver, Gold or Platinum), the credits that have been selected to meet the targeted award level, and the party accountable for meeting the requirements for each selected credit.

The NGBS recognizes innovative green practices within each of its six categories in lieu of creating a separate category.

Lastly, LEED for Homes includes "Regional Priority," which awards additional points by project location (ZIP code) for achieving specified credits in one or more of the previously mentioned categories. USGBC members for each region select which practice merit additional points depending on the region. No additional work is required by the project team to be awarded these points.

The standard also recognizes the importance and influence of a project location on sustainability practices, and provides flexibility for architects and developers to recognize regional priorities through an expansive and climate-specific point system.

Table 1: Green Practice Categories within the NGBS and LEED for Homes

NGBS	LEED HOMES
The NGBS has six practice categories: • Lot Design, Preparation, and Development • Resource Efficiency • Energy Efficiency • Water Efficiency • Indoor Environmental Quality • Operation, Maintenance, and Building Owner Education	LEED for Homes has nine practice categories: • Integrative Process(1) • Location and Transportation(1) • Sustainable Sites(1) • Water Efficiency • Energy and Atmosphere • Materials & Resources • Indoor Environmental Quality • Regional Priority • Innovation in Design(2)

(1) These categories are similar to the NGBS "Lot Design, Preparation, and Development" category.

(2) LEED for Homes offers a separate category, "Innovation." NGBS alternatively recognizes innovative green practices within each of its six categories, instead of creating a separate category.

Certification Levels

ICC/ASHRAE 700-2015 NGBS Certification Levels

Under NGBS, single-family homes and multifamily buildings can attain one of four potential certification levels: **Bronze, Silver, Gold or Emerald,** by earning a minimum number of points at each certification level, as can be seen in Table 2 below. There are 1,100 points available in the rating system. In addition to earned points, every building certified under the standard must comply with all of the relevant mandatory provisions.

The standard was specifically designed so that a project team must take a balanced and multifaceted approach to green building. Therefore, the standard requires that a project achieve a minimum number of points in each green practice category to be certified, as well as earn a minimum number of additional points from any category it chooses. This prevents project teams from obtaining all of their points from focusing on a handful of categories, and ignoring other more difficult categories. It ensures that NGBS is a rigorous green rating system.

A building's highest rating depends upon the lowest threshold met by any of the six categories. For example, if a project missed the threshold for Emerald in one category by a single point, it will still only achieve Gold certification even if it reached the required number of points for Emerald certification in all other categories.

Furthermore, for dwelling units greater than 4,000 square feet, the number of total points required to receive certification levels increases by one point for every additional 100 square feet. This makes it more challenging for larger dwellings to receive the same certification as smaller ones to account for the greater environmental impact of larger dwelling spaces.

Table: 2 NGBS Threshold Point Ratings for Certification

Green Practice Categories		Number of Mandatory Practices	Minimum Points Required Per Rating Level (1) (2)			
			BRONZE	SILVER	GOLD	EMERALD
1.	Lot Design, Preparation, and Development	0	50	64	93	121
2.	Resource Efficiency	11	43	59	89	119
3.	Energy Efficiency	13	30	45	60	70
4.	Water Efficiency	2	25	39	67	92
5.	Indoor Environmental Quality	11	25	42	69	97
6.	Operation, Maintenance, & Building Owner Ed.	2	8	10	11	12
7.	Additional Points from Any Category(2)	-	50	75	100	100
	Total Points Needed	-	231	334	489	611
	Percentage of Total Available Points	-	21%	30%	45%	56%

(1) In addition to the threshold number of points in each category, all mandatory provisions must be implemented.

(2) For dwelling units greater than 4,000 square feet, the number of points in Category 7 shall be increased by 1 point for every additional 100 sf. The "Total Points" shall be increased by the same number of points.

LEED Homes Certification Levels

Like the NGBS, LEED Homes has certification levels based on the total number of points earned by the project team. Buildings can attain one of four certification levels: **Certified, Silver, Gold** or **Platinum**. Also like the standard, LEED includes mandatory prerequisites. LEED Homes also contains three Minimum Project Requirements:

1) The project must be in a permanent location on existing land.
2) The boundary of the project must be reasonable, including all contiguous land that is associated with the project and supports its typical operations.
3) The project must be defined as a "dwelling unit" by all applicable codes.

The two rating systems differ in that LEED does not require that a minimum number of points be achieved in each green building category. Project teams are able to obtain certification by receiving points in the categories they deem are best suited for their project. However, this can also create the opportunity for a project to not address or focus on a green practice category.

Table 3: LEED for Homes Threshold Point Ratings for Certification

Green Practice Categories		Number of Mandatory Practices	Minimum Points Required Per Rating Level(1)			
			CERTIFIED	SILVER	GOLD	PLATINUM
1.	Integrative Process(2)	-	-	-	-	-
2.	Location & Transportation(2)	1	-	-	-	-
3.	Sustainable Sites(2)	2	-	-	-	-
4.	Water Efficiency	1	-	-	-	-
5.	Energy & Atmosphere	4	-	-	-	-
6.	Materials & Resources	2	-	-	-	-
7.	Indoor Environmental Quality	7	-	-	-	-
8.	Regional Priority	-	-	-	-	-
9.	Innovation	1	-	-	-	-
	Total Points Needed:	N/A	40	50	60	80
	Percentage of Total Available Points	N/A	36%	45%	55%	72%

(1) In addition to the threshold number of points in each category, all prerequisites must be implemented.

(2) Credits in these LEED Homes categories are comparable to those in the NGBS 2015 "Lot Design, Preparation, and Development" category.

Example Project Comparisons

In the sections below, four example projects demonstrate the various pathways of achieving certification through the two rating systems. Two of the projects have met the requirements to successfully achieve LEED for Homes Silver, and the other two have achieved NGBS Silver. In all four cases, Silver certification is the second-highest rating a project can achieve, above the basic "Certified" in the case of LEED and "Bronze" in the case of the NGBS.

Project A – NGBS Silver

Table 4 below provides an example of a project achieving NGBS Silver certification by achieving all of the points required within each category at the Silver level, as well as the total additional points required from any category of the team's choice. The team achieved only the minimum points required, but did so in all categories and therefore are awarded Silver. Figure 1 shows the percentage of points achieved in each category compared to the total points achieved.

Table 4: Example 'Project A' Achieving NGBS 2015 Silver Certification

Green Building Categories		Points Achieved	Points Required for Silver
1.	Lot Design, Preparation, and Development	50	50
2.	Resource Efficiency	43	43
3.	Energy Efficiency	30	30
4.	Water Efficiency	25	25
5.	Indoor Environmental Quality	25	25
6.	Operation, Maintenance, and Building Owner Education	8	8
7.	Additional Points from Any Category	50	50
	Total Points :	231	231

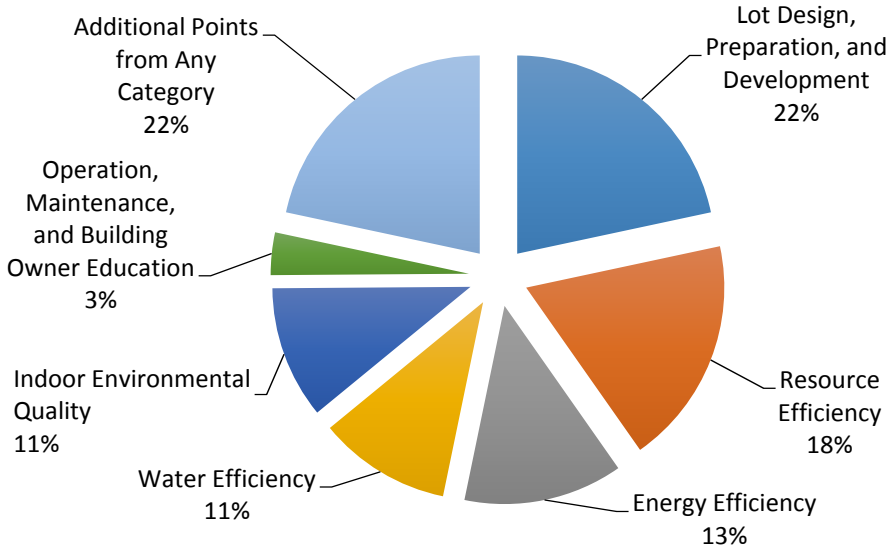


Figure 1: Distribution of Points Achieved for Example 'Project A'

Project B – LEED Silver

While a minimum number of total points are required for each certification tier, LEED for Homes does not require minimum point thresholds to be achieved in each green building category. Project teams can obtain certification by achieving points in any of the nine available categories, as observed in Table 5 below. The project team earned LEED for Homes Silver Certification without earning points within the Energy & Atmosphere category. In this example, the project team deemed the already above-code mandatory requirements of the category were sufficient to the needs of the project. These mandatory practices will be reviewed in greater detail in later sections of the report.

Table 5: Example 'Project B' Achieving LEED for Homes Silver Certification

Green Building Categories		**Points Achieved**	**Points Required for Silver**
1.	Integrative Process	2	N/A
2.	Location & Transportation	15	N/A
3.	Sustainable Sites	5	N/A
4.	Water Efficiency	10	N/A
5.	Energy & Atmosphere	0	N/A
6.	Materials & Resources	4	N/A
7.	Indoor Environmental Quality	10	N/A
8.	Regional Priority	1	N/A
9.	Innovation in Design	3	N/A
	Total Points :	50	50

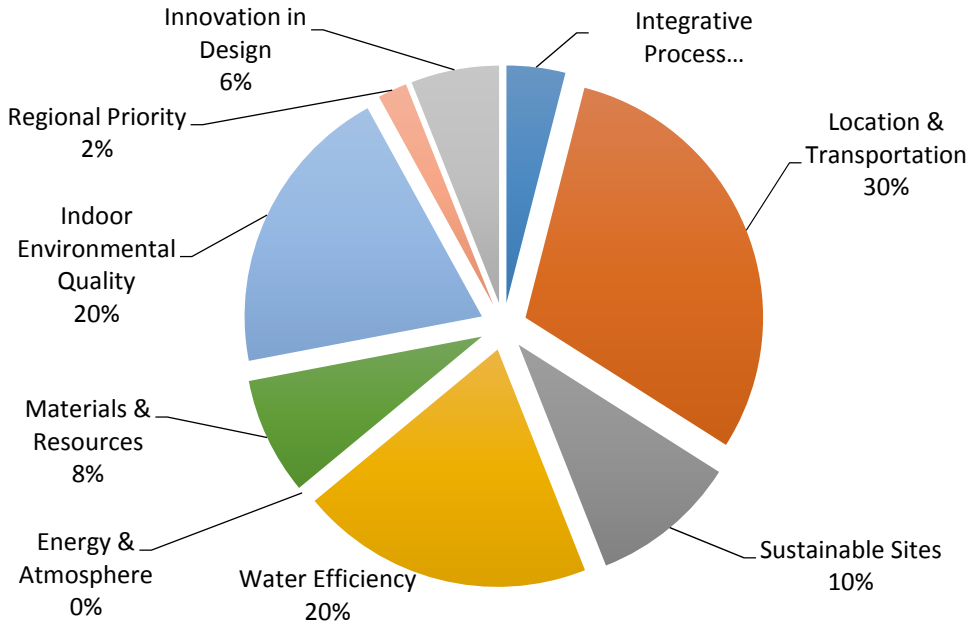


Figure 2: Distribution of Points Achieved for Example 'Project B'

Project C – NGBS Silver

In Example 'Project C' below, the project team earned enough total points to achieve NGBS Gold Certification, and also earned more than enough minimum points in each category except for one, Water Efficiency. Even though the project exceeded the minimum number of points required in multiple sections, the fact that the project did not meet the 67 points in Water Efficiency required for Gold means the entire project can only achieve Silver Certification.

Table 6: Example 'Project D' Achieving NGBS Silver Certification

Green Building Categories		Points Achieved	Points Required for Gold
1.	Lot Design, Preparation, and Development	95	93
2.	Resource Efficiency	91	89
3.	Energy Efficiency	62	60
4.	Water Efficiency	66	67
5.	Indoor Environmental Quality	69	69
6.	Operation, Maintenance, and Building Owner Education	11	11
7.	Additional Points from Any Category	103	100
	Total Points :	497	489

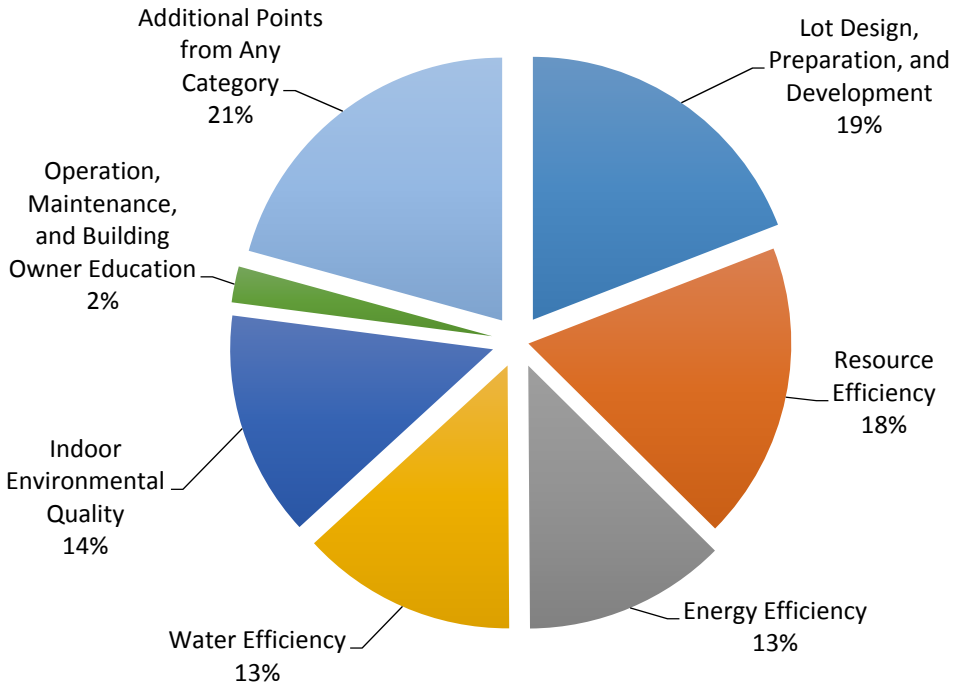


Figure 3: Distribution of Points Achieved for Example 'Project C'

Project D – LEED Silver

In Example 'Project D' below, the project team earned LEED for Homes Silver Certification while opting to not pursue points in the Sustainable Sites, Water Efficiency, and Materials & Resources categories. Based on the client needs and any other variables involved in the project, the team selected the Energy Efficiency and Location & Transportation categories to be their main points of focus. Because LEED for Homes only requires them to meet the mandatory prerequisites of each category, they were able to apply more resources on certain individual categories to achieve certification.

Table 6: Example 'Project D' Achieving LEED for Homes Silver Certification

Green Building Categories		**Points Achieved**	**Points Required for Silver**
1.	Integrative Process	2	N/A
2.	Location & Transportation	15	N/A
3.	Sustainable Sites	0	N/A
4.	Water Efficiency	0	N/A
5.	Energy & Atmosphere	23	N/A
6.	Materials & Resources	0	N/A
7.	Indoor Environmental Quality	6	N/A
8.	Regional Priority	1	N/A
9.	Innovation in Design	3	N/A
	Total Points :	**50**	**50**

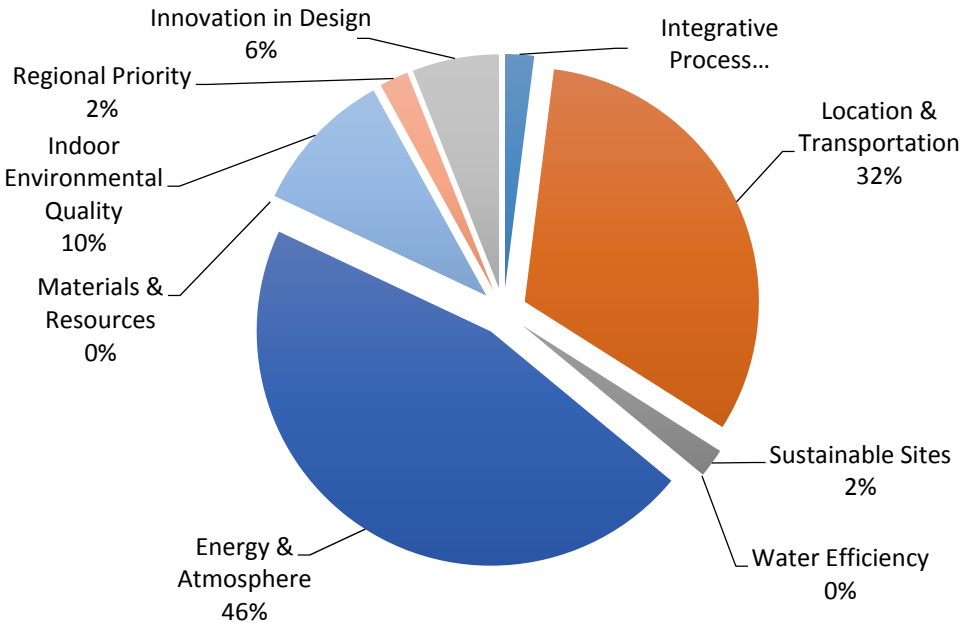


Figure 4: Distribution of Points Achieved for Example 'Project D'

The Certification Process

ICC/ASHRAE 700-2015 NGBS

NGBS conformance is verified through construction documents, plans, specifications, inspection reports and other data that demonstrates achievement of the points being pursued. All NGBS project teams must include a NGBS Green Verifier, who serves as an independent, in-field representatives of the NGBS Green certification system. Verifiers work with project teams to perform the rough and final construction inspections described below. To achieve certification, these inspection reports, along with relevant information regarding pursued practices, are provided to Home Innovation Labs for technical review and verification.

Every project must include to two independent third-party verification inspections. The accredited Verifier is responsible for the visual inspection of every green building practice in the building. In multifamily certification, the verifier must perform a rough inspection before the drywall is installed to observe the wall cavities in every apartment, and a final inspection of every apartment once the project is complete. The required verification imbues a high level of rigor, continuity and quality assurance to the system and to the projects that are certified.

Home Innovation Research Labs

Home Innovation Research Labs is a 53-year old, internationally recognized and accredited product testing and certification laboratory in Upper Marlboro, Maryland. Its work is solely focused on the residential construction industry and its mission is to improve the affordability, quality, performance and durability of housing by helping overcome barriers to innovation. Its core competency is as an independent, third-party product testing and certification lab, making it uniquely suited to administer a green certification system for residential buildings.

Home Innovation qualifies, trains and accredits building professionals to provide independent verification services for builders participating in the NGBS Green Certification system. Verifiers must first demonstrate they possess experience in residential construction and green building before they are eligible to take the verifier training. Many verifiers are also HERS Raters, LEED Homes Green Raters, or LEED Accredited Professionals. Potential verifiers must complete thorough training on exactly how to verify every NGBS practice. After completing the training, verifiers must pass a written exam before earning Home Innovation accreditation. Accreditation must be renewed annually.

Home Innovation reviews every rough and final inspection report to ensure national consistency and accuracy. Furthermore, they regularly audit verifiers and the work they perform as part of an internal quality assurance system.

LEED Homes

Conformance with LEED Homes is verified through construction documents, plans, specifications, inspection reports and other data which demonstrate compliance with the credits being pursued. All LEED Homes projects requires] on-site verification and performance testing. A Verification Team, consisting of a LEED for Homes Provider Organization, LEED for Homes Green Rater, and an Energy Rater completes these services.

The LEED for Homes Provider Organization oversees the certification process. Provider Organizations work with a network of Green Raters and provide quality assurance of their verification services. Green Raters provide the required on-site verification for LEED for Homes projects, including pre-drywall and post-construction site visits, and document fulfillment of LEED practices and prerequisites. Finally, the LEED for Homes rating system requires that the project is performance-tested by a qualified energy rater. In many cases, the Green Rater may also be a qualified energy rater, and can provide both the required on-site verification and performance testing services.

It is recommended, but not required, that a LEED-Accredited Professional (LEED-AP) be a member of the project team. An additional point is awarded when a LEED-AP is on the project team.

To achieve certification, the project's LEED Provider provides all relevant plans and information regarding pursued green practices to the Green Business Certification Institute (GBCI) for a third-party technical review and verification.

The Green Business Certification Institute

The GBCI is a nonprofit organization developed in 2008 with the support of the USGBC, and operates as the certification and credentialing organization for all LEED-related systems. Credentialing exams and designations administered by the GBCI include the LEED Green Associate, LEED AP with specialty, and LEED Fellow, among others. The GBCI has expanded beyond LEED and now provides similar services for the International WELL Building Institute's WELL Building Standard, the Perfect Power Institute's PEER standard, and the Global Real Estate Sustainability Benchmark.

Registration & Certification Fees

The registration and certification fees for both the NGBS and LEED Homes systems are depicted in the table below. This does not include any fees charged by the third-party entities required for project certification. For NGBS, this is a Green Verifier required for on-site inspections. For LEED for Homes, this includes a Provider Organization, Green Rater, and possibly an Energy Rater. These individuals and organizations set their own rates based on market prices.

Table 7: Registration and Certification Fees

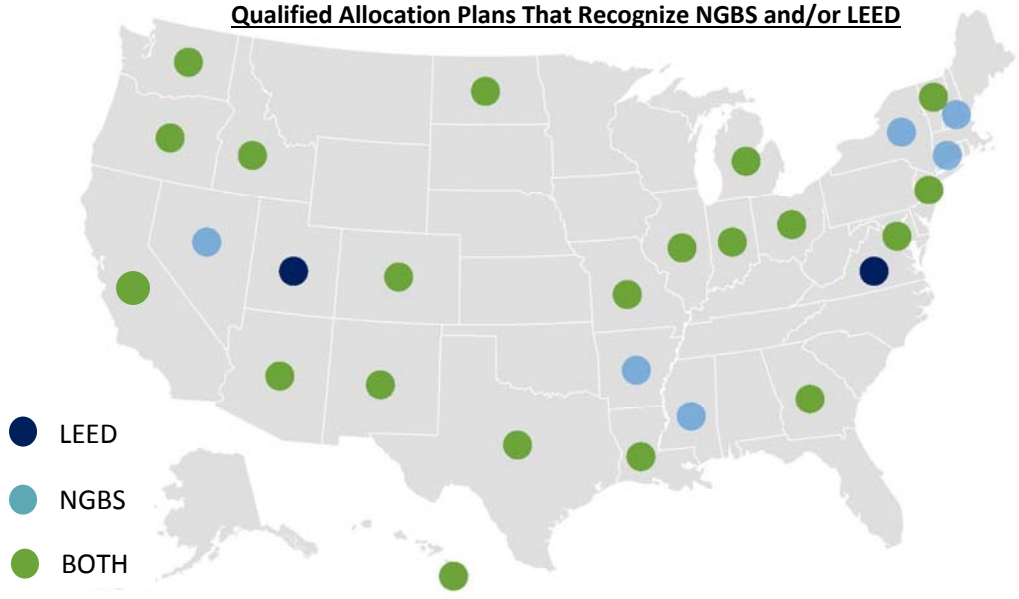
NGBS 2015		LEED for Homes	
Single-Family	Registration $0	Single-Family	Registration ● 1-25 Homes: $225 each ● >25 Homes: $125 each
	Certification $200/Home		Certification ● 1 Home: $300 ● >1 Home: $225 base + $75/home
Multifamily	Registration $0	Multifamily	Registration $1,200
	Certification ● 1-3 Stories: $200 base + $30/unit ● ≥4 Stories: $600 base + $30/unit		Certification ● 0-49 Units: $0.045 per sf ● ≥50 Units: $0.040 per sf
Additional Fees	Appeals $0	Additional Fees	Appeals ● Complex Credits: $800 per credit ● Simple Credits: $500 per credit
	Inquiries $0		Inquiries $220

Legislative and Regulatory Inclusion

Both LEED and NGBS have been considered on par or more stringent than other green building rating systems for residential projects within a number of federal systems. The following systems and municipalities recognize both LEED and the NGBS:

- **HUD & USDA Energy Efficiency Standards:** NGBS is a recognized alternative compliance path for demonstrating that HUD- or USDA housing meets the agencies' energy-efficiency standards. HUD also recently adopted significant mortgage insurance premium reductions for green certified buildings and NGBS is one of the eligible systems. See more at www.gpo.gov/fdsys/pkg/FR-2015-05-06/pdf/2015-10380.pdf.
- **USDA Rural Development, Multifamily Housing Energy-Efficiency Initiative:** Applicants to several Rural Rental Housing, Farm Labor Housing, Housing Preservation Grants, and Multifamily Housing Revitalization grants and loans can receive additional points for new construction and rehabilitation projects that are certified to NGBS, LEED for Homes, Enterprise Green Communities, and/or Energy Star. See more at https://energy.gov/eere/solarpoweringamerica/rural-development-multi-family-housing-energy-efficiency-initiative.
- **U.S. Department of Army**: This department recognizes NGBS as a LEED equivalent for its military housing in several locations.
- **North Carolina:** The Housing Finance Agency Community Partners Loan Pool awards a $1,000 financial incentive to participating local governments and non-profits who obtain NGBS or LEED for Homes.
- **Delaware** Green for Green program offers rebates ranging between $1,000 and $2,500 to homebuyers of residences certified to the NGBS, LEED, RESNET, and Energy Star 3.0. NGBS homes must be Silver or higher.
- **Homes in New Mexico** certified to either the NGBS or LEED can qualify for the generous state tax credit.
- **State Qualified Allocation Plan**: Over 20 states mandate or incentivize NGBS and LEED certification through their Qualified Allocation Plans for the federal Low Income Housing Tax Credit program.

Qualified Allocation Plans That Recognize NGBS and/or LEED



Green Practice Categories

This section includes an overview of the green practice categories featured in both LEED Home and NGBS, including mandatory practices, minimum point requirements, and green practices featured within the category.

Location and Site Development

ICC/ASHRAE 700-2015 NGBS - Lot Design, Preparation and Development

The "Lot Design, Preparation, and Development" green practice category pertains to key site-related green aspects, such as stormwater management, heat island reduction, high-priority sites (brownfields, infills, etc.), green vehicles, and access to public transportation and bicycle facilities.

This category is more process-oriented than the other NGBS categories because environmentally sensitive strategies differ depending on locale, topography, climate and other regional factors. Regardless, the standard requires a minimum number of points be earned to receive any level of certification. See the chart below for the required number of points for this category.

Mandatory Practices:

NGBS does not have any mandatory practices in this category.

Minimum Point Requirements:

Table 8: Lot Design, Preparation, and Development Minimum Point Requirements

Green Building Categories	Minimum Points Required			
	BRONZE	SILVER	GOLD	EMERALD
Lot Design, Preparation, and Development	50	64	93	121

LEED for Homes - Location and Transportation and Sustainable Sites

LEED Homes has two categories that focus on the location and site development of the project. The "Location and Transportation" category focuses on minimizing the environmental impact of the overall project based on location, such as building on high-priority sites (such as brownfields and infills) and providing access to public transportation. The second category, "Sustainable Sites," pertains more to the development of the lot itself and includes environmental practices like rainwater management, heat island reduction and sustainable site development.

Mandatory Practices:

- Complete Construction Activity Pollution Prevention activities. (See Figure 5 Below)
- Introduce no invasive plant species into the landscape.
- Do not develop buildings on land that lies within a flood hazard area

Minimum Point Requirements:

LEED does not require projects to obtain a minimum number of points per category.

Analysis

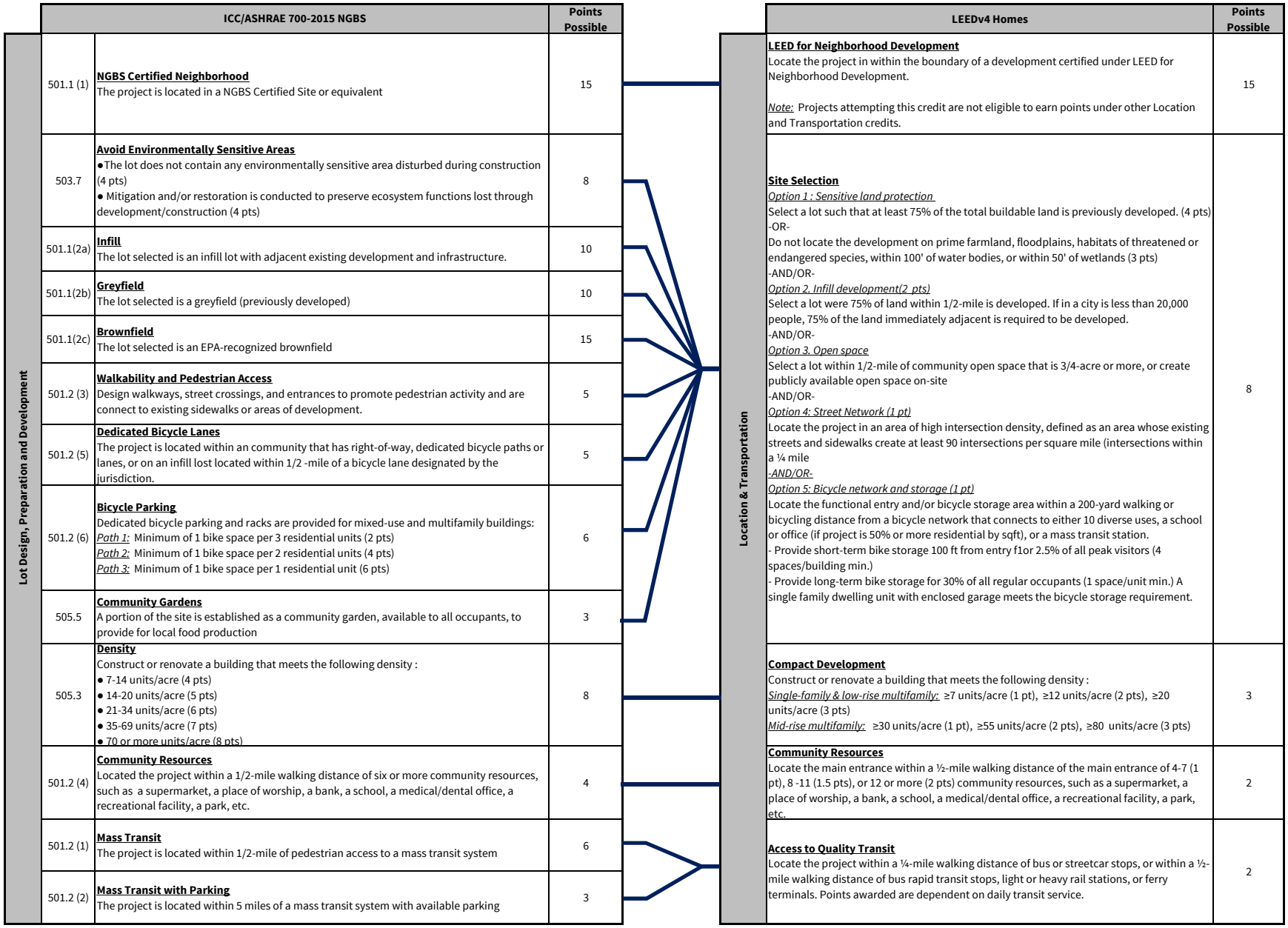
Green practices within the "Lot Design, Preparation, and Development" category of NGBS are similar to the "Location and Transportation" and "Sustainable Sites" categories of LEED Homes. One notable exception is the LEED prerequisite "Floodplain Avoidance," which requires that projects cannot be located on land within a flood hazard area. The NGBS has no such requirement.

LEED also requires certain construction activity pollution prevention measures to be implemented to comply with the Sustainable Sites category (See Figure 5 below). NGBS awards points for similar or identical activities, but does not mandate them. Lastly, LEED requires projects to not install any invasive plants on the lot. Again, the standard awards points for installing only non-invasive vegetation, but does not mandate it.

Within these categories, the NGBS has fewer mandatory practices but more overall available practices than LEED. To earn NGBS certification, a minimum number of points must be obtained within the category, allowing builders and designers to select from a wider variety of green practices that best apply to their specific project, while still requiring a minimum level of site-related sustainability at each certification level.

NGBS was designed to apply to a wide range of residential sites, from the rural single-family home, to a neotraditional neighborhood townhouse, to the high-rise apartment building. As a result, some practices may not be relevant to a particular site seeking NGBS certification. An architect designing a downtown Miami apartment building, for example, will likely be able to claim NGBS points for increased density and public transportation access, but will not be able to claim points for slope disturbance minimization (being flat terrain) and some of the natural resource preservation points (being a greyfield and infill site).

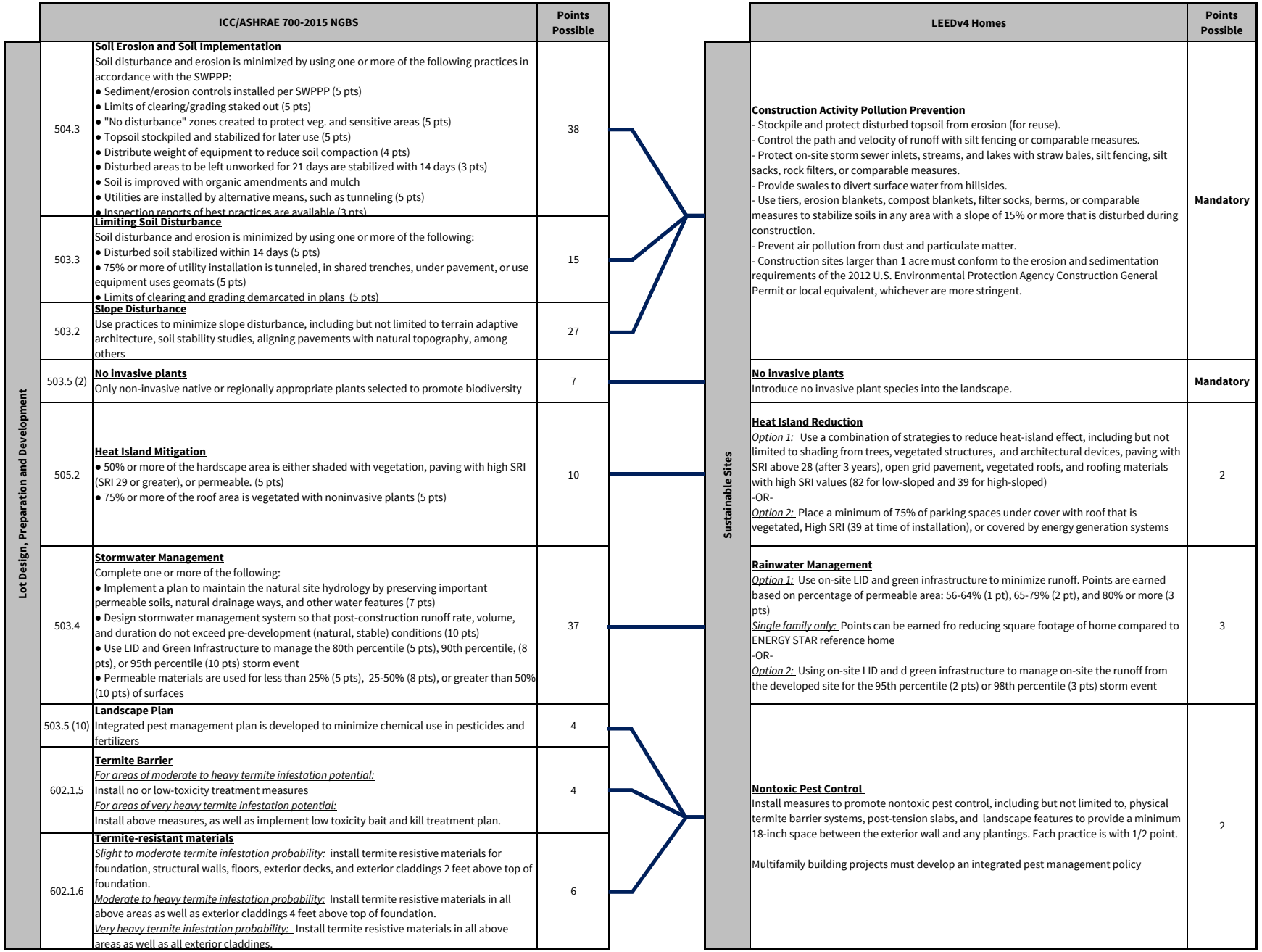
Figure 5: Location and Site Development Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Lot Design, Preparation and Development	501.1 (1)	**NGBS Certified Neighborhood** The project is located in a NGBS Certified Site or equivalent	15
	503.7	**Avoid Environmentally Sensitive Areas** ●The lot does not contain any environmentally sensitive area disturbed during construction (4 pts) ● Mitigation and/or restoration is conducted to preserve ecosystem functions lost through development/construction (4 pts)	8
	501.1(2a)	**Infill** The lot selected is an infill lot with adjacent existing development and infrastructure.	10
	501.1(2b)	**Greyfield** The lot selected is a greyfield (previously developed)	10
	501.1(2c)	**Brownfield** The lot selected is an EPA-recognized brownfield	15
	501.2 (3)	**Walkability and Pedestrian Access** Design walkways, street crossings, and entrances to promote pedestrian activity and are connect to existing sidewalks or areas of development.	5
	501.2 (5)	**Dedicated Bicycle Lanes** The project is located within an community that has right-of-way, dedicated bicycle paths or lanes, or on an infill lost located within 1/2 -mile of a bicycle lane designated by the jurisdiction.	5
	501.2 (6)	**Bicycle Parking** Dedicated bicycle parking and racks are provided for mixed-use and multifamily buildings: *Path 1:* Minimum of 1 bike space per 3 residential units (2 pts) *Path 2:* Minimum of 1 bike space per 2 residential units (4 pts) *Path 3:* Minimum of 1 bike space per 1 residential unit (6 pts)	6
	505.5	**Community Gardens** A portion of the site is established as a community garden, available to all occupants, to provide for local food production	3
	505.3	**Density** Construct or renovate a building that meets the following density : ● 7-14 units/acre (4 pts) ● 14-20 units/acre (5 pts) ● 21-34 units/acre (6 pts) ● 35-69 units/acre (7 pts) ● 70 or more units/acre (8 pts)	8
	501.2 (4)	**Community Resources** Located the project within a 1/2-mile walking distance of six or more community resources, such as a supermarket, a place of worship, a bank, a school, a medical/dental office, a recreational facility, a park, etc.	4
	501.2 (1)	**Mass Transit** The project is located within 1/2-mile of pedestrian access to a mass transit system	6
	501.2 (2)	**Mass Transit with Parking** The project is located within 5 miles of a mass transit system with available parking	3

	LEEDv4 Homes	Points Possible
Location & Transportation	**LEED for Neighborhood Development** Locate the project in within the boundary of a development certified under LEED for Neighborhood Development. *Note:* Projects attempting this credit are not eligible to earn points under other Location and Transportation credits.	15
	Site Selection *Option 1 : Sensitive land protection* Select a lot such that at least 75% of the total buildable land is previously developed. (4 pts) -OR- Do not locate the development on prime farmland, floodplains, habitats of threatened or endangered species, within 100' of water bodies, or within 50' of wetlands (3 pts) -AND/OR- *Option 2. Infill development(2 pts)* Select a lot were 75% of land within 1/2-mile is developed. If in a city is less than 20,000 people, 75% of the land immediately adjacent is required to be developed. -AND/OR- *Option 3. Open space* Select a lot within 1/2-mile of community open space that is 3/4-acre or more, or create publicly available open space on-site -AND/OR- *Option 4: Street Network (1 pt)* Locate the project in an area of high intersection density, defined as an area whose existing streets and sidewalks create at least 90 intersections per square mile (intersections within a ¼ mile *-AND/OR-* *Option 5: Bicycle network and storage (1 pt)* Locate the functional entry and/or bicycle storage area within a 200-yard walking or bicycling distance from a bicycle network that connects to either 10 diverse uses, a school or office (if project is 50% or more residential by sqft), or a mass transit station. - Provide short-term bike storage 100 ft from entry f1or 2.5% of all peak visitors (4 spaces/building min.) - Provide long-term bike storage for 30% of all regular occupants (1 space/unit min.) A single family dwelling unit with enclosed garage meets the bicycle storage requirement.	8
	Compact Development Construct or renovate a building that meets the following density : *Single-family & low-rise multifamily:* ≥7 units/acre (1 pt), ≥12 units/acre (2 pts), ≥20 units/acre (3 pts) *Mid-rise multifamily:* ≥30 units/acre (1 pt), ≥55 units/acre (2 pts), ≥80 units/acre (3 pts)	3
	Community Resources Locate the main entrance within a ½-mile walking distance of the main entrance of 4-7 (1 pt), 8 -11 (1.5 pts), or 12 or more (2 pts) community resources, such as a supermarket, a place of worship, a bank, a school, a medical/dental office, a recreational facility, a park, etc.	2
	Access to Quality Transit Locate the project within a ¼-mile walking distance of bus or streetcar stops, or within a ½-mile walking distance of bus rapid transit stops, light or heavy rail stations, or ferry terminals. Points awarded are dependent on daily transit service.	2

Figure 5: Location and Site Development Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Lot Design, Preparation and Development	504.3	**Soil Erosion and Soil Implementation** Soil disturbance and erosion is minimized by using one or more of the following practices in accordance with the SWPPP: • Sediment/erosion controls installed per SWPPP (5 pts) • Limits of clearing/grading staked out (5 pts) • "No disturbance" zones created to protect veg. and sensitive areas (5 pts) • Topsoil stockpiled and stabilized for later use (5 pts) • Distribute weight of equipment to reduce soil compaction (4 pts) • Disturbed areas to be left unworked for 21 days are stabilized with 14 days (3 pts) • Soil is improved with organic amendments and mulch • Utilities are installed by alternative means, such as tunneling (5 pts) • Inspection reports of best practices are available (3 pts)	38
	503.3	**Limiting Soil Disturbance** Soil disturbance and erosion is minimized by using one or more of the following: • Disturbed soil stabilized within 14 days (5 pts) • 75% or more of utility installation is tunneled, in shared trenches, under pavement, or use equipment uses geomats (5 pts) • Limits of clearing and grading demarcated in plans (5 pts)	15
	503.2	**Slope Disturbance** Use practices to minimize slope disturbance, including but not limited to terrain adaptive architecture, soil stability studies, aligning pavements with natural topography, among others	27
	503.5 (2)	**No invasive plants** Only non-invasive native or regionally appropriate plants selected to promote biodiversity	7
	505.2	**Heat Island Mitigation** • 50% or more of the hardscape area is either shaded with vegetation, paving with high SRI (SRI 29 or greater), or permeable. (5 pts) • 75% or more of the roof area is vegetated with noninvasive plants (5 pts)	10
	503.4	**Stormwater Management** Complete one or more of the following: • Implement a plan to maintain the natural site hydrology by preserving important permeable soils, natural drainage ways, and other water features (7 pts) • Design stormwater management system so that post-construction runoff rate, volume, and duration do not exceed pre-development (natural, stable) conditions (10 pts) • Use LID and Green Infrastructure to manage the 80th percentile (5 pts), 90th percentile, (8 pts), or 95th percentile (10 pts) storm event • Permeable materials are used for less than 25% (5 pts), 25-50% (8 pts), or greater than 50% (10 pts) of surfaces	37
	503.5 (10)	**Landscape Plan** Integrated pest management plan is developed to minimize chemical use in pesticides and fertilizers	4
	602.1.5	**Termite Barrier** *For areas of moderate to heavy termite infestation potential:* Install no or low-toxicity treatment measures *For areas of very heavy termite infestation potential:* Install above measures, as well as implement low toxicity bait and kill treatment plan.	4
	602.1.6	**Termite-resistant materials** *Slight to moderate termite infestation probability:* install termite resistive materials for foundation, structural walls, floors, exterior decks, and exterior claddings 2 feet above top of foundation. *Moderate to heavy termite infestation probability:* Install termite resistive materials in all above areas as well as exterior claddings 4 feet above top of foundation. *Very heavy termite infestation probability:* Install termite resistive materials in all above areas as well as all exterior claddings.	6

	LEEDv4 Homes	Points Possible
Sustainable Sites	**Construction Activity Pollution Prevention** - Stockpile and protect disturbed topsoil from erosion (for reuse). - Control the path and velocity of runoff with silt fencing or comparable measures. - Protect on-site storm sewer inlets, streams, and lakes with straw bales, silt fencing, silt sacks, rock filters, or comparable measures. - Provide swales to divert surface water from hillsides. - Use tiers, erosion blankets, compost blankets, filter socks, berms, or comparable measures to stabilize soils in any area with a slope of 15% or more that is disturbed during construction. - Prevent air pollution from dust and particulate matter. - Construction sites larger than 1 acre must conform to the erosion and sedimentation requirements of the 2012 U.S. Environmental Protection Agency Construction General Permit or local equivalent, whichever are more stringent.	**Mandatory**
	No invasive plants Introduce no invasive plant species into the landscape.	**Mandatory**
	Heat Island Reduction *Option 1:* Use a combination of strategies to reduce heat-island effect, including but not limited to shading from trees, vegetated structures, and architectural devices, paving with SRI above 28 (after 3 years), open grid pavement, vegetated roofs, and roofing materials with high SRI values (82 for low-sloped and 39 for high-sloped) -OR- *Option 2:* Place a minimum of 75% of parking spaces under cover with roof that is vegetated, High SRI (39 at time of installation), or covered by energy generation systems	2
	Rainwater Management *Option 1:* Use on-site LID and green infrastructure to minimize runoff. Points are earned based on percentage of permeable area: 56-64% (1 pt), 65-79% (2 pt), and 80% or more (3 pts) *Single family only:* Points can be earned fro reducing square footage of home compared to ENERGY STAR reference home -OR- *Option 2:* Using on-site LID and d green infrastructure to manage on-site the runoff from the developed site for the 95th percentile (2 pts) or 98th percentile (3 pts) storm event	3
	Nontoxic Pest Control Install measures to promote nontoxic pest control, including but not limited to, physical termite barrier systems, post-tension slabs, and landscape features to provide a minimum 18-inch space between the exterior wall and any plantings. Each practice is with 1/2 point. Multifamily building projects must develop an integrated pest management policy	2

Figure 5: Location and Site Development Practices

Other NGBS Lot Design, Preparation and Development Credits

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Lot Design, Preparation and Development	502.1	**Project Team, Mission Statement, and Goals** A team is established roles identified for green lot design, preparation, and development. A mission statement is developed with green goal's and objectives	4
	503.1	**Natural Resources** Natural resources are conserved by one or more of the following: ● A natural resource inventory is completed under the direction of a qualified professional (5 pts) ● A plan is implemented to conserve the elements identified by the natural resource inventory (6 pts) ● Listed items are protected under direction of qualified professional (4 pts) ● Basic training on resource protection provided to on-site supervisor (4 pts) ● Tree pruning conducted by certified arborist (3 pts) ● Vegetation maintenance in accordance with TCIA A300 (4 pts) ● Protection plan of adjacent common areas implemented (5 pts)	31
	503.6	**Wildlife Habitat** At least two of the following practices must be selected to earn this credit: ● Plants and garden are selected that encourage wildlife, such as bird and butterfly gardens (3 pts) ● Include a certified "backyard wildlife" program (3 pts) ● The lot is designed in regard to wildlife corridors, fish and game parks, and preserved areas (3 pts) ● Outdoor lighting techniques are utilized with regard to wildlife (3 pts)	12
	504.2	**Tree and Vegetation Preservation** Trees and vegetation are preserved by one ore more of the following: ● Fencing is installed to protect trees and other vegetation (3 pts) ● Trenching, significant changes of grade, and soil compaction in "tree save" areas are avoided (5 pts) ● Damage to existing trees and vegetation is mitigated during construction (4 pts)	12
	503.5	**Landscape Plan (cont'd)** A landscaping plan is developed with one ore more of the following: ● A plan is implemented that protects, restores, or enhances natural vegetation for 12% (1 pt), 25% (2 pts), 50% (3 pts), or 100% (4 pts) of the lot ● Only non-invasive native or regionally appropriate plants selected to promote biodiversity (7 pts) ● To improve pollinator habitat, 10% or more of planted area are non-invasive flowering and nectar producing plants (3 pts) ● EPA WaterSense Water Budget Tool used to implement mas % of turf area (2 pts) Path 5: Max % of vegetated areas that are turf is 0% (5 pts), less than 20% (4 pts), less than 40% (3 pts), less than 60% (2 pts) ● Plants with similar watering needs are grouped (5 pts) ● 30% or more of building walls shaded in summer by plants (5 pts) ● Vegetative wind breaks/channels designed to protect lot (5 pts) ● On-site or community tree trimmings of native trees used as mulch (3 pts) ● Developer creates a plan to remove or contain invasive plants from disturbed areas of the site (3 pts) ● Developer creates a plan to remove or contain invasive plants from undisturbed areas of the site (5 pts)	46

Other LEEDv4-Homes Credits

	LEEDv4 Homes	Points Possible
Integrative Process	**Integrative Process** Perform a preliminary "simple box" energy modeling analysis and water budget analysis before the completion of schematic design that explores how to reduce energy and water use in the building. Document how the analyses informed building and site design decisions in the project's OPR and BOD.	1
Location & Transportation	**Floodplain Avoidance** Do not develop buildings on land that lies within a flood hazard area shown on a legally adopted flood hazard map	Mandatory

Figure 5: Location and Site Development Practices

Other NGBS Lot Design, Preparation and Development Credits (Cont'd)

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Lot Design, Preparation and Development	505.1	**Driveways and Parking Reduction** Impervious areas are minimized by one or more of the following: • Off-street parking and driveways are shared (5 pts) • For multifamily, parking does not exceed local minimums (5 pts) • Structured parking is use or reduce footprint by 25% (4 pts), 50% (5 pts), or greater than 75% (6 pts) • Water permeable surfacing is used to reduce impervious driving and parking surfaces by 10% (1 pt), 25% (2 pts), and greater than 75% (3 pts)	16
	505.6 / 706.8	**Electric Vehicle Charging Stations** Plug-in electric vehicle charging capability (Level 2) is provided for 1% or more of parking stalls. Stalls are equipped with either Level 2 charging AC grounded outlets or Level 2 charging stations.	4
	503.8	**Demolition of Existing Building** A demolition waste management plan is implemented to recycle and/or salvage a minimum of 50% of nonhazardous demolition waste. One additional point awarded for every 10% above 50%.	5-10
	504.1	**On-site Supervision of Green Practices** On-site supervision is provided during clearing, grading, trenching, paving, an utility installation to ensure green practices are implemented	4
	505.4	**Mixed-Use Development** The lot contains a mixed-use building	8

Materials & Resource Efficiency

ICC/ASHRAE 700-2015 NGBS - Resource Efficiency

The "Resource Efficiency" green practice category is focused on minimizing the environmental impact of buildings by incorporating environmentally efficient building systems and materials, and reducing waste generated during construction and after the home is occupied. Practices include using products and systems with enhanced durability and reduced maintenance, as well as reused, recycled, regional or salvaged materials.

Mandatory Practices:

- For dwelling units greater than 4,000 ft^2, the number of points required for certification increases by one point for every additional 100 ft^2.
- A capillary break and vapor retarder must be installed at concrete slabs in accordance with ICC IRC or IBC codes referenced in the standard.
- Where required, exterior drain tile must be installed
- Crawlspaces:
    - Damp proof walls must be provided below grade
    - 6-mil PE sheeting or Class I Vapor retarder must be installed
- Insulation in cavities is dry
- Where required, water-resistive barrier or drainage plane system must be installed behind exterior veneer/siding.
- Flashing must be installed at all locations listed in ICC/ASHRAE-700 2015
- Tile backing materials must be installed under tiled surfaces in wet areas
- Where required, ice barriers are installed at roof eaves of pitched roofs
- All horizontal ledgers are sloped away to provide gravity drainage
- Finished grades at all sides of a building must provide a minimum of 6 inches of fall within 10 feet of the building for proper drainage.

Minimum Point Requirements:

Table 9: Resource Efficiency Minimum Point Requirements

Green Building Categories	Minimum Points Required			
	BRONZE	SILVER	GOLD	EMERALD
Resource Efficiency	43	59	89	119

LEED Homes - Material & Resources

The "Material & Resources" category of LEED Homes focuses on the environmental performance and durability of products and materials within the home, as well as

diverting material waste from landfills and incineration facilities. Practices in this category include selecting environmentally preferable materials, such as salvaged and bio-based materials, as well as certified wood.

Mandatory Practices:

- All wood in the building must be non-tropical, reused or reclaimed, or certified by the Forest Stewardship Council, or USGBC-approved equivalent.
- Meet the requirements of the ENERGY STAR for Homes, version 3, Water Management System Builder Checklist (See Figure 6 below).

Minimum Point Requirements:

LEED does not require projects to obtain a minimum number of points per category.

Analysis

As seen in Figure 6 below, the NGBS and LEED include several nearly identical practices in their Materials and Resources categories. Both rating systems include mandatory levels of durability, with the NGBS containing substantially more mandatory practices than LEED to increase material durability and ensure good building practices. LEED material durability requirements focus inside the home, while the NGBS focuses on materials both inside and outside of the weatherproofing, such as foundation drainage, moisture control measures, flashing, and sufficient drainage away from the home.

Both systems encourage environmentally preferable materials, such as salvaged, recycled and bio-based materials, as well as manufacturer responsibility, such as using Environmental Management Systems. Both also encourage the reduction of material use through material-efficient construction practices, such as advanced framing.

A significant point of divergence between the rating systems is the LEED requirement that all wood in the building must be non-tropical, reused, reclaimed or certified by the Forest Stewardship Council, or USGBC-approved equivalent. The standard awards points for using certified wood products, but does not mandate it nor prohibit the use of tropical wood.

Figure 6: Material Resource Efficiency Practices

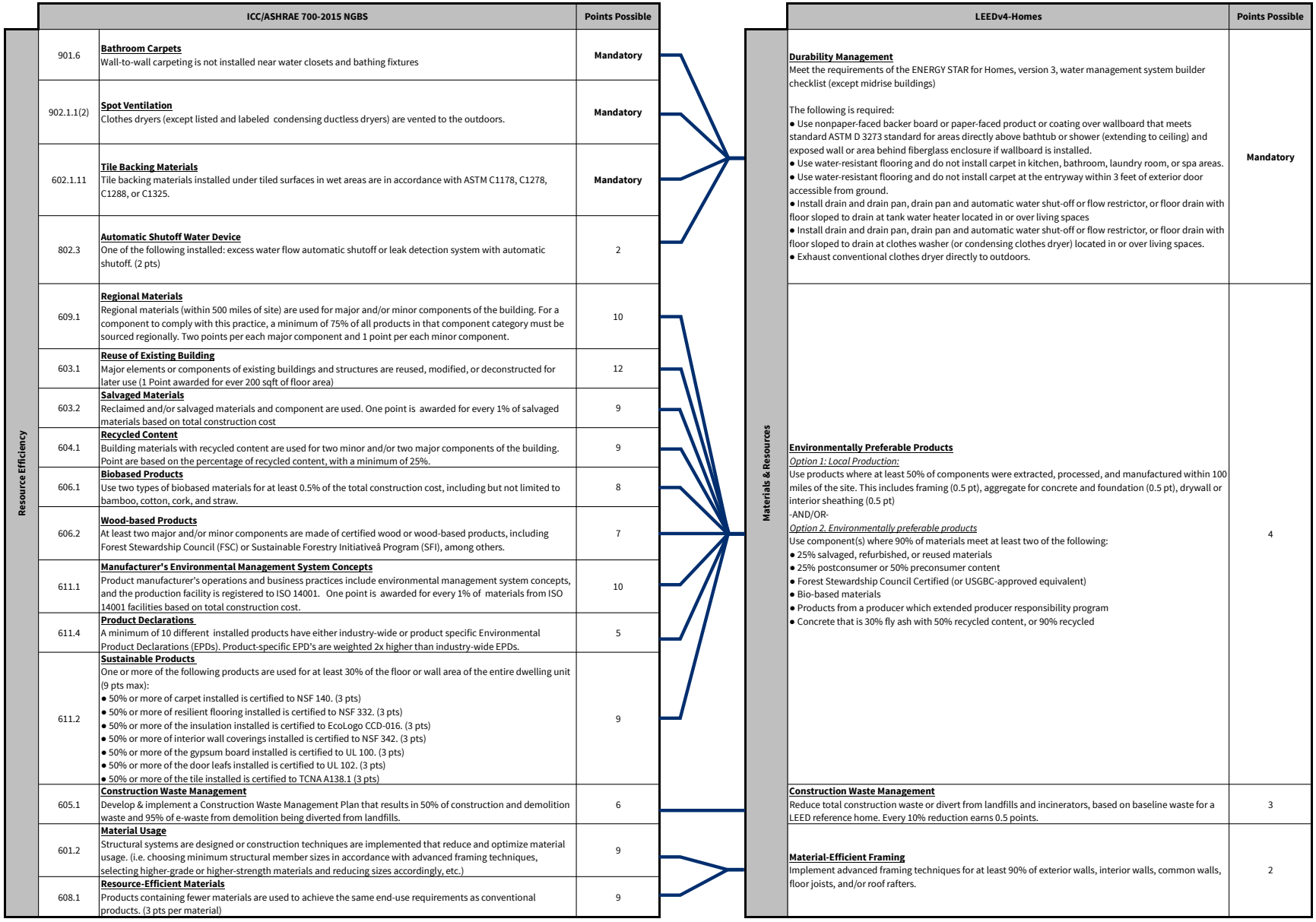


Figure 6: Material Resource Efficiency Practices

Other NGBS Resource Efficiency Credits

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Resource Efficiency	601.1	**Conditioned Floor Area** Total finished floor area of a dwelling unit is limited to the following areas: ● ≤ 700 sqft: 14 points ● ≤ 1,000 sqft: 12 points ● ≤ 1,500 sqft: 9 points ● ≤ 2,000 sqft: 6 points ● ≤ 2,500 sqft: 3 points ● ≤ 4,000 sqft: **Mandatory:** No point awarded and for every 100 sqft over 4,000 sqft, one additional point is required to be earned elsewhere in the home for every level of certification. **Multifamily:** A weighted average of the individual unit sizes is used for this practice.	14 (**Mandatory** if over 4,000 sqft)
	601.3	**Building Dimensions and Layouts** Building dimensions and layouts are designed to reduce material cuts and waste. This practice is used for a minimum of 80 percent of the following areas: ● floor area (3 pts) ● wall area (3 pts) ● roof area (3 pts) ● cladding or siding area (3 pts) ● penetrations or trim area (1 pt)	13
	601.4	**Framing and Structural Plans** Detailed framing or structural plans, material quantity lists and on-site cut lists for framing, structural materials, and sheathing materials are provided.	4
	601.5	**Prefabricated Components** Precut or preassembled components, or panelized or precast assemblies are utilized for a minimum of 90 percent for the following system or building: ● floor system (4 pts) ● wall system (4 pts) ● roof system (4 pts) ● modular construction for the entire building located above grade (13 pts) ● manufactured home construction for the entire building located above grade (13 pts)	13
	601.6	**Stacked Stories** Stories above grade are stacked, with support floors at least 1/2 the size of ground floor and 7-foor ceiling. First stacked floor is worth 4 points, with 2 points for each additional floor, 8 points max.	8
	601.7	**Prefinished Materials** Prefinished building materials or assemblies, such as trim, walls, floors, ceilings, and fenestrations, have no additional site-applied finishing material are installed.	12
	601.8	**Foundations** The foundation system minimizes soil disturbance, excavation quantities, and material usage.	3
	601.9	**Above-Grade Wall Systems** Above-grade wall systems provide the structural and thermal characteristics of mass walls and are used for at least 75% of the gross exterior wall area of the building.	4
	602.1.1	**Capillary Breaks** ● **Mandatory**: A capillary break and vapor retarder are installed at concrete slabs in accordance with ICC IRC Sections R506.2.2 and R506.2.3 or ICC IBC Sections 1907 and 1805.4.1. ● A capillary break between the footing and the foundation wall is provided to prevent moisture migration into foundation wall. (3 pts)	**Mandatory** + 3 Points
	602.1.2	**Foundation Waterproofing** Enhanced foundation waterproofing is installed using one or both of the following: ● rubberized coating ● drainage mat	4
	602.1.3	**Foundation Drainage** ● **Mandatory:** Where required by the ICC IRC or IBC for habitable and usable spaces below grade, exterior drain tile is installed. ● Interior and exterior foundation perimeter drains are installed and sloped to discharge to daylight, dry well, or sump pit. (4 pts)	**Mandatory** + 4 Points
	602.1.4	**Crawlspaces** *For unconditioned and vented crawlspace:* ● **Mandatory:** Dampproof walls are provided below finished grade. ● Minimum 6-mil vapor retarder installed on the crawlspace floor and extended at least 6 inches up the wall and is attached and sealed to the wall. (6 pts) *For conditioned crawlspace:* ● **Mandatory:** 6-mil polyethylene sheeting, or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the IRC. ● A concrete slab over 6-mil polyethylene sheeting, or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the IRC. (8 pts)	8

Other LEEDv4-Homes Materials & Resources Credits

	LEEDv4-Homes	Points Possible
Materials & Resources	**Certified Tropical Wood** All wood in the building must be nontropical, reused or reclaimed, or certified by the Forest Stewardship Council, or USGBC-approved equivalent. A tree species is considered tropical if it is grown in a location that lies between the Tropic of Cancer and the Tropic of Capricorn.	**Mandatory**
	Durability Management Verification The verification team inspects and verifies each measure listed in the ENERGY STAR for Homes, version 3, water management system builder checklist.	1

Figure 6: Material Resource Efficiency Practices

Other NGBS Resource Efficiency Credits (cont'd)

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Resource Efficiency	602.1.5	**Termite Barrier** *For areas of moderate to heavy termite infestation potential:* Install no or low-toxicity treatment measures (4 pts) *For areas of very heavy termite infestation potential:* Install above measures, as well as implement low toxicity bait and kill treatment plan. (4 pts)	4
	602.1.6	**Termite-resistant materials** *Slight to moderate termite infestation probability:* Install termite resistive materials for foundation, structural walls, floors, exterior decks, and exterior claddings 2 feet above top of foundation. (2 pts) *Moderate to heavy termite infestation probability:* Install termite resistive materials in all above areas as well as exterior claddings 4 feet above top of foundation. (4 pts) *Very heavy termite infestation probability:* Install termite resistive materials in all above areas as well as all exterior claddings. (6 pts)	6
	602.1.7	**Moisture Control Measures** ● **Mandatory:** Insulation in cavities is dry in accordance with manufacturer's instructions when enclosed (2 pts) ● **Mandatory:** Moisture content of subfloor, substrate, or concrete slabs is in accordance with the appropriate industry standard for the finish flooring to be applied. ● Building materials with visible mold are not installed or are cleaned or encapsulated prior to concealment and closing. (2 pts) ● The moisture content of lumber is sampled to ensure it does not exceed 19 percent prior to the surface and/or cavity enclosure. (4 pts) ● Building envelope assemblies are designed for moisture control based on documented hygrothermal simulation or field study analysis. (4 pts)	**Mandatory** + 14 Points
	602.1.8	**Water-Resistive Barrier** Where required by the ICC, IRC, or IBC, a water-resistive barrier and/or drainage plane system is installed behind exterior veneer and/or siding.	**Mandatory**
	602.1.9	**Flashing** ● **Mandatory:** Flashing is installed at all of the following locations, as applicable: (a) around exterior fenestrations, skylights, and doors (b) at roof valleys (c) at all building-to-deck, -balcony, -porch, and -stair intersections (d) at roof-to-wall intersections, at roof-to-chimney intersections, at wall-to-chimney intersections, and at parapets (e) at ends of and under masonry, wood, or metal copings and sills (f) above projecting wood trim (g) at built-in roof gutters, and (h) drip edge is installed at eave and rake edges. ● All window and door head and jamb flashing is either self-adhered flashing complying with AAMA 711-13 or liquid applied flashing complying with AAMA 714-15 and installed in accordance with fenestration or flashing manufacturer's installation instructions. (2 pts) ● Pan flashing is installed at sills of all exterior windows and doors. (3 pts) ● Seamless, preformed kickout flashing or prefabricated metal with soldered seams is provided at all roof-to-wall intersections. (3 pts) ● A rainscreen wall design is used for exterior wall assemblies. (4 pts) ● Through-wall flashing is installed at transitions between wall cladding materials or wall construction types. (2 pts) ● Flashing is installed at expansion joints in stucco walls. (2 pts)	**Mandatory** + 16 Points
	602.1.10	**Exterior Doors** Entries at exterior door assemblies, inclusive of side lights , are covered by installing a porch roof or awning, extending the roof overhang, recessing the exterior door, or installing a storm door. (2 pts per door, 6 pts max)	**6**
	602.1.12	**Roof Overhangs** Roof overhangs are provided over at least 90% of exterior walls to protect the envelope.	**4**
	602.1.13	**Ice Barrier** In applicable climates, an ice barrier is installed in accordance with the ICC IRC or IBC at roof eaves of pitched roofs and extends at least 24 inches inside the exterior wall line.	**Mandatory**
	602.1.14	**Architectural Features** ● **Mandatory:** All horizontal ledgers are sloped away to provide gravity drainage. (1 pt) ● No roof configurations create horizontal valleys in roof design. (2 pts) ● No recessed windows and architectural features trap water on horizontal surfaces. (2 pts)	**Mandatory** + 5 Points
	602.2	**Roof Surfaces** At least 90% of roof surfaces are comprised of one or more of the following: ● ENERGY STAR® cool roof certification or equivalent materials ● A vegetated roof system ● Materials with a minimum initial SRI of 78 for low-sloped roof (a slope less than 2:12) and a minimum initial SRI of 29 for a steep-sloped roof (a slope equal to or greater than 2:12). *Note:* Do not include roof area that is used for roof penetrations and associated equipment, on-site renewable energy systems such as photovoltaics or solar thermal energy collectors, or rooftop decks, amenities and walkways.	3

Figure 6: Material Resource Efficiency Practices

Other NGBS Resource Efficiency Credits (cont'd)

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Resource Efficiency	602.3	**Roof Water Discharge** A gutter and downspout system or splash blocks and effective grading are provided to carry water a minimum of 5 feet away from perimeter foundation walls.	4
	602.4	**Finished Grade** ● **Mandatory:** Finished grade at all sides of a building is sloped to provide a minimum of 6 inches of fall within 10 feet of the edge of the building. Where there is not 10 feet available, the final grade is sloped away from the edge of the building at 2% or greater. ● Final grade is sloped away from the edge of the building at a minimum slope of 5%. (1 pt) ● Water is directed to drains or swales to ensure drainage away from the structure. (1 pt)	**Mandatory** + 2 Points
	603.3	**Scrap Materials** Sorting and reuse of scrap building material is facilitated.	4
	605.2	**On-Site Recycling** On-site recycling measures following are implemented, such as the following: ● Materials are ground or otherwise safely applied on-site as soil amendment or fill. At least of 50% (by weight) of construction and land-clearing waste is diverted from landfill. ● Compatible untreated biomass material are set aside for combustion if a solid fuel-burning appliance will be available for on-site renewable energy.	7
	605.3	**Recycled Construction Materials** Construction materials are recycled offsite. A minimum of two types of materials are recycled (3 pts), and one additional point is earned for each additional recycled material type.	6
	606.3	**Manufacturing Energy** Materials manufactured using a minimum of 33% of manufacturing process energy from renewable or combustible waste sources, or renewable energy credits. Two points are awarded per material.	6
	607.1	**Recycling and Composting** ● A built-in collection space in each kitchen and a aggregation/pickup space in a covered area for recycling containers is provided (3 pts) ● A compost facility is provided on-site (3 pts) ● A minimum of one food waste disposer is installed at the primary kitchen sink. (1 pt)	7
	610.1.1	**Whole Building Life Cycle Assessment (LCA)** ● Execute LCA at the whole building level through a comparative analysis between the final and reference building designs as set forth under Standard Practice, ASTM E2921. (8 pts) The assessment criteria includes the following environmental impact categories: - Primary energy use - Global warming potential - Acidification potential - Eutrophication potential - Ozone depletion potential - Smog potential ● Execute LCA on regulated loads throughout the building operations life cycle stage. (5 pts) ● Execute full LCA, including use-phase, through calculation of operating energy impacts using local or regional emissions factors from energy supplier, utility, or EPA. (2 pts)	15
	610.1.2	**Product and/or Building Assembly Life Cycle Assessment (LCA)** Select products and/or building assemblies that have completed a LCA using the following environmental impact measures: - Primary energy use - Global warming potential - Acidification potential - Eutrophication potential - Ozone depletion potential - Smog potential	10
	611.3	**Universal Design Elements** Dwelling incorporates one or more of the following universal design elements. (12 pts max): ● Any no-step entrance into the dwelling which is accessible from a substantially level parking or drop-off area (no more than 2%) via an accessible path which has no individual change in elevation or other obstruction of more than 1-1/2 inches in height with the pitch not exceeding 1 in 12, and provides a minimum 32-inch wide clearance into the dwelling. (3 pts) ● Minimum 36-inch wide accessible route from the no-step entrance into at least one visiting room in the dwelling and into at least one full or half bathroom which has a minimum 32-inch clear door width and a 30-inch by 48-inch clear area inside the bathroom outside the door swing. (3 pts) ● Minimum 36-inch wide accessible route from the no-step entrance into at least one bedroom which has a minimum 32-inch clear door width. (3 pts) ● Blocking or equivalent installed in the accessible bathroom walls for future installation of grab bars at water closet and bathing fixture, if applicable. (1 pt) ● All interior and exterior door handles are levers rather than knobs. (1 pt) ● All sink faucet controls are single-handle controls of both volume and temperature. (1 pt) ● Interior convenience Power receptacles, communication connections and switches are placed between 15” and 48” above the finished floor. Additional switches to control devices and systems (such as alarms, home theaters and other equipment) not required by the local building code may be installed as desired. (1 pt) ● All light switches are rocker-type switches or other similar switches that can be operated by pressing them (with assistive devices). Toggle-type switches may not be used. (1 pt) ● Any of the following can be controlled with a (wireless) mobile device such as a smartphone, tablet or laptop computer: HVAC, lighting, alarm system or door locks. (1 pt)	12

Energy Efficiency

ICC/ASHRAE 700-2015 NGBS – Energy Efficiency

This NGBS category focuses on design and construction practices that help increase the energy efficiency of a project while encouraging the use of renewable energies. There are multiple paths for a project to comply, providing builders and project teams the flexibility to choose the best means of demonstrating increased energy efficiency based on their local conditions and market. Regardless of the path selected, this category includes multiple mandatory practices to ensure a solid base of energy efficiency regardless of project type and location.

Table 10 below shows the pathways available to demonstrate compliance with this category. Also listed are the corresponding levels of certification a project can achieve by selecting the various pathways. For example, a project selecting an EnergyStar 3.0 Certified Home label as the compliance method can only achieve Bronze Certification, while only a project pursuing the Performance Path can achieve the highest level of Certification, Emerald.

Table 10: NGBS Energy Efficiency Compliance Paths

Energy Performance Compliance Path	Summary	Rating Levels Achievable
Performance Path	Meet or surpass ICC IECC 2015 baseline performance, and include at least two additional energy efficiency practices, such as occupancy sensors & lighting controls. Two points are earned for every percentage point above IECC 2015	• Bronze • Silver • Gold • Emerald
Prescriptive Path	Obtain at least 30 points through prescriptive practices detailed in the ICC/ASHRAE-700 2015, and include at least two additional energy efficiency practices, such as occupancy sensors & lighting controls.	• Bronze • Silver • Gold
HERS Index	Complete EPA HERS Index Target Procedure with final value equal to or less than EPA HERS Index Target, and include at least two additional energy efficiency practices, such as occupancy sensors & lighting controls.	• Bronze • Silver • Gold
ENERGY STAR Version 3.0	Qualify as an ENERGY STAR Version 3.0 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03	• Bronze Only
ENERGY STAR Version 3.1	Qualify as an ENERGY STAR Version 3.1 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03 (with a baseline at ASHRAE 90.1-2010)	• Silver Only

Mandatory Practices:

- One of the available compliance pathways from Table 1 must be selected.
- All installation of insulation must meet Grade 1 standards.
- Building envelope tightness must be tested in accordance with ASTM E-779 using a blower door at 1.05 psf (50 Pa).
- The building thermal envelope must be durably sealed to limit infiltration. All openings, penetrations, joints, seams, connections, common walls and other sources of infiltration are caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film or solid material
- The HVAC system must be sized per load calculations using ACCA Manual J.
- Radiant and hydronic space heating systems must be designed, installed and documented using industry-approved guidelines and standards.
- All ducts must be air sealed with materials in conformance with UL 181A or UL 181B.
- Framing cavities cannot be used as ducts or plenums.
- Duct systems must be sized and designed in accordance with ACCA Manual D (or equal).
- Fenestrations, such as windows, must not have an infiltration rate of 0.3 cfm per square foot, while swinging doors must not exceed 0.5 cfm per square foot.
- Recessed luminaries installed in the thermal envelope must be sealed to limit air leakage, IC-rated and labeled as meeting ASTM E283, and sealed with a gasket or caulk.
- Dwelling unit(s) must either have a minimum of 75% of total hard-wired lighting fixtures or bulbs qualify as high efficacy, or the lighting power density be 1.1 watts/square foot or less.
- Any boiler supply piping in unconditioned space must be insulated.

Minimum Point Requirements:

Table 11: Energy Efficiency Minimum Point Requirements

Green Building Categories	Minimum Points Required			
	BRONZE	SILVER	GOLD	EMERALD
Energy Efficiency	30	45	60	70

LEED Homes – Energy Efficiency

The "Energy Efficiency" category of LEED Homes is focused on design and construction practices that help increase the energy efficiency of a project while encouraging the use of renewable energies. To comply, projects have must either meet the requirements of ENERGY STAR for Homes v3 and achieve a HERS index rating at or below the HERS index target, or meet the requirements of the ENERGY STAR for Homes v3 Prescriptive Pathway. The project must also compare the size of the conditioned floor area to the ENERGY STAR for Homes reference home, and will either earn or lose points depending on the relative size of the home.

Mandatory Practices:

- Meet the requirements of ENERGY STAR for Homes v3 and achieve a HERS index rating at or below the HERS index target or meet the requirements of the ENERGY STAR for Homes v3 Prescriptive Pathway, including all components of the ENERGY STAR Reference Design.
- At least one refrigerator, dishwasher, and/or clothes washer must be ENERGY STAR qualified.
- All duct runs must be fully ducted (i.e., building cavities may not be used as ducts).
- An electricity meter or submeter must be installed for each residential unit in a multifamily building and a gas meter for the entire building, or a gas meter or sub-meter for each unit.
- The builder must provide an operations and maintenance manual to responsible parties, such as the home owner or building operator. (See Figure 7).
- The builder must conduct a walkthrough of the home with the occupants, identifying all installed equipment and instructing how to use, operate and maintain the equipment.
- The project earns one point for every 4% decrease in conditioned floor area compared with the ENERGY STAR for Homes, version 3, reference home. Buildings that are larger than the reference home lose one point for every 4% increase in conditioned floor area.

Minimum Point Requirements:

LEED does not require projects to obtain a minimum number of points per category.

Analysis

Both the standard and LEED Homes provide pathways for demonstrating overall energy efficiency by means of a HERS Index rating and ENERGY STAR for Homes, version 3. The standard also allows for energy modeling as a pathway to compliance. This is generally used more by multifamily buildings, and is an available pathway for the separate LEED-NC system.

Both LEED and the NGBS require home owner education, including operations and maintenance manuals as well as first-hand home owner or building operator training. The standard places these requirements in a separate category, as it also includes green practices outside of energy efficiency, such as pest management and recycling and composting practices.

NGBS includes a number of additional mandatory practices, such as HVAC and duct-sizing requirements, to ensure a baseline of energy efficiency. Notably, NGBS requires all insulation to be installed to Grade 1 standards, which is verified pre-drywall to ensure no visual defects. LEED Homes includes this practice as an option for earning added points.

LEED mandates that a multifamily building must install an electricity meter or submeter for each residential unit and a gas meter for the entire building, or a gas meter or sub-meter for each unit. The NGBS does not mandate metering procedures, although it encourages optional whole building metering and submetering of residential units through available points.

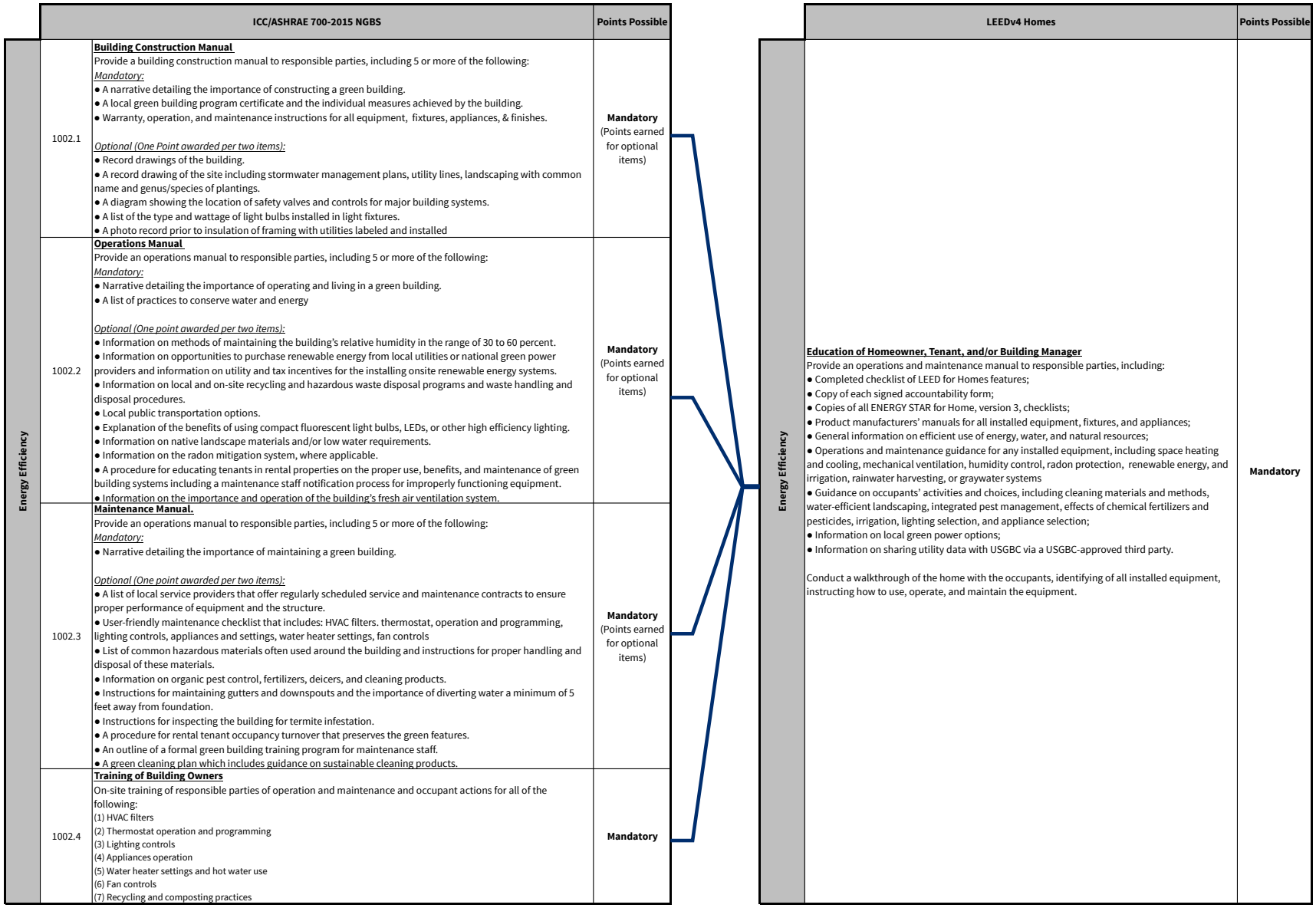
Both systems encourage the on-site generation and/or the purchase of renewable energy by awarding projects that pursue these strategies with additional points.

Figure 7: Energy Efficiency Practices

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Energy Efficiency	701.1.1 & 702	**Minimum Performance Path Requirements (ICC IECC 2015)** Demonstrate through energy modeling that the proposed building performance is equal to or better than the baseline building performance. Calculate the baseline building performance according to ICC IECC 2015.	**Mandatory (Option 1)**
	701.1.2 & 703	**Minimum Prescriptive Path Requirements (ICC/ASHRAE 700-2015)** Comply with all mandatory requirements, as well as obtain a minimum of 30 points, within Section 703 of the ICC/ASHRAE 700-2015. *Note:* All projects must also include two additional energy conservation practices listed in Section 705 of the ICC/ASHRAE 700-2015, such as occupancy sensors & lighting controls.	**Mandatory (Option 2)**
	701.1.3	**EPA HERS Index Target Path** The building must complete the EPA HERS Index Target Procedure with the final value equal to or less than EPA HERS Index Target. *Note:* All projects must also include two additional energy conservation practices listed in Section 705 of the ICC/ASHRAE 700-2015, such as occupancy sensors & lighting controls.	**Mandatory (Option 3)**
	701.1.4	**ENERGY STAR Version 3.0 Certified Home** A project that qualifies as an ENERGY STAR Version 3.0 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03 can satisfy the Energy Efficiency category, but **can only achieve Bronze Certification.** A project that qualifies as an ENERGY STAR Version 3.1 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03 (with the baseline as AHSRAE 90.1-2010) can satisfy the Energy Efficiency category, but **can only achieve Silver Certification.**	**Mandatory (Option 4)**
	701.4.2.1	**Duct Air Sealing** All duct sealing is in conformance with UL 181A or UL 181B	**Mandatory**
	701.4.2.2	**Ducts and Plenums** Building cavities are not used as ducts or plenums.	**Mandatory**
	703.6.2	**ENERGY STAR Appliances** Installed refrigerator (1 pt), dishwasher (1 pt), and/or clothes washer (4 pts) are ENERGY STAR-qualified.	6
	706.3	**Smart Appliances and Systems** Smart appliances and systems are installed for at least three of the following: refrigerator, freezer, dishwasher, clothes dryer, clothes washer, HAVC System, Service Hot Water Heating System	2
	706.1 (2)	**Energy Consumption Control** Install a whole-building energy-monitoring device or system.	1
	705.7	**Submetering System** In a multifamily building, an advanced submetering system is installed to monitor energy consumption for each unit. Information is available to occupants monthly.	1

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Minimum Energy Performance** *Requirement 1:* Meet the requirements of ENERGY STAR for Homes v3. Achieve a HERS index rating at or below the HERS index target or meet the requirements of the ENERGY STAR for Homes v3 Prescriptive Pathway, including all components of the ENERGY STAR Reference Design. *Requirement 2:* At least one refrigerator, dishwasher, and/or clothes washer must be ENERGY STAR qualified *Requirement 3:*All duct runs must be fully ducted (i.e., building cavities may not be used as ducts).	**Mandatory**
	Energy Metering *Single Family* Install whole-house electric and gas meters, as applicable. *Multifamily* Install an electricity meter or submeter for each residential unit and a gas meter for the entire building, or a gas meter or sub-meter for each unit. Encourage homeowners or tenants to share energy usage data with USGBC.	**Mandatory**

Figure 7: Energy Efficiency Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Energy Efficiency	1002.1	**Building Construction Manual** Provide a building construction manual to responsible parties, including 5 or more of the following: *Mandatory:* ● A narrative detailing the importance of constructing a green building. ● A local green building program certificate and the individual measures achieved by the building. ● Warranty, operation, and maintenance instructions for all equipment, fixtures, appliances, & finishes. *Optional (One Point awarded per two items):* ● Record drawings of the building. ● A record drawing of the site including stormwater management plans, utility lines, landscaping with common name and genus/species of plantings. ● A diagram showing the location of safety valves and controls for major building systems. ● A list of the type and wattage of light bulbs installed in light fixtures. ● A photo record prior to insulation of framing with utilities labeled and installed	**Mandatory** (Points earned for optional items)
	1002.2	**Operations Manual** Provide an operations manual to responsible parties, including 5 or more of the following: *Mandatory:* ● Narrative detailing the importance of operating and living in a green building. ● A list of practices to conserve water and energy *Optional (One point awarded per two items):* ● Information on methods of maintaining the building's relative humidity in the range of 30 to 60 percent. ● Information on opportunities to purchase renewable energy from local utilities or national green power providers and information on utility and tax incentives for the installing onsite renewable energy systems. ● Information on local and on-site recycling and hazardous waste disposal programs and waste handling and disposal procedures. ● Local public transportation options. ● Explanation of the benefits of using compact fluorescent light bulbs, LEDs, or other high efficiency lighting. ● Information on native landscape materials and/or low water requirements. ● Information on the radon mitigation system, where applicable. ● A procedure for educating tenants in rental properties on the proper use, benefits, and maintenance of green building systems including a maintenance staff notification process for improperly functioning equipment. ● Information on the importance and operation of the building's fresh air ventilation system.	**Mandatory** (Points earned for optional items)
	1002.3	**Maintenance Manual.** Provide an operations manual to responsible parties, including 5 or more of the following: *Mandatory:* ● Narrative detailing the importance of maintaining a green building. *Optional (One point awarded per two items):* ● A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure. ● User-friendly maintenance checklist that includes: HVAC filters. thermostat, operation and programming, lighting controls, appliances and settings, water heater settings, fan controls ● List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials. ● Information on organic pest control, fertilizers, deicers, and cleaning products. ● Instructions for maintaining gutters and downspouts and the importance of diverting water a minimum of 5 feet away from foundation. ● Instructions for inspecting the building for termite infestation. ● A procedure for rental tenant occupancy turnover that preserves the green features. ● An outline of a formal green building training program for maintenance staff. ● A green cleaning plan which includes guidance on sustainable cleaning products.	**Mandatory** (Points earned for optional items)
	1002.4	**Training of Building Owners** On-site training of responsible parties of operation and maintenance and occupant actions for all of the following: (1) HVAC filters (2) Thermostat operation and programming (3) Lighting controls (4) Appliances operation (5) Water heater settings and hot water use (6) Fan controls (7) Recycling and composting practices	**Mandatory**

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Education of Homeowner, Tenant, and/or Building Manager** Provide an operations and maintenance manual to responsible parties, including: ● Completed checklist of LEED for Homes features; ● Copy of each signed accountability form; ● Copies of all ENERGY STAR for Home, version 3, checklists; ● Product manufacturers' manuals for all installed equipment, fixtures, and appliances; ● General information on efficient use of energy, water, and natural resources; ● Operations and maintenance guidance for any installed equipment, including space heating and cooling, mechanical ventilation, humidity control, radon protection, renewable energy, and irrigation, rainwater harvesting, or graywater systems ● Guidance on occupants' activities and choices, including cleaning materials and methods, water-efficient landscaping, integrated pest management, effects of chemical fertilizers and pesticides, irrigation, lighting selection, and appliance selection; ● Information on local green power options; ● Information on sharing utility data with USGBC via a USGBC-approved third party. Conduct a walkthrough of the home with the occupants, identifying of all installed equipment, instructing how to use, operate, and maintain the equipment.	**Mandatory**

Figure 7: Energy Efficiency Practices

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Energy Efficiency	601.1	**Conditioned Floor Area** Total finished floor area of a dwelling unit is limited to the following areas: ● ≤ 700 sqft: 14 points ● ≤ 1,000 sqft: 12 points ● ≤ 1,500 sqft: 9 points ● ≤ 2,000 sqft: 6 points ● ≤ 2,500 sqft: 3 points ● ≤ 4,000 sqft: **Mandatory:** No point awarded and for every 100 sqft over 4,000 sqft, one additional point is required to be earned elsewhere in the home for every level of certification. For a multifamily building, a weighted average of the individual unit sizes is used for this practice.	14 (**Mandatory** if over 4,000 sqft)
	701.1.1 & 702	**Performance Path Requirements (ICC IECC 2015)** Demonstrate an improvement of 1% or more in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to ICC IECC 2015.	30+
	701.1.2 & 703	**Prescriptive Path Requirements (ICC/ASHRAE 700-2015)** Obtain a minimum of 30 points, within Section 703 of the ICC/ASHRAE 700-2015. *Note:* All projects must also include two additional energy conservation practices listed in Section 705 of the ICC/ASHRAE 700-2015, such as occupancy sensors & lighting controls.	30+
	701.1.3	**EPA HERS Index Target Path** The building must complete the EPA HERS Index Target Procedure with the final value less than EPA HERS Index Target. Points are awarded per percent less than EnergyStar HERS Index Target.	30+
	801.1	**Indoor Hot Water Usage** ● Max volume from water heater to furthest fixture is 1 gal, 0.5 gal, or 0.25 gal. (29 pts max) ● Demand controlled hot water priming pump installed on main supply pipe, and volume in circulation loop from heater to furthest fixture is 1 gal. (39 pts) ● Central hot water recirculation system implemented in multifamily. (9 pts) ● Tankless water heater w/ at least 0.5 gal storage or ramp up to 100F in 5 secs installed. (4 added pts)	43 max
	701.4.5	**Boiler Supply Piping** Any boiler supply piping in unconditioned space must be insulated	**Mandatory**
	705.6.3	**Insulating Hot Water Pipes** Piping involved in hot water is insulated with a minimum thermal resistance of R-3	1

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Home size** Earn 1 point for every 4% decrease in conditioned floor area compared with the ENERGY STAR for Homes, version 3, reference home. Buildings that are larger than the reference home lose 1 point for every 4% increase in conditioned floor area. *Reference Home:* ● 1-Bedroom: 1,000 sqft ● 2-Bedrooms: 1,600 sqft ● 3-Bedrooms: 2,200 sqft ● 4-Bedrooms: 2,800 sqft ● 5-Bedrooms: 3,400 sqft ● 6-Bedrooms: 4,000 sqft ● 7-Bedrooms: 4,600 sqft ● 8-Bedrooms or more: +600 sqft per added bedroom	**Mandatory** (Points Possible)
	Annual Energy Use *Option 1: Modeling* Design and construct a building whose modeled annual energy usage is lower than the LEED energy budget. The LEED energy budget is based on the ENERGY STAR for Homes, HERS Index Target Procedure for National Program Requirements, version 3, with modification listed by LEED. *Option 2. HERS Index with Home Size Adjuster* Design and construct a home whose modeled annual energy usage achieves a HERS index rating of 70 or better Points are earn for every HERS index at or below 70.	29
	Efficient Hot Water Distribution System *Option 1. Efficient hot water distribution* (2 points) *Path 1:* Do not exceed the maximum allowable pipe length from the source of hot water to the termination of the fixture supply pipe as listed in LEED based on pipe size -OR- *Path 2*: Do not exceed a maximum volume of hot or tempered water of 64 ounces for hot water from a water heater or boiler with no circulation loop or heat traced pipe. *Option 2: Performance test* (3 points) Using EPA WaterSense testing procedures, verify that no more than 0.5 gallons of water is stored in any piping between the hot water source and any fixture, and that no more than 0.6 gallons of water is collected from the hot water fixture before hot water is delivered. WaterSense Labeled New Homes meets the requirement. If Hot water source is a circulation loop or heat traced pipe serving a single unit or house, no more than 0.25 gallons of water can be collected from the hot water fixture furthest from the recirculation loop. -AND/OR- *Option 3. Pipe insulation* (2 points) Install at least R-4 insulation on all domestic hot water piping, including subslab pipes.	

Figure 7: Energy Efficiency Practices

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Energy Efficiency	706.1	**Energy Consumption Control** ● Install a whole-building or whole-dwelling unit energy-monitoring device or system. (1 pt) ● Install a whole-building or whole-dwelling unit energy management control system. (3 pts)	4
	703.5.5	**Solar Water Heater** Solar domestic water heating system is installed and meets Solar Rating & Certification Corporation OG 300 rating. Points awarded based on Solar Energy Factor and Climate Zone.	1-33
	706.5	**On-site Renewable Energy System** An on-site renewable energy production system is installed. Two points are awarded based on kW produced, divided by the number of dwelling units.	2 or more (kW per DU)
	705.5	**HVAC Design and Installation** *705.5.1:* HVAC Contractor and service technician are certified by nationally/regionally recognized program (e.g., Building Performance Institute). (1 Pt) *705.5.2:* Performance of system is verified by HVAC contractor, including start-up procedure refrigerant charge, air handler speed, and total airflow, among others. (3 Pts)	4
	703.7.1	**Passive Solar Design** The building is designed for passive solar, including but not limited to, The long side () of the building facing within 20 degrees of true south, Overhangs or adjustable canopies or awnings or trellises provide shading on south-facing glass for the appropriate climate zone, and the south face windows have a SHGC of 0.40 or higher.	4
	701.4.3.2	**Air Sealing & Insulation Testing** ● Building envelope tightness must be tested with blower door per ASTM E-779. ● Air barrier and insulation must be field verified by Green Verifier pre-drywall and post-construction.	**Mandatory**
	703.1.2	**Building Envelope Leakage** Building thermal envelope must be in accordance with 2015 IECC R402.4.1.2 or C402.5	**Mandatory** (Prescriptive Path)
	705.6.1	**Installation and Performance Verification** Third-party onsite inspections are conducted pre-drywall and post-construction to verify proper duct installation and sealing, building envelope sealing, and all fenestration sealing, in addition to Green Verifier inspection.	3
	705.6.2.1	**Air Leakage Validation of Building or Dwelling Units** If not required by IECC 2015, blower door testing (3 Points) or third party verification (5 Point) is completed.	5

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Advanced Utility Tracking** **Single-Family:** *Option 1: (1 pt)* Install a permanent energy-monitoring system that records at intervals of one hour or less and is equipped with the ability to transmits data to the homeowner or occupant at a remote location. -AND/OR- *Option 2* (1 pt) The homeowner must share all applicable utility data with USGBC before submitting application for certification. **Multifamily:** *Option 1: (1 pt)* In each unit, install a permanent energy-monitoring system that records at intervals of one hour or less and is equipped with the ability to transmit data to the homeowner or occupant at a remote location. -AND/OR- *Option 2 (1 pt)* The building owner must share all applicable utility data with USGBC or 50% of unit occupants must share all applicable utility data with USGBC.	
	Active Solar-Ready Design *Option 1: Photovoltaic-Ready (1 pt)* Meet EPA's solar photovoltaic specifications for a renewable energy–ready home. Provide detailed information about such systems in the homeowner education manual so that future occupants can install an active PV system. -AND/OR- *Option 2 : Solar Direct Hot Water-Ready* (1 pt) Meet EPA's solar water heating specifications for a renewable energy–ready home. Provide detailed information about such systems in the homeowner education manual so that future occupants can install an active solar DHW system. Projects that use these systems to earn points in other sections "Renewable Energy" and/or "Efficient Domestic Hot Water Equipment " cannot earn points here.	1
	HVAC Start-up Credentialing All HVAC systems commissioned by a technician with North American Technician Excellence certification, HVAC contractor credentialed by an EPA-recognized HVAC Quality Installation Training and Oversight Organization.	1
	Building Orientation for Passive Solar Buildings must be designed so that the south-facing glazing area is at least 50% greater than the sum of the glazing area on the east- and west-facing walls, the east-west axis of the building is within 15 degrees of due east-west, and at least 90% of the south-facing glazing is completely shaded (by awnings, overhangs, plantings) at solar noon on the summer solstice and unshaded at noon on the winter solstice.	3
	Air Infiltration Meet the air leakage requirements stated by LEED based on IECC climate zone. For multifamily, meet the requirements for leakage to outside the conditioned envelope for each dwelling unit, unless the whole building can be entirely and sufficiently depressurized by a blower doors.	2

Figure 7: Energy Efficiency Practices

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Energy Efficiency	701.4.3.2.1	**Grade I Insulation Installation** Insulation must be installed to Grade 1 standards and visually inspected by Green Verifier before installation of drywall.	**Mandatory**
	703.1.1.1	**Maximum UA** The total building UA is less than or equal to the total maximum UA as computed by 2015 IECC. The total UA proposed and baseline calculations are documented. REScheck or COMcheck is deemed to provide UA calculation documentation.	**Mandatory**
	703.1.1.2	**Prescriptive R-values and Fenestration Requirements** The building thermal envelope is in accordance with the insulation and fenestration requirements of 2015 IECC.	**Mandatory**
	703.2.5.1	**Efficient Fenestration** NFRC-certified U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices (TDDs) do not exceed the values in NGBS Table 703.2.5.1.	**Mandatory** (Prescriptive Path)
	703.2.5.2	**Enhanced Fenestration** NFRC-certified (or equivalent) U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices (TDDs) meet the values in NGBS Table 703.2.5.2.	6
	703.3	**HVAC Equipment Efficiency** Design and install HVAC equipment that is meets efficiency standards stated in NGBS Section 703.3 Tables. Points are dependent on equipment type and Climate Zone.	1-52
	703.1.3	**Duct Testing** The duct system is in accordance with 2015 IECC R403.3.2 through R403.3.5 as applicable.	**Mandatory**
	705.6.2.3	**HVAC Duct Leakage Testing** If not required by IECC 2015, duct leakage is tested in accordance with IECC R403.3.3 and R403.3.4 (3 Points). An additional 2 points can be earned if conducted by independent third party.	5
	703.4	**Duct Systems** Install ductless heating and/or cooling systems, install all ducts in the conditioned space, and/or have the entire HVAC duct system tested by a third party for total leakage at a pressure differential of 25 Pa and max air leakage is no more than 6% of design flow rate, or 4.0 cfm at 25 Pascals per 100 square feet. Points are dependent on climate zone.	15
	703.5	**Water Heating System** Water heating system meets the necessary Energy Factor or Solar Energy Factor required to earn points. Points are dependent on water heater type (gas, heat pump, desuperheater, solar, etc.) and climate zone.	25
	701.4.4	**High-Efficacy Lighting** Dwelling unit(s) must either have a minimum of 75% of total hard-wired lighting fixtures or bulbs qualify as high efficacy, or the lighting power density be 1.1 watts/square foot or less.	**Mandatory**
	703.6.1	**Hard-wired Lighting** ● 95% percent of the total hard-wired interior luminaires or lamps qualify as ENERGY STAR or equivalent. (2-3 pts based on climate zone) ● A minimum of 80 percent of the exterior lighting wattage has a minimum efficacy of 40 lumens per watt or is solar-powered. (1 pt) ● In multifamily buildings, common area lighting power density (LPD) is less than 0.51 Watts per square foot. (7 pts)	11
	705.2.1.2	**Exterior Lighting** Photo or motion sensors are installed on 75 percent of outdoor lighting fixtures to control lighting.	1

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Envelope Insulation** Select insulation whose R-value exceeds the requirements listed in the 2012 International Energy Conservation Code (IECC). Earn 1 point for exceeding code requirements by 10%, and 2 points for 20%. Install the insulation to meet the Grade I specifications set by the RESNET Home Energy Rating Standard. Installation must be verified by a qualified energy rater conducting a pre-drywall thermal enclosure inspection.	2
	Windows Design and install windows, skylights, and glass doors whose ratings from the National Fenestration Rating Council (NFRC) exceed the requirements in the ENERGY STAR for Homes, version 3, prescriptive pathway. Points awarded based on climate zone.	3
	Space Heating and Cooling Equipment Design and install HVAC equipment that is more efficient than the equipment required by the ENERGY STAR for Homes, version 3, prescriptive pathway. Points are dependent on equipment type and Climate Zone.	4
	Heating and Cooling Distribution Systems *Case 1. Forced-Air System* *Option 1. Ductwork in Conditioned Space (3 points)* Duct leakage testing is waived if the air-handler unit and all ductwork are located entirely within conditioned spaces and the envelope is airtight. Ductless systems with air circulation blowers qualify. -OR- *Option 2: Ductwork in Unconditioned Space (2 points)* Tested duct leakage rate must not exceed 4.0 cfm at 25 Pascals per 100 square feet for small homes and 3.0 cfm at 25 Pascals per 100 square feet for large homes. This must be verified by the qualified energy rater. *Case 2. Hydronic System (2–3 points)* Keep the system entirely within the conditioned envelope (2 pts). For an additional point, install an outdoor reset control that modulates distribution water temperature based on the outdoor air temperature (1 pt).	3
	Efficient Domestic Hot Water Equipment Install an ENERGY STAR–qualified water heater (1 pt), or install a solar water heater that, in combination with an ENERGY STAR water heater, meets at least 40% (2 pts) or 60% (3 pts) of the annual domestic hot water load.	3
	Lighting **Single Family:** *Option 1. Indoor Lighting (1.5 points)* Install high-efficacy lighting, with LPD of 0.72 w/sf (0.5 pt) to .48 W/sf (1.5 pts). -AND/OR- *Option 2. Exterior Lighting (0.5 point)* All exterior lighting must be Dark Sky qualified and have motion sensor controls, integrative photovoltaic cells, photo sensors, or astronomic time-clock operation. **Multifamily:** *Option 1. Indoor Lighting (1.5 points)* Install high-efficacy lighting and/or lighting controls that achieve a reduction from the ENERGY STAR baseline, from 35% (0.5 pts) to 55% (1.5 pts). -AND/OR- *Option 2. Exterior Lighting (0.5 point)* Complete the ENERGY STAR multifamily midrise worksheet for exterior lighting. Reduce exterior lighting wattage by at least 50%. All exterior lighting must be Dark Sky qualified.	2

Figure 7: Energy Efficiency Practices

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Energy Efficiency	703.3.7	**ENERGY STAR Ceiling Fans** ENERGY STAR, or equivalent, ceiling fans are installed	1
	703.6.2	**ENERGY STAR Appliances** Install ENERGY STAR-qualified appliances for the following: ● Refrigerator (1 pt) ● Dishwasher (1 pt) ● Washing Machine (4 pts)	6
	706.2	**Renewable Energy Service Plan** A renewable energy service plan is provided: - Builder's local administrative office has renewable energy service and also selects renewable energy service plan for interim electric service for project until occupant occupied (1 Point) - The homeowner selects a renewable energy service provider with minimum two-year commitment for 1-49% (1 Point) or 50%+ (2 Points) of projected energy use.	3
	706.5	**On-site Renewable Energy System** An on-site renewable energy production system is installed. Points are awarded based on kW produced and number of dwelling units.	2 or more (kW per DU)

	LEEDv4 Homes	Points Possible
Energy Efficiency	**High-Efficiency Appliances** Install ENERGY STAR–qualified appliances for the following: -Refrigerator(s) (1 pt) - Ceiling fans (0.5 pt) - Dishwasher(s) (0.5 pt)	2
	Renewable Energy Design and install a renewable electricity generation system. Receive 1 point for every 500 kWh produced per year by the system. Renewable energy certificates (RECs) must be retained by the building owner.	4

Figure 7: Energy Efficiency Practices

Other NGBS Energy Efficiency Credits

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Energy Efficiency	701.4.1.1	**HVAC System Sizing** Equipment is sized according to loads calculated using ACCA Manual J (or equal).	**Mandatory**
	701.4.1.2	**Radiant and Hydronic Space Heating** System is designed, installed, and documented using industry-approved guidelines and standards.	**Mandatory**
	701.4.2.3	**Duct System Sizing** Duct systems are sized and designed in accordance with ACCA Manual D (or equal).	**Mandatory**
	701.4.3.1	**Building Thermal Envelope Air Sealing** Building thermal envelope is durably sealed to limit infiltration. All openings, penetrations, joints, seams, connections, common walls, and other sources of infiltration are caulked, gasketed, weather-stripped, or otherwise sealed with an air barrier material, suitable film, or solid material.	**Mandatory**
	701.4.3.4	**Fenestration Air Leakage** Fenestrations, such as windows, must not have an infiltration rate of 0.3 cfm per square foot, while swinging doors must not exceed 0.5 cfm per square foot.	**Mandatory**
	701.4.3.5	**Recessed Lighting** Recessed luminaries installed in the thermal envelope must be sealed to limit air leakage, must be IC-rated and labeled as meeting ASTM E283, and sealed with a gasket or caulk.	**Mandatory**
	705.2.1	**Lighting Controls** Points can be earned for providing dimming controls and/or occupancy or photo sensors for interior and/or exterior lighting fixtures of dwelling units. Multifamily projects can earn points for having dimmers or occupancy sensors in common areas, and for providing automatic light reduction for unoccupied interior corridors, stairwells, garages, and parking areas.	15
	705.2.2	**TDD's and Skylights** A tubular daylight device or skylight is installed in rooms without windows.	2
	705.2.3	**Lighting Outlets** Occupancy sensors are installed for 80% or more hard-wired lighting outlets in living spaces.	1
	705.2.4	**Recessed Luminaires** Recessed luminaires penetrating the thermal envelope is less than 1 per 400 square feet.	1
	705.3	**Induction Cooktop** An induction cooktop is installed.	1
	705.4	**Return Ducts/Transfer Grilles** Return ducts or transfer grilles installed in every room with a door (except bathrooms, kitchens, closets, pantries, and laundry rooms).	2
	705.6.2.2	**HVAC Airflow Testing** Balanced airflows are demonstrated by a third-party. Test results are in accordance with ACCA 5 QI-2010, Section 5.2.	5
	705.6.4	**Potable Hot Water Demand Re-circulation System** A Potable Hot Water Demand Re-circulation System is installed.	2
	706.4	**Pumps** ● Electronically controlled variable-speed pumps are installed. ● Sump pumps with electrically commutated motors or permanent split capacitor motors are installed.	5
	706.6	**Parking Garage Efficiency** Structured Parking Garages are designed to require no mechanical ventilation for fresh air.	2
	706.7	**Grid-Interactive Thermal Storage System** A grid-interactive electric thermal storage system is installed for water and/or space heating and cooling.	2
	706.8	**Electrical Vehicle Charging Station** A Level 2 or 3 electric vehicle charging station is installed on the building site.	2
	706.9	**Automatic Demand Response** An automatic demand response system is installed that curtails energy usage upon a signal from the utility or energy service provider.	1

Water Efficiency

ICC/ASHRAE 700-2015 NGBS – Water Efficiency

The "Water Efficiency" practice category is focused on conserving and efficiently using one of the world's most important resources: water. From rainwater harvesting to wastewater treatment systems, this category provides a broad selection of water efficiency strategies specifically targeted towards residential design, construction and operation.

Mandatory Practices:

- If a project is seeking Gold or Emerald Certification, all water closets and urinals must have a maximum flow rate of 1.28gpm, regardless of dual-flush capabilities.
- If a landscaping system is installed, an irrigation plan must be executed by a qualified professional certified by a WaterSense labeled system (or equal).

Minimum Point Requirements:

Table 12: Water Efficiency Minimum Point Requirements

Green Building Categories	Minimum Points Required			
	BRONZE	SILVER	GOLD	EMERALD
Water Efficiency	25	39	69	97

LEED Homes – Water Efficiency

The "Water Efficiency" category is focused on reducing the use of water both inside and outside of the home through conservation measures. Projects can choose to tackle indoor and outdoor water reduction separately by meeting LEED practices, or reduce the overall water consumption of the home and use LEED's Water Reduction Calculator to determine savings.

Mandatory Practices:

- Install a water meter or submeter for each unit or the entire building.

Minimum Point Requirements:

LEED does not require projects to obtain a minimum number of points per category.

Analysis

Both LEED and NGBS tackle water conservation indoors and outdoors. NGBS provides specific water-conserving strategy options including low-flow fixtures, rainwater catchment, using the WaterSense Budget Tool, and advanced wastewater treatment system.

LEED allows teams to either earn points by adhering to specific water-conserving practices, such as fixture flow rates and limited turf grass areas, or by reducing the overall water consumption of the home and verifying it through LEED's Water Reduction Calculator as well as the EPA WaterSense Water Budget Tool.

Indoors, both systems set limits for flush and flow rates of fixtures in order to earn points. Overall, maximum allowable flush and flow rates are higher for NGBS. LEED also requires fixtures to be WaterSense labeled.

Outdoors, LEED awards projects that reduce overall water consumption before using alternative water sources, such as a rainwater harvesting. This includes reducing the area planted with turf grass and instead using plants native or adapted to the region. The standard also awards these same strategies.

NGBS has the added requirement that if a landscaping system is installed, an irrigation plan must be executed by a qualified professional certified by a WaterSense labeled program(or equal). LEED uses the WaterSense Budget Tool as a means to earn additional points, as does the NGBS, but LEED for Homes does not require the irrigation plan to be executed by a qualified professional certified by a WaterSense labeled system.

LEED includes the added mandate that a water meter or submeter for each unit or the entire building must be installed. The NGBS does not mandate water-metering strategies.

Figure 8: Water Efficiency Practices

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Water Efficiency	801.2	**Water-Conserving Appliances** ENERGY STAR or equivalent water-conserving dishwasher (2 pts) and/or washing machine (13 pts) or washing machine with a water factor of 4.0 or less (24 pts) are installed.	24
	801.3	**Showerheads** • Showerheads are less than 2.5 gpm. (4 pts for 1st shower, 1 pt for each added shower, 7 pts max) • All showerheads are less than 2.5 gpm (6 added pts), less than 2.0 gpm (10 added pts), or less than 1.6 gpm (14 added pts). • Showers can shut off flow without affecting temperature. (1 pt each, 3 pts max)	24
	801.4	**Lavatory Faucets** • Bathroom faucets are 1.5 gpm or less. (1 pt each, 3 pts max) • All bathroom faucets are 1.5 gpm or less. (6 added pts) • Self-closing valve, motion sensor, metered, or petal-activated faucet installed. (1 pt each, 3 pts max)	12
	801.5	**Water Closets and Urinals** • Water closet have a flush volume of 1.28 gal or less. (2 pts per fixture, 6 pts max) • All water closets have a flush volume of 1.28 gal or less. (11 pts, and **Mandatory** for Gold or Emerald Certification) • Water closets have flush volume of 1.2 gal or less. (1 added pt per toilet, 3 pts max) • One or more urinals have flush volume of 0.5 gal or less. (1 added pt) • One or more toilets and/or urinals are composting or waterless. (6 added pts)	19
	504.3	**Landscape Plan** • A plan is implemented that protects, restores, or enhances natural vegetation for 12% (1 pt), 25% (2 pts), 50% (3 pts), or 100% (4 pts) of the lot. • Only non-invasive native or regionally appropriate plants selected to promote biodiversity. (7 pts) • EPA WaterSense Water Budget Tool used to implement mas % of turf area (2 pts) • Max percentage of vegetated areas that are turf is 0% (5 pts), less than 20% (4 pts), less than 40% (3 pts), or less than 60%. (2 pts)	17

	LEEDv4 Homes	Points Possible
Water Efficiency	**Indoor Water Use** **Single Family:** *Lavatory Faucets:* WaterSense labeled and must not exceed 1.5 gpm (1 pt) or 1.0 gpm (2 pts). *Showerheads:* WaterSense labeled and must not exceed 1.75 gpm (1 pt) or 1.0 gpm (2 pts). If showerheads use more than 2.5 gpm, project must use "Total Water Use" Credit. *Toilets:* WaterSense labeled and must not exceed 1.1 gpf. (1 pt) *Washing Machine:* ENERGY STAR -qualified (1 pt) The water pressure in the house must not exceed 60 psi. **Multifamily:** Meet the above requirements for all in-unit spaces and non-unit (residential-associated and nonresidential) spaces. Multifamily and midrise projects are exempt from the water pressure testing criterion.	6
	Outdoor Water Use Reduce the landscape area planted to turf grass by landscaping with plants that are native or adapted to the region. Points are dependent on percentage of turf and native planting areas, with a maximum of 60% turf and minimum of 25% native plant areas.	4

Figure 8: Water Efficiency Practices

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Water Efficiency	801.2	**Water-Conserving Appliances** See details above.	See above
	801.3	**Showerheads** See details above.	See above
	801.4	**Lavatory Faucets** See details above.	See above
	801.5	**Water Closets and Urinals** See details above.	See above
	801.6	**Irrigation Systems** • Sprinkler nozzles have a max precipitation rate of 1.2 in/hr, tested by a third-party laboratory. (6 pts) • Drip irrigation is installed in landscapes beds, turf, and zone specs show plant type and water need for each emitter. (13 pts max) • **Mandatory:** Irrigation plans must be executed by a qualified professional certified by WaterSense labeled program. • Either no irrigation (& corresponding landscape plan), irrigation. controller with rain sensor/soil moisture sensor installed, or irrigation. controller labeled by WaterSense installed. (15 pts max) • Irrigation zones use pressure regulation. (3 pts)	**Mandatory** + 26 Points
	801.7.1	**Rainwater Collection and Distribution (Irrigation)** • Rainwater is diverted to landscape without storage. (5 pts) • Storage of rainwater provided: 50-499 gal (5 pts), 500-2499 gal (10 pts), 2500 or larger designed by ARCSA professional. (15 pts) • All irrigation met by rainwater capture, designed by ARCSA professional. (25 pts)	25
	802.1(2)	**Reclaimed , Gray , or Recycled Water (Irrigation)** Irrigation demand is met by reclaimed, gray or recycled water on-site.	10

	LEEDv4 Homes	Points Possible
Water Efficiency	**Total Water Use** **If points are earned in this credit, the project is not eligible to earn points under the "Indoor Water Use" or "Outdoor Water Use" credits.** Reduce total indoor and outdoor water consumption by at least 10% over standard practices to earn one point. An additional point is earned for every 5% savings above 10%. *For indoor water savings:* Use LEED's Water Reduction Calculator to determine savings. *For outdoor water savings:* Use the EPA WaterSense Water Budget Tool to calculate the baseline and design water consumption. Further water use reduction can be achieved with soil moisture sensor control system(s) or a weather-based irrigation control system(s), captured rainwater, reclaimed water, and/or water treated on site or conveyed by a public agency specifically for nonpotable uses.	12

Figure 8: Water Efficiency Practices

Other NGBS Water Efficiency Credits

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Water Efficiency	801.1	**Indoor Hot Water Usage** • Max volume from water heater to furthest fixture is 1 gal, 0.5 gal, or 0.25 gal. (29 pts max) • Demand controlled hot water priming pump installed on main supply pipe, and volume in circulation loop from heater to furthest fixture is 1 gal. (39 pts) • Central hot water recirculation system implemented in multifamily. (9 pts) • Tankless water heater w/ at least 0.5 gal storage or ramp up to 100F in 5 secs installed. (4 added pts)	43
	801.7.2	**Rainwater Collection and Distribution (Domestic)** • Rainwater is used to supply indoor appliance(s) or fixture(s). (5 pts each) • Rainwater used for total domestic demand. (25 pts)	25
	801.8	**Sediment Filters** Water filter installed to reduce sediment and protecting plumbing for entire building or dwelling unit(s). (1 pt)	1
	802.1(1)	**Reclaimed , Gray , or Recycled Water (Domestic)** Water closet flushed by reclaimed, gray, or recycled water. (5 pts each, 20 max)	20
	802.2	**Reclaimed Water, Graywater, or Rainwater Pre-Piping** These systems are rough-plumbed into building for future use. (3 pts per system)	9
	802.3	**Automatic Shutoff Water Device** One of the following installed: excess water flow automatic shutoff or leak detection system with automatic shutoff. (2 pts)	2
	802.4	**Engineered Biological System or Intensive Bioremediation System** One of these systems are installed and treated water is used on-site. (20 pts)	20
	802.5	**Recirculating Humidifier** Where humidifier required, a recirculating humidifier is used in lieu of flow through type. (1 pt)	1
	802.6	**Advanced Wastewater Treatment System** Advanced wastewater (aerobic) treatment system installed and treated water used on-site. (20 pts)	20

Other LEEDv4-Homes Water Efficiency Credits

	LEEDv4 Homes	Points Possible
Water Efficiency	**Water Metering** **Single Family:** Install a whole-house water meter and Encourage homeowners or tenants to share water usage data with USGBC. Well water is exempt. **Multifamily:** Install a water meter or submeter for each unit or the entire building. Encourage homeowners or tenants to share water usage data with USGBC.	**Mandatory**

Indoor Environmental Quality

ICC/ASHRAE 700-2015 NGBS – Indoor Environmental Quality

The "Indoor Environmental Quality" practice category is focused on providing clean air and a higher quality environment inside the home. This encompasses a multitude of interior components from floor to ceiling, including how fireplaces are installed and which types of paint are used. Ventilation is the primary focus, with a number of ventilation requirements and points being available for strategies such as cross-ventilation and MERV 14 filters.

Mandatory Practices:

- Bathrooms are vented to the outdoors.
- Clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors.
- Carbon monoxide alarms are provided in accordance with the IRC Section R315.
- Gas-fired fireplaces and direct heating equipment within dwelling units are installed in accordance with applicable code and vented to the outdoors.
- Solid fuel-burning appliances must be code compliant and in accordance with the requirements listed in Figure 9.
- Doors are installed in common walls between garage and conditioned space are sealed and gasketed.
- A continuous air barrier is provided in the wall between the garage and conditioned space.
- Radon control measures are mandatory in Zone 1.
- The living space is sealed in accordance with Section 701.4.3.1 (Building Thermal Envelope Air Sealing) to prevent unwanted contaminants.
- Structural plywood is compliant DOC PS and/or DOC PS 2. OSB meets DOC PS 2.
- Wall-to-wall carpeting is not installed near water closets and bathing fixtures.

Minimum Point Requirements:

Table 13: Indoor Environmental Quality Minimum Point Requirements

Green Building Categories	Minimum Points Required			
	BRONZE	SILVER	GOLD	EMERALD
Indoor Environmental Quality	25	42	69	97

LEED Homes – Indoor Environmental Quality

The "Indoor Environmental Quality" practice category is focused on providing clean air

and reducing the occupants' exposure to possible indoor pollutants, including balanced ventilation testing, low-emitting materials, and radon-resistant construction. This category has several mandatory prerequisites, more than any other category in LEED Homes. Some requirements are specific to multifamily buildings, such as managing tobacco smoke, and do not apply to single-family residences.

Mandatory Practices:

- Meet ventilation requirements detailed in Figure 9.
- Do not install any unvented combustion appliances (ovens and ranges excluded).
- Install a carbon monoxide (CO) monitor on each floor.
- For indoor fireplaces and woodstoves, provide closing doors or a solid glass enclosure.
- Interior fireplaces and woodstoves that are not closed-combustion or power-vented must pass BPI or RESNET combustion safety testing protocols
- Space- and water-heating equipment that involves combustion must be designed and installed with closed combustion, designed and installed with power-vented exhaust, or located in a detached utility building or open-air facility.
- Place all air-handling equipment and ductwork outside the fire-rated envelope of the garage.
- Tightly seal shared surfaces between the garage and conditioned spaces, including installing carbon monoxide detectors in rooms that share a door with the garage.
- Install MERV 8 air filters or higher on all recirculating space conditioning systems, or MERV 6 air filters or higher for mechanically supplied outdoor air systems with 10 feet of ductwork or more.
- Multifamily projects only: Prohibit smoking in all common areas of the building. Prohibit exterior smoking within 25 feet of entries, outdoor air intakes, and operable windows.
- Multifamily and Attached Single-Family Projects Only: Comply with compartmentalization requirements detailed Figure 9.

Minimum Point Requirements:

LEED does not require projects to obtain a minimum number of points per category.

Analysis

As observed in Figure 9, both systems have multiple mandatory and optional practices related to whole-building, spot and combustion ventilation. LEED is unique in that it requires compliance with AHSRAE 62.2-2010 and ASRAE 62.1-2010 for mechanically and naturally ventilated spaces. Both systems provide points for not installing solid-fuel burning appliances, require the installation of carbon monoxide alarms in the home, and require radon control measures if the project is in a Zone 1 area.

Sealing garages from the rest of the conditioned space is mandatory in both systems, and both provide additional points for replacing an attached garage with either a detached garage, carport, or simply not installing a garage at all.

Low-emitting products, from floor to ceiling, are encouraged in both systems with both recognizing the value in products that have been tested and found compliant with the California Department of Public Health Standard Method V1.1.

NGBS includes additional practices such as installing a humidity monitoring system that measures temperature and relative humidity to ensure occupant comfort. It also includes a unique practice of installing a central vacuum system and venting it outside to prevent allergens, dust and dirt from being exhausted into the air by handheld vacuum cleaners.

Figure 9: Indoor Environmental Quality Practices

	ICC/ASHRAE 700-2015 NGBS		Points Possible
Indoor Environmental Quality	902.2.1	**Building Ventilation Systems** One of the following whole-building ventilation systems is implemented: ● Exhaust air supply fan(s) ready for continuous operation (3 pts) ● Balanced exhaust and supply fans with supply intakes located in accordance with the manufacturer's guidelines as to not allow polluted air back into the building (6 pts) ● Heat-recovery ventilator (7 pts) ● Energy-recovery ventilator (8 pts)	**Mandatory** where max air infiltration less than 5.0 ACH50 + 8 Points
	902.1.1	**Spot Ventilation** ● **Mandatory:** Bathrooms are vented to the outdoors. The minimum ventilation rate is 50 cfm for intermittent operation or 20 cfm for continuous. One points is possible if a window complying with IRC Section R303.3 is provided as well as mech. ventilation.) ● **Mandatory:** Clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors. ● Kitchen exhaust units and/or range hoods are ducted to the outdoors and have a minimum ventilation rate of 100 cfm for intermittent operation or 25 cfm for continuous operation. (8 pts)	**Mandatory** + 9 Points
	902.1.3	**Exhaust Verification** Kitchen range, bathroom, and laundry exhaust are verified to air flow specification. Ventilation airflow at the point of exhaust is tested to a minimum of 100 cfm intermittent or 25 cfm continuous for kitchens, and 50 cfm intermittent or 20 cfm continuous for bathrooms and/or laundry.	8
	902.1.4	**ENERGY STAR Exhaust Fans** Exhaust fans are ENERGY STAR, as applicable. ● ENERGY STAR fans, or equivalent (2 pts per fam, 12 pts max) ● ENERGY STAR fans operating at or below 1 sone, or equivalent (3 pts per fam, 12 pts max)	12
	902.1.5	**Stack-Effect and Cross-Ventilation** Fenestration in spaces (except bathrooms, laundry rooms, and kitchens) are designed for stack effect or cross-ventilation in accordance with all of the following: ● Operable windows, skylights, or sliding glass doors with a total area of at least 15% of the conditioned floor area are provided. ● Insect screens are provided for all operable windows, skylights, and sliding glass doors. ● A minimum of two operable windows or sliding glass doors are placed in adjacent or opposite walls. If there is only one wall surface in that space exposed to the exterior, the minimum windows or sliding glass doors may be on the same wall.	3
	903.3	**Relative Humidity** In climate zones 1A, 2A, 3A, 4A, and 5A defined by the 2015 IECC, install equipment to maintain relative humidity at or below 60% using either additional dehumidification systems or a central HVAC system equipped with controls to operate in dehumidification mode	7
	905.2	**Kitchen Exhaust** The kitchen exhaust unit equals or exceeds 400 cfm, with make-up air provided	2
	902.1.2	**Bathroom/Laundry Exhaust Fan Controls** ● Bathroom and/or laundry exhaust fan is provided with an automatic timer and/or humidistat. (5 pts for first device, 2 pts for each added device, 11 pts max)	11
	902.2.1	**Building Ventilation Systems** See details previously described above.	**Mandatory** (See above)

	LEEDv4-Homes	Points Possible
Indoor Environmental Quality	**Ventilation** **Single Family:** ● Meet the requirements of ASHRAE 62.2 – 2010, sections 4, 5 and 7 and Section 1504.4 of the 2009 International Residential Code. ● Design and install local exhaust systems in all full and half bathrooms as well as the kitchen to meet the requirements of ASHRAE Standard 62.2–2010, Sections 5 and 7. ● Exhaust air to the outdoors. Recirculating range hoods or recirculating over-the-range microwaves do not satisfy the kitchen exhaust requirements. ● Use ENERGY STAR–labeled bathroom exhaust fans in all bathrooms. ● For exhaust hood systems exhaust in excess of 400 cfm, provide makeup air. ● Design and install a whole-house mechanical ventilation system that complies with ASHRAE Standard 62.2–2010, Sections 4 and 7 (or equal). *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite. **Multifamily:** ● Design and install a whole-unit ventilation system for each individual dwelling unit that complies with the requirements of ASHRAE Standard 62.2–2010 (with errata) and all local exhaust requirements for the above Single Family section. ● For all non-unit spaces, meet the minimum requirements of ASHRAE Standard 62.1–2010, Sections 4–7. ● Naturally ventilated spaces must comply with ASHRAE Standard 62.1–2010, Section 6.4.	**Mandatory**
	Enhanced Ventilation *Option 1. Enhanced Local Exhaust (1 pt)* ● Use one of the following in every bathroom with a shower, bathtub, or spa to control the use of the local exhaust fan: an occupancy sensor, an automatic humidistat controller, a continuously operating exhaust fan, a delay timer that operates the fan for at least 20 minutes. -AND/OR- *Option 2. Enhanced Whole-House Ventilation (2 pts)* ● Install a balanced whole-house ventilation system that meets the minimum ventilation requirements of ASHRAE Standard 62.2–2010, Sections 4 and 7. **Multifamily:** ● Meet the above requirements for all in-unit residential spaces in both options 1 and 2.	3

Figure 9: Indoor Environmental Quality Practices

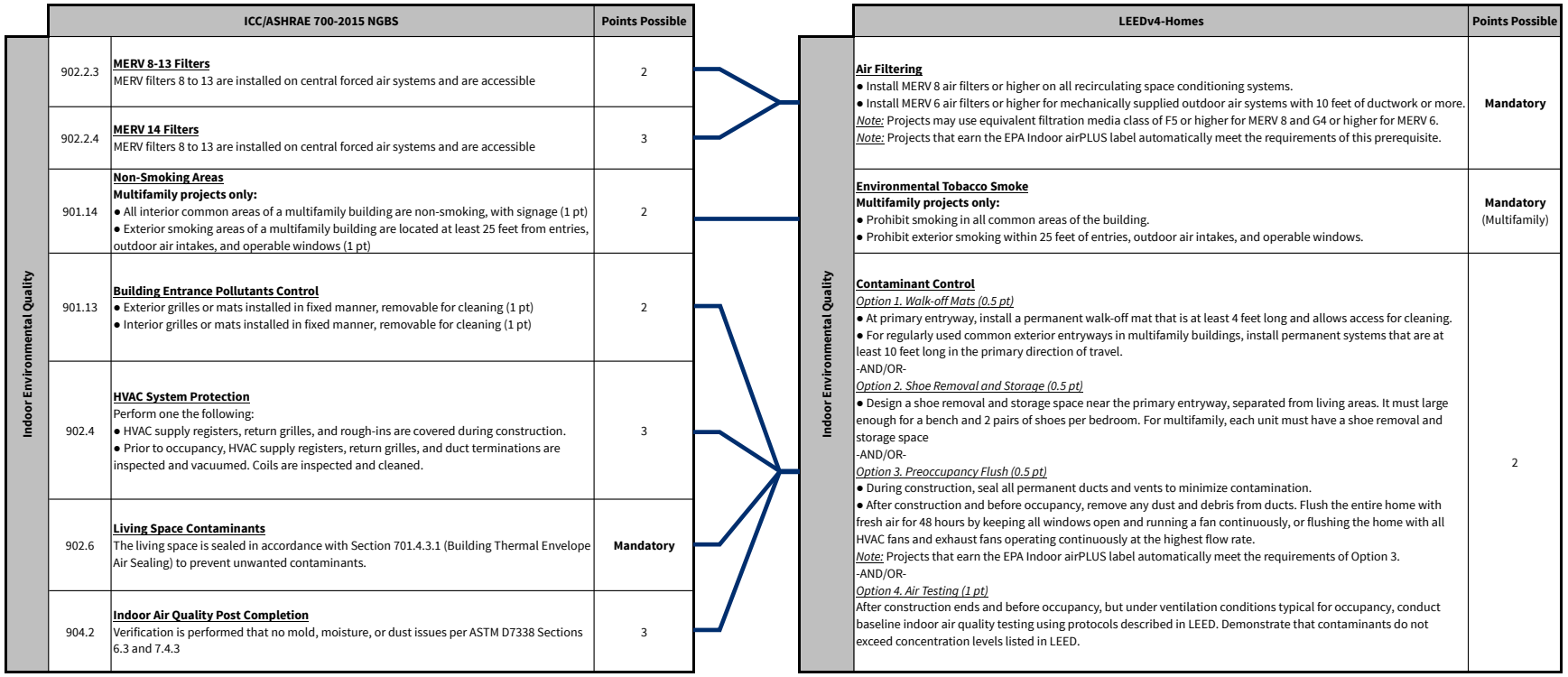
	ICC/ASHRAE 700-2015 NGBS		Points Possible
Indoor Environmental Quality	901.12	**Carbon Monoxide (CO) Alarms** A CO alarm is provided in accordance with the IRC Section R315	**Mandatory**
	901.1.1	**Natural Draft Heaters** Natural draft furnaces, boilers or water heaters are not located in conditioned spaces, unless in mechanical room with outdoor air source which is sealed and insulated from conditioned spaces	5
	901.1.3	**Combustion Space/Water Heaters Inside the Conditioned Space** ● All furnaces or boilers are power-vented (3 pts) or direct-vented (5 pts) ● All water heaters are power-vented (3 pts) or direct-vented (5 pts)	5
	901.1.4	**Gas Fireplaces** Gas-fired fireplaces and direct heating equipment within dwelling units are installed in accordance with applicable code and vented to the outdoors.	**Mandatory**
	901.1.5	**Natural Gas/Propane Fireplaces** Natural gas and propane fireplaces are direct vented, have permanently fixed glass fronts or gasketed doors, and comply with CSA Z21.88/CSA 2.33 or CSA Z21.50b/CSA 2.22b	7
	901.2.1	**Solid Fuel-Burning Appliances** Solid Fuel-burning appliances must be code compliant and are in accordance with the following **Mandatory** requirements: ● Site-built masonry wood-burning fireplaces us outside combustion air and include means of sealing the flue and combustion air outlets. (4 pts) ● Factory-built wood burning fireplaces are meet certification requirements of UL 127 and are EPA certified or Phase 2 Qualified. (6 pts) ● Wood stove and fireplace inserts meet certification requirements of UL 1482 and meet emission requirements of EPA certification and State of Washington WAC 173-433-100(3). (6 pts) ● Biomass stoves and furnaces meet ASTM E1509 or are EPA certified. (6 pts) ● Masonry heaters are meet definitions in ASTM E1602 and ICC IBC Section 2112.1. (6pts)	**Mandatory** + 6 points
	901.2.2	**No Solid-Fuel Indoors** Fireplaces, woodstoves, pellet stoves, or masonry heaters are not installed	6
	901.1.4	**Gas Fireplaces** See details previously describe above above.	**Mandatory**
	901.1.5	**Natural Gas/Propane Fireplaces** See details previously describe above above.	7
	901.2.1	**Solid Fuel-Burning Appliances** See details previously describe above above.	**Mandatory** + 6 points

	LEEDv4-Homes	Points Possible
Indoor Environmental Quality	**Combustion Venting** ● Do not install any unvented combustion appliances (ovens and ranges excluded). ● Install a carbon monoxide (CO) monitor on each floor. ● For indoor fireplaces and woodstoves, provide closing doors or a solid glass enclosure. ● Interior fireplaces and woodstoves that are not closed-combustion or power-vented must pass BPI or RESNET combustion safety testing protocols ● Space- and water-heating equipment that involves combustion must be designed and installed with closed combustion, designed and installed with power-vented exhaust, or located in a detached utility building or open-air facility. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.	**Mandatory**
	Enhanced Combustion Venting *Option 1. No fireplace or woodstove (2 points)* Do not install any fireplaces or woodstoves. -OR- *Option 2. Enhanced combustion venting measures (1 point)* ● Wood- or pellet-burning stoves: Install equipment that is EPA certified. For wood-burning fireplaces, install equipment that is EPA qualified. Provide power or direct venting. ● Natural gas, propane, or alcohol stoves: Install equipment listed by an approved safety testing facility. The stove must have a permanently fixed glass front or gasketed door and an electronic pilot. Provide power or direct venting. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of Option 2.	**2**

Figure 9: Indoor Environmental Quality Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	LEEDv4-Homes	Points Possible
901.1.2	**No Air Handling in Garage** Air handling equipment and return ducts not place d in garage, unless in isolated, air-sealed mechanical rooms with outdoor air source.	5	**Garage Pollutant Protection** ● Place all air-handling equipment and ductwork outside the fire-rated envelope of the garage. ● Tightly seal shared surfaces between the garage and conditioned spaces, including installing carbon monoxide detectors in rooms that share a door with the garage. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.	**Mandatory**
901.3	**Garages** *Option (1) - Attached garages:* ● **Mandatory:** Doors installed in common walls with conditioned space are sealed and gasketed (2 pts) ● **Mandatory:** Continuous air barrier is provided in common wall with conditioned space (2 pts) ● For 1-2 family welling units, ducted exhaust fan installed and vented to outdoors (8 pts) -OR- *Option (2) - Detached or no garage:* A carport is installed in lieu of garage, garage is detached, or no garage installed (10 pts)	**Mandatory** + 10 Points	**Enhanced Garage Pollutant Protection** **Case 1. Single Family** *Option 1. Exhaust Fan in Garage (1 pt)* Install in the garage an exhaust fan that is rated at least 75 cfm and meets ENERGY STAR cfm/w performance requirements. The fan must vent directly to the outdoors. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of Option 1. -OR- *Option 2. No Garage, or Detached Garage, or Carport (2 pts)* Select one: ● Do not construct a garage. ● Install a detached garage that does not share a wall with the home. ● Install a carport **Case 2. Multifamily** *Option 1. Exhaust Fan in Multicar Garage (1 pt)* For a garage that accommodates more than three cars, follow the requirements in ASHRAE 62.1–2010. Exhaust the garage sufficiently to create negative pressure with respect to adjacent spaces with the doors to the garage closed. Provide self-closing doors and deck-to-deck partitions or a hard lid ceiling. -OR- *Option 2. Exhaust Fan in Small Garage (1 pt)* For a garage that accommodates one, two, or three cars, install an exhaust fan that meets ENERGY STAR minimum efficacy levels (cfm/W); direct-exhaust fans must be 100 cfm or greater, and ducted exhaust fans must be 130 cfm or greater. -OR- *Option 3. No Garage, or Detached Garage (2 pts)* Select one: ● Do not construct a garage. ● Install a detached garage that does not share a wall with the home.	2
902.3	**Radon Control** Radon control measures are installed in accordance with ICC IRC Appendix F. *Zone 1:* ● Radon control is **Mandatory.** ● Passive Radon System installed (7 points) ● Active Radon System installed (10 points) *Zones 2 & 3:* ● Passive or active radon system installed (7 points)	**Mandatory** for Zone 1 + 10 Points	**Radon-Resistant Construction** **New Construction:** ● If the building is in EPA radon zone 1, design and build with radon-resistant construction techniques. *Note:* Buildings that are elevated by at least 2 feet with open air space between the building and ground are exempt. An enclosed vented crawlspace does not qualify. A garage under a building is an acceptable alternative. **Building Renovation:** ● If the building is in EPA radon zone 1 and no slab work is being performed, test the building for radon. If the results are greater than 4 pCi/L, install an active ventilation system. If the results are less than 4 pCi/L, no radon-resistant construction techniques are required. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.	**Mandatory**

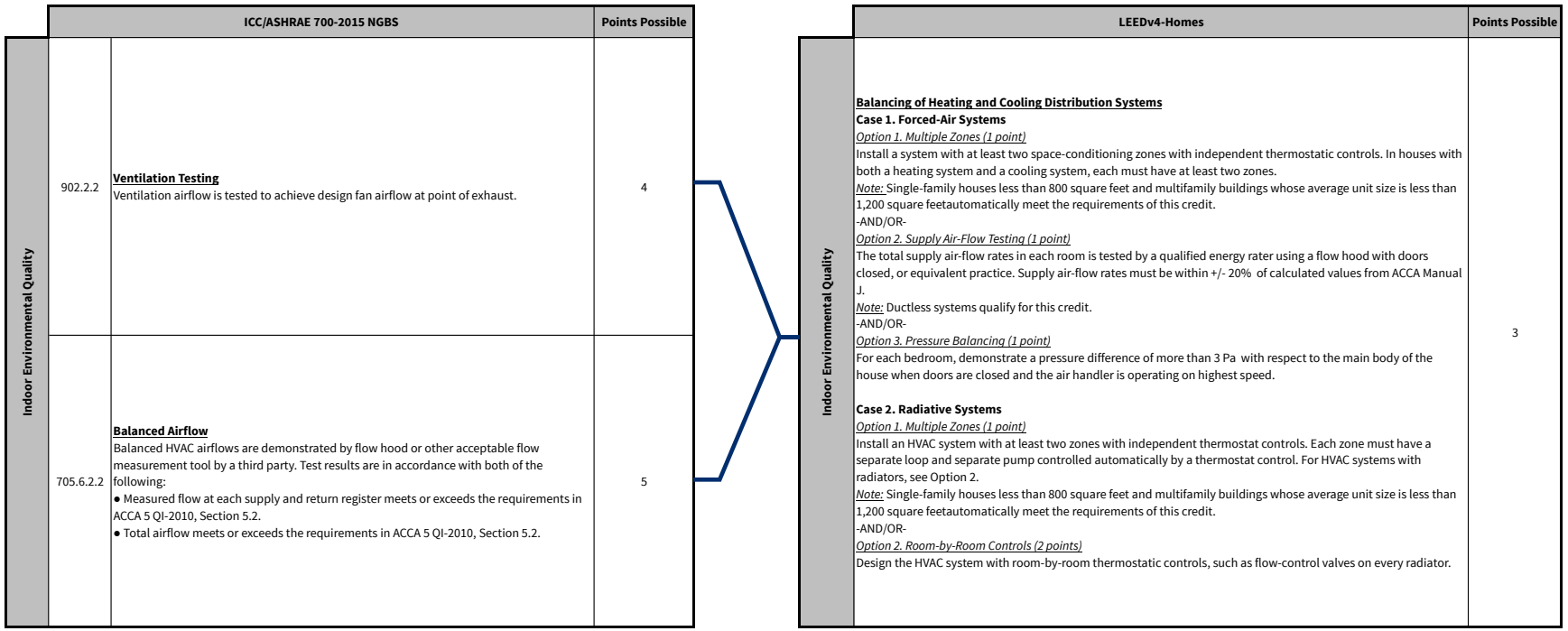
Figure 9: Indoor Environmental Quality Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Indoor Environmental Quality	902.2.3	**MERV 8-13 Filters** MERV filters 8 to 13 are installed on central forced air systems and are accessible	2
	902.2.4	**MERV 14 Filters** MERV filters 8 to 13 are installed on central forced air systems and are accessible	3
	901.14	**Non-Smoking Areas** **Multifamily projects only:** ● All interior common areas of a multifamily building are non-smoking, with signage (1 pt) ● Exterior smoking areas of a multifamily building are located at least 25 feet from entries, outdoor air intakes, and operable windows (1 pt)	2
	901.13	**Building Entrance Pollutants Control** ● Exterior grilles or mats installed in fixed manner, removable for cleaning (1 pt) ● Interior grilles or mats installed in fixed manner, removable for cleaning (1 pt)	2
	902.4	**HVAC System Protection** Perform one the following: ● HVAC supply registers, return grilles, and rough-ins are covered during construction. ● Prior to occupancy, HVAC supply registers, return grilles, and duct terminations are inspected and vacuumed. Coils are inspected and cleaned.	3
	902.6	**Living Space Contaminants** The living space is sealed in accordance with Section 701.4.3.1 (Building Thermal Envelope Air Sealing) to prevent unwanted contaminants.	**Mandatory**
	904.2	**Indoor Air Quality Post Completion** Verification is performed that no mold, moisture, or dust issues per ASTM D7338 Sections 6.3 and 7.4.3	3

	LEEDv4-Homes	Points Possible
Indoor Environmental Quality	**Air Filtering** ● Install MERV 8 air filters or higher on all recirculating space conditioning systems. ● Install MERV 6 air filters or higher for mechanically supplied outdoor air systems with 10 feet of ductwork or more. *Note:* Projects may use equivalent filtration media class of F5 or higher for MERV 8 and G4 or higher for MERV 6. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.	**Mandatory**
	Environmental Tobacco Smoke **Multifamily projects only:** ● Prohibit smoking in all common areas of the building. ● Prohibit exterior smoking within 25 feet of entries, outdoor air intakes, and operable windows.	**Mandatory** (Multifamily)
	Contaminant Control *Option 1. Walk-off Mats (0.5 pt)* ● At primary entryway, install a permanent walk-off mat that is at least 4 feet long and allows access for cleaning. ● For regularly used common exterior entryways in multifamily buildings, install permanent systems that are at least 10 feet long in the primary direction of travel. -AND/OR- *Option 2. Shoe Removal and Storage (0.5 pt)* ● Design a shoe removal and storage space near the primary entryway, separated from living areas. It must large enough for a bench and 2 pairs of shoes per bedroom. For multifamily, each unit must have a shoe removal and storage space -AND/OR- *Option 3. Preoccupancy Flush (0.5 pt)* ● During construction, seal all permanent ducts and vents to minimize contamination. ● After construction and before occupancy, remove any dust and debris from ducts. Flush the entire home with fresh air for 48 hours by keeping all windows open and running a fan continuously, or flushing the home with all HVAC fans and exhaust fans operating continuously at the highest flow rate. *Note:* Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of Option 3. -AND/OR- *Option 4. Air Testing (1 pt)* After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline indoor air quality testing using protocols described in LEED. Demonstrate that contaminants do not exceed concentration levels listed in LEED.	2

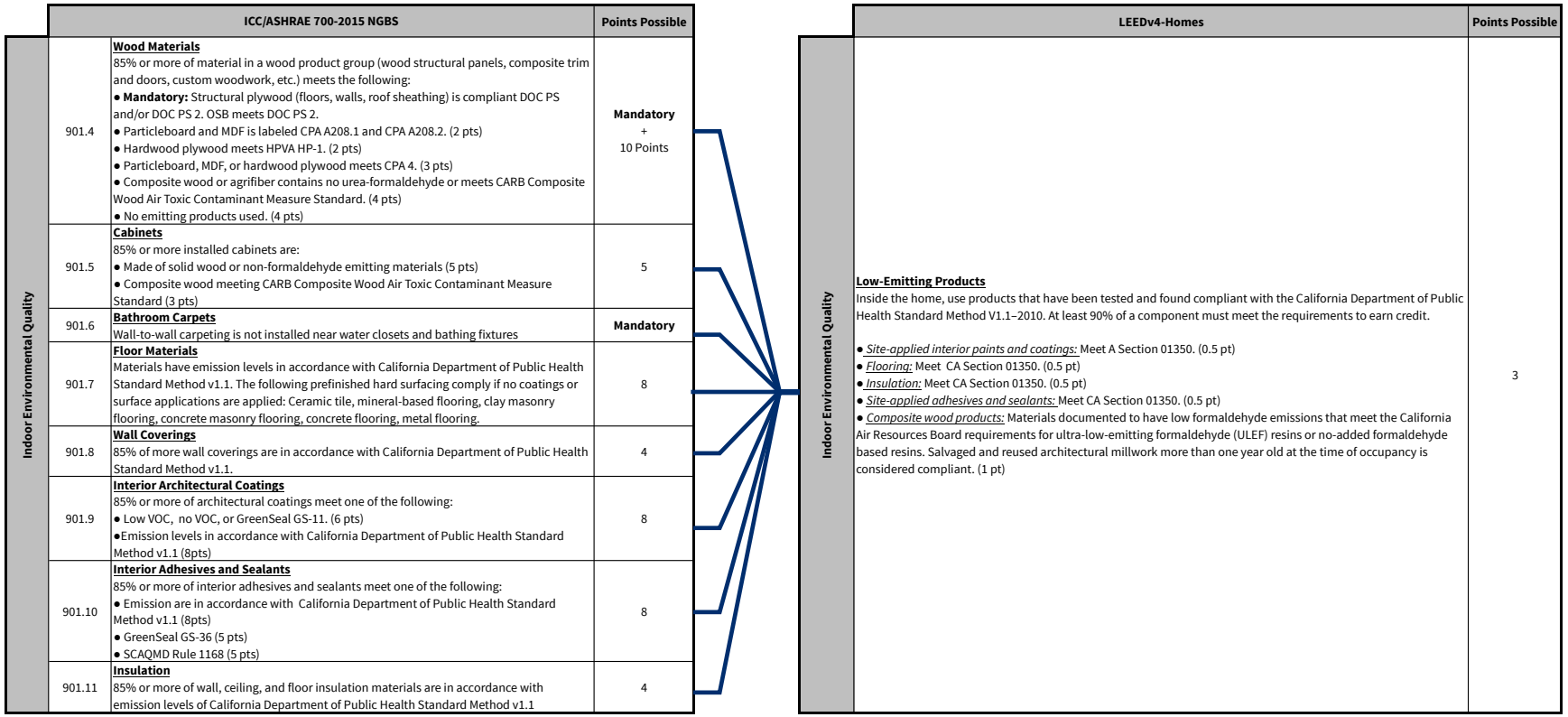
Figure 9: Indoor Environmental Quality Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Indoor Environmental Quality	902.2.2	**Ventilation Testing** Ventilation airflow is tested to achieve design fan airflow at point of exhaust.	4
	705.6.2.2	**Balanced Airflow** Balanced HVAC airflows are demonstrated by flow hood or other acceptable flow measurement tool by a third party. Test results are in accordance with both of the following: ● Measured flow at each supply and return register meets or exceeds the requirements in ACCA 5 QI-2010, Section 5.2. ● Total airflow meets or exceeds the requirements in ACCA 5 QI-2010, Section 5.2.	5

	LEEDv4-Homes	Points Possible
Indoor Environmental Quality	**Balancing of Heating and Cooling Distribution Systems** **Case 1. Forced-Air Systems** *Option 1. Multiple Zones (1 point)* Install a system with at least two space-conditioning zones with independent thermostatic controls. In houses with both a heating system and a cooling system, each must have at least two zones. *Note:* Single-family houses less than 800 square feet and multifamily buildings whose average unit size is less than 1,200 square feetautomatically meet the requirements of this credit. -AND/OR- *Option 2. Supply Air-Flow Testing (1 point)* The total supply air-flow rates in each room is tested by a qualified energy rater using a flow hood with doors closed, or equivalent practice. Supply air-flow rates must be within +/- 20% of calculated values from ACCA Manual J. *Note:* Ductless systems qualify for this credit. -AND/OR- *Option 3. Pressure Balancing (1 point)* For each bedroom, demonstrate a pressure difference of more than 3 Pa with respect to the main body of the house when doors are closed and the air handler is operating on highest speed. **Case 2. Radiative Systems** *Option 1. Multiple Zones (1 point)* Install an HVAC system with at least two zones with independent thermostat controls. Each zone must have a separate loop and separate pump controlled automatically by a thermostat control. For HVAC systems with radiators, see Option 2. *Note:* Single-family houses less than 800 square feet and multifamily buildings whose average unit size is less than 1,200 square feetautomatically meet the requirements of this credit. -AND/OR- *Option 2. Room-by-Room Controls (2 points)* Design the HVAC system with room-by-room thermostatic controls, such as flow-control valves on every radiator.	3

Figure 9: Indoor Environmental Quality Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Indoor Environmental Quality	901.4	**Wood Materials** 85% or more of material in a wood product group (wood structural panels, composite trim and doors, custom woodwork, etc.) meets the following: ● **Mandatory:** Structural plywood (floors, walls, roof sheathing) is compliant DOC PS and/or DOC PS 2. OSB meets DOC PS 2. ● Particleboard and MDF is labeled CPA A208.1 and CPA A208.2. (2 pts) ● Hardwood plywood meets HPVA HP-1. (2 pts) ● Particleboard, MDF, or hardwood plywood meets CPA 4. (3 pts) ● Composite wood or agrifiber contains no urea-formaldehyde or meets CARB Composite Wood Air Toxic Contaminant Measure Standard. (4 pts) ● No emitting products used. (4 pts)	**Mandatory** + 10 Points
	901.5	**Cabinets** 85% or more installed cabinets are: ● Made of solid wood or non-formaldehyde emitting materials (5 pts) ● Composite wood meeting CARB Composite Wood Air Toxic Contaminant Measure Standard (3 pts)	5
	901.6	**Bathroom Carpets** Wall-to-wall carpeting is not installed near water closets and bathing fixtures	**Mandatory**
	901.7	**Floor Materials** Materials have emission levels in accordance with California Department of Public Health Standard Method v1.1. The following prefinished hard surfacing comply if no coatings or surface applications are applied: Ceramic tile, mineral-based flooring, clay masonry flooring, concrete masonry flooring, concrete flooring, metal flooring.	8
	901.8	**Wall Coverings** 85% of more wall coverings are in accordance with California Department of Public Health Standard Method v1.1.	4
	901.9	**Interior Architectural Coatings** 85% or more of architectural coatings meet one of the following: ● Low VOC, no VOC, or GreenSeal GS-11. (6 pts) ●Emission levels in accordance with California Department of Public Health Standard Method v1.1 (8pts)	8
	901.10	**Interior Adhesives and Sealants** 85% or more of interior adhesives and sealants meet one of the following: ● Emission are in accordance with California Department of Public Health Standard Method v1.1 (8pts) ● GreenSeal GS-36 (5 pts) ● SCAQMD Rule 1168 (5 pts)	8
	901.11	**Insulation** 85% or more of wall, ceiling, and floor insulation materials are in accordance with emission levels of California Department of Public Health Standard Method v1.1	4

	LEEDv4-Homes	Points Possible
Indoor Environmental Quality	**Low-Emitting Products** Inside the home, use products that have been tested and found compliant with the California Department of Public Health Standard Method V1.1–2010. At least 90% of a component must meet the requirements to earn credit. ● *Site-applied interior paints and coatings:* Meet A Section 01350. (0.5 pt) ● *Flooring:* Meet CA Section 01350. (0.5 pt) ● *Insulation:* Meet CA Section 01350. (0.5 pt) ● *Site-applied adhesives and sealants:* Meet CA Section 01350. (0.5 pt) ● *Composite wood products:* Materials documented to have low formaldehyde emissions that meet the California Air Resources Board requirements for ultra-low-emitting formaldehyde (ULEF) resins or no-added formaldehyde based resins. Salvaged and reused architectural millwork more than one year old at the time of occupancy is considered compliant. (1 pt)	3

Figure 9: Indoor Environmental Quality Practices

Other NGBS Indoor Environmental Quality Credits

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Indoor Environmental Quality	901.1.6	**Electric heat pump air handler** *Path 1:* Install the heat pump in an unconditioned space (2 pts) *Path 2:* Install the heat pump in a conditioned space (5 pts)	5
	902.5	***Central Vacuum Systems*** Central vacuum system is installed and vented outside	3
	903.1	**Plumbing** *Path 1:* Cold water pipes in unconditioned spaces are insulated, R-4 or higher (2 pts) *Path 2:* Plumbing is not installed in unconditioned spaces. (5 pts)	5
	903.2	**Duct Installation** ● All HVAC ducts, plenums, & trunks located in conditioned space (1 pt) ● Complete above practice, as well as all HVAC ducts insulated to R4 or higher (3 pts)	3
	904.1	**Indoor Air Quality During Construction** Wood is kept dry, sources of water infiltration of condensation is eliminated, accessible interior surfaces are dry a free of water damage	2
	905.1	**Humidity Monitoring System** A humidity monitoring system is installed that measures temperature and relative humidity. The system shall have two remote sensor units, minimum, with one inside the conditioned space and the other outside.	2

Other LEEDv4 Homes Indoor Environmental Quality Credits

	LEEDv4-Homes	Points Possible
Indoor Environmental Quality	**Compartmentalization** **Multifamily and Attached Single-Family Projects Only:** ● Compartmentalize each residential unit to minimize leakage between units. ● Minimize uncontrolled pathways for smoke and other indoor air pollutants between units by sealing penetrations in walls, ceilings, and floors and by sealing vertical chases adjacent to the units. ● Weather-strip all doors in the residential units leading to common hallways. ● Weather-strip all exterior doors and operable windows. ● Demonstrate sealing of units by a blower door test. Demonstrate acceptable sealing of residential units by a blower door test.	**Mandatory** (Multifamily & Attached Single-Family)
	Enhanced Compartmentalization **Multifamily and Attached Single-Family Projects Only:** Perform a compartmentalization blower door test according to RESNET or the ENERGY STAR testing and verification protocols for multifamily midrise buildings, with an allowable maximum leakage of 0.15 cfm50 per square foot of enclosure.	1

Operation, Maintenance, and Building Owner Education

ICC/ASHRAE 700-2015 NGBS – Operation, Maintenance, and Building Owner Education

The "Operation, Maintenance, and Building Owner Education" practice category is focused on providing information on the building's use, maintenance, and green components to all necessary parties. This includes mandatory operation and maintenance manual(s) and first-hand training of building owners or operators. Additional points can be earn for increasing public awareness of the building's green aspects as well as performing a post-occupancy performance assessment.

Mandatory Practices:

- Single-family: Provide a home owner's manual to responsible parties that complies with Figure 10.
- Multifamily: Provide a building construction, operations and maintenance manual to responsible parties that complies with Figure 10.
- Provide on-site training to responsible parties regarding operations and maintenance, control systems, and actions that will improve the environmental performance of the building.

Minimum Point Requirements:

Table 14: Operation, Maintenance, and Building Owner Education Minimum Point Requirements

Green Building Categories	Minimum Points Required			
	BRONZE	SILVER	GOLD	EMERALD
Operation, Maintenance, and Building Owner Education	8	10	11	12

LEED Homes - N/A

LEED Homes does not have a designated Operations and Maintenance category. However, it does require that a mandatory operations and maintenance manual be provided to responsible parties, as well as requires a walk-through of the home with the occupants, identifying all installed equipment and instructing them how to use, operate, and maintain the equipment.

Mandatory Practices (in "Energy Efficiency" Category):

- Provide an operations and maintenance manual to responsible parties, such as home owner or building operator. (See Figure 10)
- Conduct a walkthrough of the home with the occupants, identifying all installed equipment and instructing how to use, operate, and maintain the equipment.

Minimum Point Requirements:

Not applicable to this section.

Analysis

As observed in Figure 10, both systems have similar requirements for building owner education and providing appropriate information to responsible parties.

LEED for Homes requires that the project team provide an operations and maintenance manual to responsible parties, such as the home owner or building operator. See Figure 10 for more details. It also requires that the team conduct a walk-through of the home with the occupants, identifying all installed equipment and instructing how to use, operate, and maintain the equipment

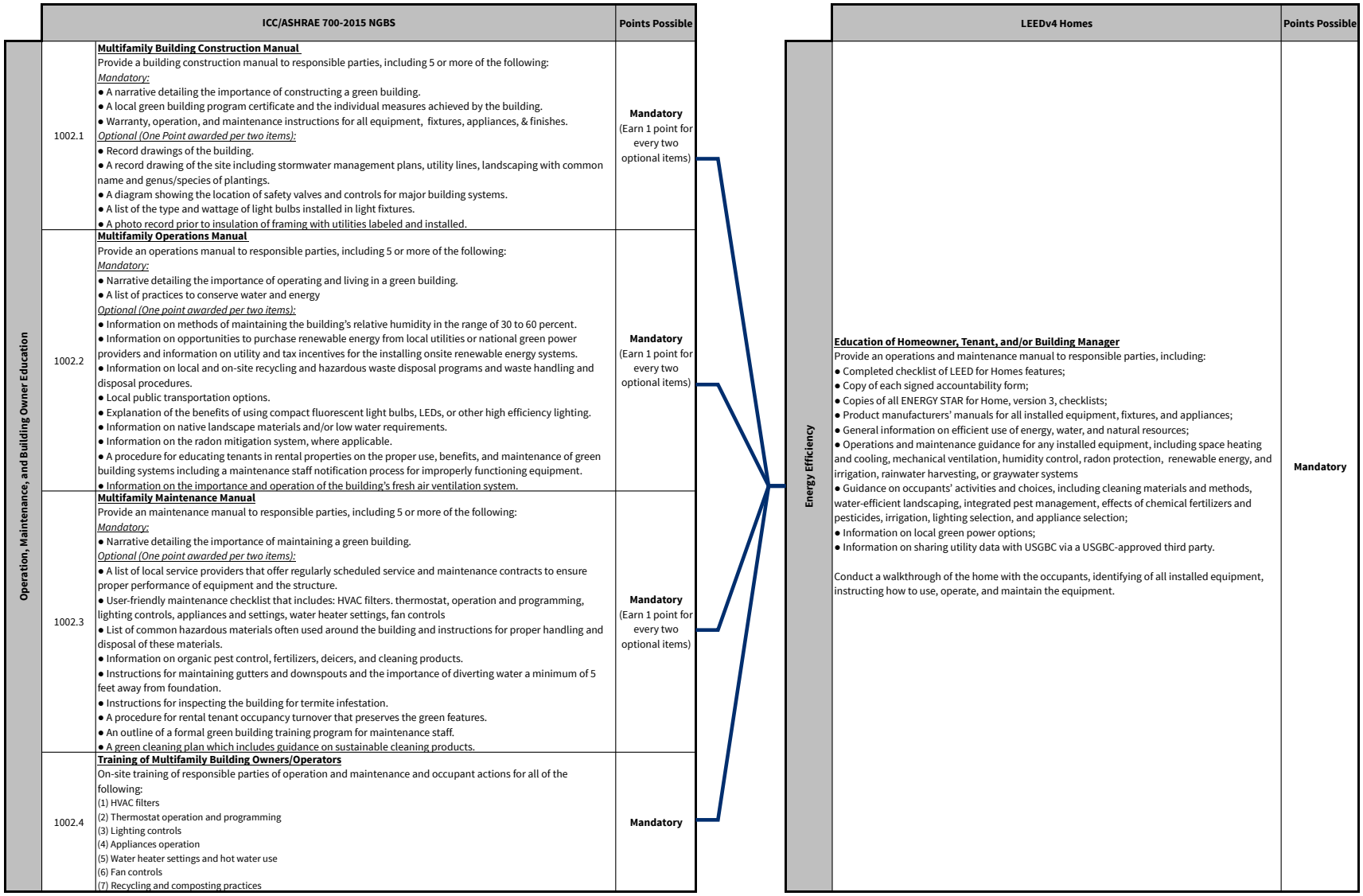
NGBS requires a home owner manual for single-family homes, or a series of operation and maintenance manuals for multifamily homes, to be provided to responsible parties. These manuals must include information such as appliance data sheets and lists of green features, but are also required to select a few additional practices to include from a provided list. Examples of these include information on opportunities to purchase renewable energy from local utilities, local and on-site recycling and hazardous waste disposal programs and waste handling and disposal procedures, organic pest control, fertilizers, deicers, and cleaning products.

On-site training of responsible parties is mandatory in NGBS, and must include at minimum the operation and maintenance and occupant actions HVAC filters, thermostat operation and programming, lighting controls, appliances operation, water heater settings and hot water use, fan controls, recycling and composting practices.

NGBS also awards points for providing public education about the green features of the project, such as construction signs demonstrating how the project is designed and built in accordance with the National Green Building Standard.

Providing a verification system plan also earns points. The verification system provides methods for demonstrating continued energy and water savings that are determined from the building's initial year of occupancy of water and energy consumption, and comparing it to annualized consumption at least every four years.

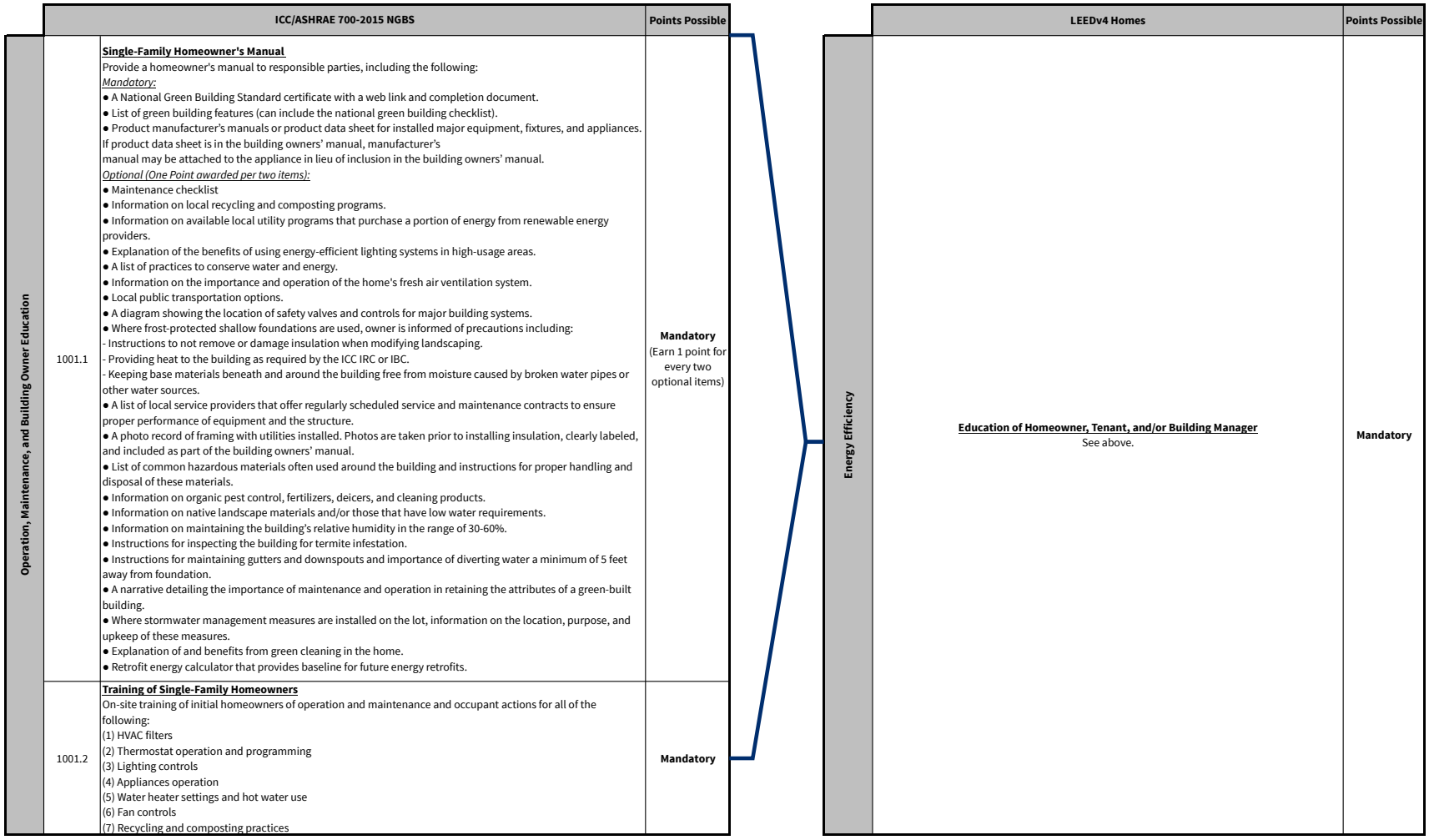
Figure 10: Operation, Maintenance, and Building Owner Education Practices



	ICC/ASHRAE 700-2015 NGBS		Points Possible
Operation, Maintenance, and Building Owner Education	1002.1	**Multifamily Building Construction Manual** Provide a building construction manual to responsible parties, including 5 or more of the following: *Mandatory:* ● A narrative detailing the importance of constructing a green building. ● A local green building program certificate and the individual measures achieved by the building. ● Warranty, operation, and maintenance instructions for all equipment, fixtures, appliances, & finishes. *Optional (One Point awarded per two items):* ● Record drawings of the building. ● A record drawing of the site including stormwater management plans, utility lines, landscaping with common name and genus/species of plantings. ● A diagram showing the location of safety valves and controls for major building systems. ● A list of the type and wattage of light bulbs installed in light fixtures. ● A photo record prior to insulation of framing with utilities labeled and installed.	**Mandatory** (Earn 1 point for every two optional items)
	1002.2	**Multifamily Operations Manual** Provide an operations manual to responsible parties, including 5 or more of the following: *Mandatory:* ● Narrative detailing the importance of operating and living in a green building. ● A list of practices to conserve water and energy *Optional (One point awarded per two items):* ● Information on methods of maintaining the building's relative humidity in the range of 30 to 60 percent. ● Information on opportunities to purchase renewable energy from local utilities or national green power providers and information on utility and tax incentives for the installing onsite renewable energy systems. ● Information on local and on-site recycling and hazardous waste disposal programs and waste handling and disposal procedures. ● Local public transportation options. ● Explanation of the benefits of using compact fluorescent light bulbs, LEDs, or other high efficiency lighting. ● Information on native landscape materials and/or low water requirements. ● Information on the radon mitigation system, where applicable. ● A procedure for educating tenants in rental properties on the proper use, benefits, and maintenance of green building systems including a maintenance staff notification process for improperly functioning equipment. ● Information on the importance and operation of the building's fresh air ventilation system.	**Mandatory** (Earn 1 point for every two optional items)
	1002.3	**Multifamily Maintenance Manual** Provide an maintenance manual to responsible parties, including 5 or more of the following: *Mandatory:* ● Narrative detailing the importance of maintaining a green building. *Optional (One point awarded per two items):* ● A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure. ● User-friendly maintenance checklist that includes: HVAC filters. thermostat, operation and programming, lighting controls, appliances and settings, water heater settings, fan controls ● List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials. ● Information on organic pest control, fertilizers, deicers, and cleaning products. ● Instructions for maintaining gutters and downspouts and the importance of diverting water a minimum of 5 feet away from foundation. ● Instructions for inspecting the building for termite infestation. ● A procedure for rental tenant occupancy turnover that preserves the green features. ● An outline of a formal green building training program for maintenance staff. ● A green cleaning plan which includes guidance on sustainable cleaning products.	**Mandatory** (Earn 1 point for every two optional items)
	1002.4	**Training of Multifamily Building Owners/Operators** On-site training of responsible parties of operation and maintenance and occupant actions for all of the following: (1) HVAC filters (2) Thermostat operation and programming (3) Lighting controls (4) Appliances operation (5) Water heater settings and hot water use (6) Fan controls (7) Recycling and composting practices	**Mandatory**

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Education of Homeowner, Tenant, and/or Building Manager** Provide an operations and maintenance manual to responsible parties, including: ● Completed checklist of LEED for Homes features; ● Copy of each signed accountability form; ● Copies of all ENERGY STAR for Home, version 3, checklists; ● Product manufacturers' manuals for all installed equipment, fixtures, and appliances; ● General information on efficient use of energy, water, and natural resources; ● Operations and maintenance guidance for any installed equipment, including space heating and cooling, mechanical ventilation, humidity control, radon protection, renewable energy, and irrigation, rainwater harvesting, or graywater systems ● Guidance on occupants' activities and choices, including cleaning materials and methods, water-efficient landscaping, integrated pest management, effects of chemical fertilizers and pesticides, irrigation, lighting selection, and appliance selection; ● Information on local green power options; ● Information on sharing utility data with USGBC via a USGBC-approved third party. Conduct a walkthrough of the home with the occupants, identifying of all installed equipment, instructing how to use, operate, and maintain the equipment.	**Mandatory**

Figure 10: Operation, Maintenance, and Building Owner Education Practices



	ICC/ASHRAE 700-2015 NGBS			Points Possible
Operation, Maintenance, and Building Owner Education	1001.1	**Single-Family Homeowner's Manual** Provide a homeowner's manual to responsible parties, including the following: *Mandatory:* ● A National Green Building Standard certificate with a web link and completion document. ● List of green building features (can include the national green building checklist). ● Product manufacturer's manuals or product data sheet for installed major equipment, fixtures, and appliances. If product data sheet is in the building owners' manual, manufacturer's manual may be attached to the appliance in lieu of inclusion in the building owners' manual. *Optional (One Point awarded per two items):* ● Maintenance checklist ● Information on local recycling and composting programs. ● Information on available local utility programs that purchase a portion of energy from renewable energy providers. ● Explanation of the benefits of using energy-efficient lighting systems in high-usage areas. ● A list of practices to conserve water and energy. ● Information on the importance and operation of the home's fresh air ventilation system. ● Local public transportation options. ● A diagram showing the location of safety valves and controls for major building systems. ● Where frost-protected shallow foundations are used, owner is informed of precautions including: - Instructions to not remove or damage insulation when modifying landscaping. - Providing heat to the building as required by the ICC IRC or IBC. - Keeping base materials beneath and around the building free from moisture caused by broken water pipes or other water sources. ● A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure. ● A photo record of framing with utilities installed. Photos are taken prior to installing insulation, clearly labeled, and included as part of the building owners' manual. ● List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials. ● Information on organic pest control, fertilizers, deicers, and cleaning products. ● Information on native landscape materials and/or those that have low water requirements. ● Information on maintaining the building's relative humidity in the range of 30-60%. ● Instructions for inspecting the building for termite infestation. ● Instructions for maintaining gutters and downspouts and importance of diverting water a minimum of 5 feet away from foundation. ● A narrative detailing the importance of maintenance and operation in retaining the attributes of a green-built building. ● Where stormwater management measures are installed on the lot, information on the location, purpose, and upkeep of these measures. ● Explanation of and benefits from green cleaning in the home. ● Retrofit energy calculator that provides baseline for future energy retrofits.	**Mandatory** (Earn 1 point for every two optional items)
	1001.2	**Training of Single-Family Homeowners** On-site training of initial homeowners of operation and maintenance and occupant actions for all of the following: (1) HVAC filters (2) Thermostat operation and programming (3) Lighting controls (4) Appliances operation (5) Water heater settings and hot water use (6) Fan controls (7) Recycling and composting practices	**Mandatory**

	LEEDv4 Homes	Points Possible
Energy Efficiency	**Education of Homeowner, Tenant, and/or Building Manager** See above.	**Mandatory**

Figure 10: Operation, Maintenance, and Building Owner Education Practices

Other NGBS Energy Efficiency Credits

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Operation, Maintenance, and Building Owner Educ	1003.1	**Public Education** One or more of the following is implemented. (2 pts max): ● Signs showing the project is designed and built in accordance with the National Green Building Standard are posted on the construction site. (1 pt) ● National Green Building Standard certification plaques with rating level attained are placed in a conspicuous location near the utility area of the home or, in a conspicuous location near the main entrance of a multifamily building. (1 pt) ● A URL for the National Green Building Standard is included on site signage, builder website (or property website for multifamily buildings), and marketing materials for homes certified under the National Green Building Standard. (1 pt)	**2**
	1004.1	**Verification System** A verification system plan is provided in the building owner's manual. The verification system provides methods for demonstrating continued energy and water savings that are determined from the building's initial year of occupancy of water and energy consumption as compared to annualized consumption at least every four years. ● Verification plan is developed top monitor post-occupancy energy and water use and is provided in the building owner's manual. (1 pt) ● Verification system is installed in the building to monitor post-occupancy energy and water use. (3 pt)	**4**

Conclusion

Both LEED Homes and the National Green Building Standard are effective systems for the integration of green building strategies into single-family and low-rise multifamily homes. NGBS can also be applied to high-rise multifamily projects, while the USGBC has a separate rating system, LEED New Construction, for multifamily high-rises. This rating system is very different than LEED Homes; Please see "A Comparative Overview of the National Green Building Standard 2015 & LEED v4 BD+C: New Construction" for more information on how these two programs relate to each other.

Both LEED Homes and NGBS require certain practices to be completed, and then offer a catalog of optional practices for a project to earn points. Both systems require a project to meet a minimum number of total points to earn tiered levels of certification. NGBS also requires projects to earn a minimum number of points within each green building practice category as well, ensuring a balanced approach to sustainable design and construction.

Both LEED and NGBS focus on the six main subject areas of sustainability in the residential industry: Water Efficiency, Energy Efficiency, Location and Site Development, Material and Resource Efficiency, Indoor Environmental Quality, as well as Operation, Maintenance, and Building Owner Education. Both systems encourage innovative strategies as well as understand impacts to design and construction based on region.

Within each green practice category, the rating systems contain a number of similar or identical design and construction practices. In total, NGBS has more individual mandates than LEED, mostly within the construction phase of the project timeline. NGBS also has a greater amount of individual optional practices which a project team can select from in order to earn points.

Both rating systems require projects to have third-party on-site verification of proper installation of green building features both pre-drywall and post-construction. This ensures items have not been value engineered out of the project during the construction phase. Projects then are certified by an overseeing entity – For NGBS, this is usually the Home Innovation Research Labs; for LEED Homes, this is the Green Business Certification Institute.

The LEED family of rating systems and NGBS are included as a means of demonstrating energy efficiency and sustainability compliance in a number of regulations and incentive programs across the country, including state Low-Income Housing Tax Credits Qualified Allocation Plans and numerous federal agencies.

As of the time of this report, there are over 100,000 homes certified NGBS Green, and over 120,000 certified LEED for Homes residential units.