



Home Innovation
RESEARCH LABS™

DETERMINING EQUIVALENCY

COMPARISON:
2015 NATIONAL GREEN BUILDING
STANDARD® (NGBS) AND LEED NC v4

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NATIONAL GREEN BUILDING STANDARD DEVELOPMENT

The ICC-700 *National Green Building Standard*[®] (NGBS) is the first and only residential green building rating system to undergo the full consensus process and receive approval from the American National Standards Institute (ANSI). Since 2008, each version of the NGBS has been approved by the American National Standards Institute (ANSI)¹. The 2008 and 2012 NGBS versions were developed through with support from the National Association of Home Builders (NAHB) and the International Code Council (ICC). For the third edition of the standard, the 2015 version², the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) participated as a third co-sponsor.

The NGBS is also the first and solely residential green building standard to be one of the ICC suite of I-codes that form a complete set of comprehensive and coordinated building codes. As the industry standard for green residential development, it is embedded within the International Green Construction Code (IgCC) as an alternative compliance path for multifamily residential buildings and the residential portion of mixed-use buildings. Finally, the NGBS is also approved as an ASHRAE Standard.

The NGBS was developed as a national residential green building rating system because previously developed programs were either not well suited for housing or too local in their scope and practices. Despite the impeccable development process and its reputable partners, which have included NAHB, ICC, and ASHRAE, the NGBS has suffered from the misperception that it is not as stringent as the U.S. Green Building Council (USGBC) rating systems. This is simply not true.

The truth about the NGBS is that it is just as rigorous, if not more, than the LEED rating systems. Further, if we are to be successful in transforming the way we design, build, maintain and operate our buildings, homes and communities, we will need to provide architects, builders, remodelers, developers, engineers, building scientists, realtors, appraisers, financiers, homeowners, renters, government agencies, code officials, with a truckload of innovative, effective, affordable, tools to help them reach that goal.

LEED NEW CONSTRUCTION DEVELOPMENT

In contrast, USGBC's development process suggests a consensus-based approach to development of its LEED rating system; however, it is not a true consensus standard. One must be a USGBC member to participate in the development of the LEED rating system. This factor alone would disqualify LEED from being accepted as a true consensus standard, because the development process is not open to all stakeholders. Furthermore, there is no obligation to ensure balance among the stakeholders. Finally, USGBC is not accredited as a standards development organization, and LEED is not approved as a national standard by any national standards-making body.

¹ The original 2008 version was approved in 2009; the 2012 version was approved in early 2013; the 2015 edition was approved in 2016; and the 2020 version was approved in 2020.

² More information at www.homeinnovation.com/ngbs

NGBS VS. LEED NC SCOPE

The NGBS is designed specifically for residential construction, development, and renovation. LEED New Construction (NC) is intended for use by both commercial office buildings, as well as multifamily buildings. While commercial buildings and multifamily buildings may share construction types and methods, occupancy matters, and, thus, the NGBS is uniquely suited to residential occupancy.

The NGBS specifically addresses single-family home, multi-unit buildings, the residential portions of mixed-use buildings, land developments, and remodeling projects.³ (This comparison report addresses the new construction compliance path.) However, the definition of dwelling unit allows for broader use beyond these types of residential construction. There are no restrictions based on end-use, height, or construction type. The NGBS covers residential construction with units that meet the definition of a dwelling unit—i.e., “a single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, cooking, and sanitation.”

Under the 2015 NGBS, a hotel can be certified, provided that all units meet the NGBS definition of a dwelling unit. The NGBS is applicable to hotels that offer amenities that make it function more like a residence than merely a sleeping unit. Each unit should have at a minimum a refrigerator; a microwave, range, or cooktop; a bed(s); bathroom; and living area. Other buildings with residential end-use may also be applicable for NGBS Green certification, including dormitories, military housing, shelters, rescue squad facilities, and more. This expanded definition is important to note, as it opens the NGBS up to be applicable to both private and public construction and various building types.

CATEGORIES OF GREEN PRACTICES

The NGBS and LEED NC have practices in five identical categories: (1) Water Efficiency; (2) Energy Efficiency; (3) Location & Transportation / Sustainable Sites; (4) Resource Efficiency; and (5) Indoor Environmental Quality.

LEED NC includes an Integrative Process credit which specifies energy modeling and water budget analysis during a project’s design phase. While not represented as a NGBS practice, these activities are typically conducted as part of the NGBS Green certification process.

LEED NC addresses site selection and development in two separate categories: (1) Location & Transportation; and (2) Sustainable Sites. The NGBS addresses these topics in one combined section, titled Lot Design, Preparation, & Development.

LEED NC offers a dedicated category for Innovation in Design. The NGBS recognizes innovative green practices in each of its six categories.

LEED NC also offers a section for Regional Priority. The NGBS provides greater flexibility for architects and developers to recognize regional priorities, because the NGBS is a more expansive, flexible point system.

³ This report covers the 2015 NGBS. The 2020 NGBS scope was specifically amended to include mixed-use buildings, as long as the non-residential portion is 49% or less of the gross floor area, and other residentially-used buildings such as assisted living facilities, hotels, and dormitories.

Finally, the NGBS has a category for Building Operation, Maintenance, and Building Owner Education. LEED NC has no comparable category.

NGBS	LEED NC
6 categories of green practices:	9 categories of green practices:
<ul style="list-style-type: none"> • Lot Design, Preparation, & Development • Resource Efficiency • Energy Efficiency • Water Efficiency • Indoor Environmental Quality • Operation, Maintenance, and Building Owner Education 	<ul style="list-style-type: none"> • Integrative Process • Sustainable Sites • Location & Transportation • Water Efficiency • Energy & Atmosphere • Materials & Resources • Indoor Environmental Quality • Innovation* • Regional Priority
<p><i>(* Each NGBS category includes an innovative practices section.)</i></p>	

NGBS VS. LEED NC MANDATORY REQUIREMENTS COMPARISON

Both NGBS and LEED have mandatory practices that must be completed to attain certification at any level.

LEED NC has a total of 12 prerequisites. One of the LEED prerequisites is identical to NGBS mandatory practice (Minimum Energy Performance at the Certified/Bronze level). For 10 LEED prerequisites, NGBS has an identical practice that awards points toward certification. Only 1 LEED prerequisite is not exactly duplicated in the NGBS (Minimum Indoor Air Quality Performance); however, the NGBS has numerous practices intended to ensure improved indoor air quality.

In comparison, the NGBS has 17 Mandatory practices, 16 of which are not required by LEED. Many of these practices address critical building durability (i.e., moisture management), minimum energy efficiency, pollutant control, and building owner education. Some but not all of these NGBS mandatory practices are covered by LEED credits, with the notable exception being the NGBS mandatory practices for operation, maintenance, and building owner education.

NGBS VS. LEED CERTIFICATION REQUIREMENTS

Both programs offer four levels of certification. LEED has Certified, Silver, Gold, and Platinum. NGBS offers Bronze; Silver; Gold; or Emerald.

For LEED, buildings may attain points in any category to achieve the total points required for a given certification level; LEED does not require point minimums in every category of the rating system.

Certification via LEED is based on total points achieved out of the 100 available points.

Certified	40-49 points
Silver	50-59 points
Gold	60-79 points
Platinum	80 points and above

Within the NGBS, no one category of green practices is weighted as more important than another. All projects must achieve a minimum point threshold in every category of green building practice to be certified at any level. The NGBS is the only national program with this level of cross-category stringency, making it the most rigorous and comprehensive green building rating system.

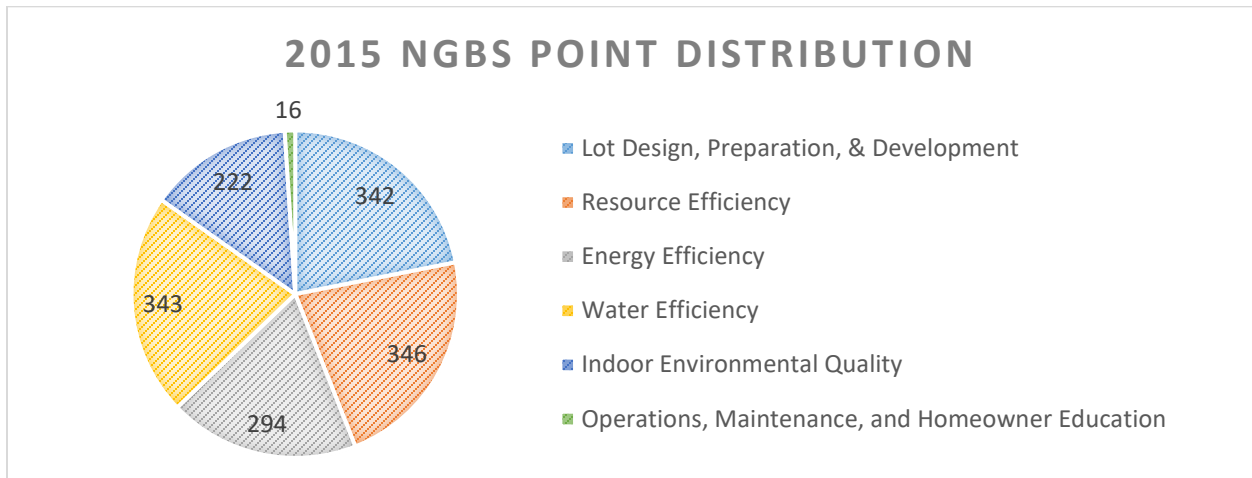
Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^{(a) (b)}			
			BRONZE	SILVER	GOLD	EMERALD
1.	Chapter 5	Lot Design, Preparation, and Development	50	64	93	121
2.	Chapter 6	Resource Efficiency	43	59	89	119
3.	Chapter 7	Energy Efficiency	30	45	60	70
4.	Chapter 8	Water Efficiency	25	39	67	92
5.	Chapter 9	Indoor Environmental Quality	25	42	69	97
6.	Chapter 10	Operation, Maintenance, and Building Owner Education	8	10	11	12
7.		Additional Points from Any Category	50	75	100	100
Total Points:			231	334	489	611

- (a) In addition to the threshold number of points in each category, all mandatory provisions of each category shall be implemented.
- (b) For dwelling units greater than 4,000 square feet (372 m²), the number of points in Category 7 (Additional Points from Any Category) shall be increased in accordance with Section 601.1. The "Total Points" shall be increased by the same number of points.

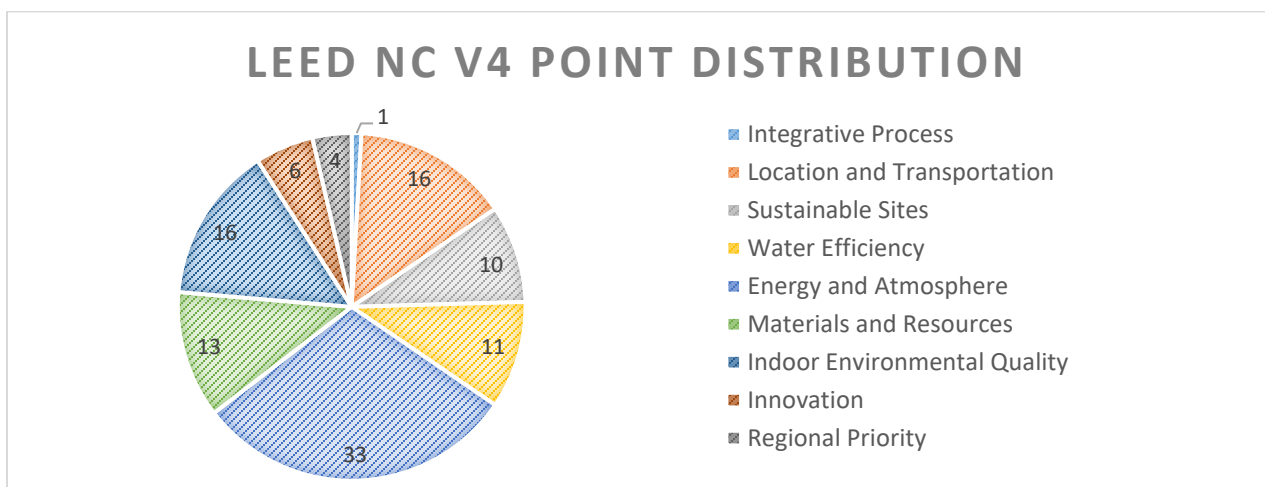
NGBS VS. LEED POINT DISTRIBUTION

While LEED and NGBS both address the same categories of green practices, the distribution of practices available under category differ. The NGBS presents a more balanced offering of green practices, while LEED includes significantly more items within a few categories.



The chart above illustrates the percentage of points that are available in each NGBS category of green building practices. The number of points that are achievable within each of the NGBS section is relatively even, with each category having between 14 and 22% of the available points.

The chart below illustrates the percentage of points that are available in each LEED category of green building practices. There is a greater range in the points available under each category. About two-thirds of points are available from just 3 of the 9 LEED categories (Energy & Atmosphere; Indoor Environmental Quality; Materials & Resources). Less than ten percent are available under the Sustainable Sites (9%), Regional Priority (4%), and Integrative Process (1%) categories. Also, as a further note, it is important not to assume that because LEED has a higher percentage of points available in Energy and Atmosphere that LEED buildings will be more energy efficient. As discussed below, a building certified to the 2015 NGBS Bronze level is expected to be as energy efficient as a LEED Certified building.



UNDERSTANDING THE IMPORTANCE OF POINT THRESHOLDS FOR ENERGY EFFICIENCY

The lack of minimum point thresholds for the categories means that a building can attain any level of certification under the LEED rating system (including the highest level, Platinum) while being only 0.5% more efficient than an NGBS Bronze certified building. In comparison, a building seeking NGBS certification at higher levels (Silver, Gold, or Emerald) would be required to be 7.5%, 15%, or 20% higher than the Bronze level. See Energy & Atmosphere section for more details.

NGBS GREEN CERTIFICATION PROGRAM

Home Innovation serves as Adopting Entity and provides certification services to the NGBS. Home Innovation is a 56-year old, internationally recognized, accredited product testing and certification laboratory located in Upper Marlboro, Maryland. Our work is solely focused on the residential construction industry and our mission is to improve the affordability, performance, and durability of housing by helping overcome barriers to innovation. Our core competency is as an independent, third-party product testing and certification lab, making us uniquely suited to administer a green certification program for residential buildings. Our staff is made up of mechanical, structural, and electrical engineers; planners; economists; architects; former builders, remodelers, and contractors; lab and technicians. Combined, they possess an unparalleled depth of knowledge and experience in all facets of market analysis and building science research and testing. Why is that important? Because behind every building seeking NGBS compliance stands a team of experts on a mission to help` them succeed. Participation in NGBS Green brings our building science expertise to each project team at no additional cost.

NGBS VERIFICATION: REQUIRES TWO MANDATORY INSPECTIONS

The NGBS requires that a qualified, independent third-party inspect the project and verify that all green design or construction practices claimed by the builder toward green certification are incorporated correctly into the project. Most projects require at least two inspections. The verifier must perform a rough inspection before the drywall is installed to observe the wall cavities, and a final inspection once the project is complete. The required verification offers imbues an elevated level of rigor and quality assurance to the projects that are certified. A local jurisdiction can be assured that construction practices for higher building performance and healthier residences are successfully achieved.

Verifiers record the results of their rough and final inspections on a Verification Report which is submitted to Home Innovation Research Labs. Home Innovation reviews every rough and final inspection to ensure national consistency and accuracy in the verification reports. After the Verification Reports are reviewed and approved, our team issues green certification to the project.

Home Innovation Research Labs qualifies, trains, tests, and accredits the NGBS Green Verifiers and maintains a current list at www.HomeInnovation.com/FindNGBSVerifier. Verifiers must possess experience in residential construction and green building. Many verifiers are Home Energy Rating System (HERS) raters. Potential verifiers are trained on how to verify every NGBS practice. After completing the training, verifiers must pass a three-part exam and carry sufficient insurance to 3 earn accreditation. Verifiers renew their accreditation annually and retrain and retest with every NGBS version.

Home Innovation maintains strict rules to ensure verifiers remain independent and free of conflict-of-interest on the projects for which they provide verification services. Verifiers serve as our field agents to confirm buildings are NGBS compliant. Further, we regularly audit our verifiers and their verifications as part of our internal quality assurance program.

The NGBS Green inspection requirements imbue a high level of Quality Assurance on the certification program, which LEED simply does not share. For example, we know from our verifiers that it is common that insulation is not installed correctly, and frankly, it is impossible to determine correct insulation installation via photographs. Our verifiers inspect each apartment before drywall and can ensure the behind the wall practices are done correctly before the drywall is installed, or if necessary, have the contractor correct any installation issues.

NGBS VS. LEED NC VERIFICATION REQUIREMENTS COMPARISON

NGBS	LEED NC
Every NGBS new construction project is <u>required to be inspected</u> at least twice by an independent, third-party Accredited Verifier. There is no self-certification. Practices must be visually inspected to receive points; documentation, photos, or written assertions are not allowed as alternatives.	Buildings are <u>not required</u> to be inspected on site for every point claimed toward certification. Documentation, photos, or written assertions are allowed in lieu of a visual inspection.

CREDIBILITY AND RIGOR OF THE NGBS COMPARED TO LEED

Several studies have been completed to demonstrate the affordability and/or rigor of the NGBS.

- *Green Home Building Rating Systems - A Sample Comparison* evaluates the costs and technical requirements of bringing two sample code-compliant production houses in different climate zones into compliance with the 2012 NGBS and LEED for Homes.
- AIA Cincinnati published a report comparing the 2008 NGBS and LEED for Homes that found the programs to be essentially equivalent in rigor, but the NGBS to be more affordable and easier to use.
- The Home Builders Association of Greater Chicago released an independently prepared report evaluating the additional costs required to elevate three sample code-compliant, urban, residential building types in the City of Chicago into compliance with the Chicago Green Homes Program (CGH), the 2008 NGBS, and LEED-H.

LEGISLATIVE AND REGULATORY PARITY WITH LEED

Since 2009 when ANSI first approved the NGBS, without exception NGBS has been considered as on par or more stringent than LEED or Green Communities as a green building rating system for residential projects.

- On the federal level, HUD recognizes the NGBS by name specifically and as on par with Green Communities.⁴ For example, in their 2013 funding notice for jurisdictions affected by Hurricane Sandy, the agency cited the NGBS as an acceptable green standard for reconstruction efforts.
- HUD's April 2016 Mortgage Insurance Premium reduction program recognizes NGBS Green as one of the accepted green certification programs.
- The U.S. Department of Army recognizes NGBS as a LEED equivalent for military housing nationwide.
- Fannie Mae and Freddie Mac both recognize NGBS Green for financing incentives in the same tier, or higher, than LEED.
- 23 states recognize, mandate, or incentivize NGBS certification through their Qualified Allocation Plan for the federal Low Income Housing Tax Credit Program.⁵
- Between 2009 and 2012, NYSERDA provides financial incentives for residential buildings built in New York that were certified to the Silver level of either the NGBS or LEED.
- Delaware provides financial incentives for homes built to the Silver level of either the NGBS or LEED in its Green for Green program.
- In New Mexico, homes certified to either the NGBS or LEED can qualify for the generous state Sustainable Building Tax Credit for New Construction.

To date, not a single jurisdiction has refused to recognize the NGBS as an alternative compliance path for any regulatory or incentive program where we have asked them to make an equivalency decision. For a more complete listing of where NGBS has been recognized, visit our summary of incentives⁶.

NGBS VS. LEED NC COMPARISON

Location and Transportation / Sustainable Sites

LEED NC includes chapters for Location & Transportation, which address site selection, density, and alternative transportation, and Sustainable Sites, which addresses site assessment and development .

The NGBS addresses all these topics within a combined Lot Design, Preparation, and Development chapter that address all of these topics.

NGBS practices that are directly comparable are shown to the right of the LEED prerequisites and credits. Further below, a dedicated table shows the NGBS Lot Design, Preparation, and Development practices that address concepts not represented in the LEED rating system.

⁴ U.S. Department of Housing and Urban Development memo from Kathryn Saylor, Assistant Inspector General for Evaluation to Clifford Taffet, General Deputy Assistant Secretary, dated November 20, 2015 citing National Green Building Standard specifically as one of the HUD adopted energy building rating systems.

⁵http://www.homeinnovation.com/services/certification/green_homes/resources/ngbs_incentives_summary/gap_recognition.

⁶ www.homeinnovation.com/ngbsgreenincentives

LEED NC Version 4 Location & Transportation		
Type	Credit	Points
Credit	LEED for Neighborhood Development Location	16
Credit	Sensitive Land Protection	1
Credit	High Priority Site	2
Credit	Surrounding Density and Diverse Uses	5
Credit	Access to Quality Transit	5
Credit	Bicycle Facilities	1
Credit	Reduced Parking Footprint	1
Credit	Green Vehicles	1

Comparable NGBS Lot Design, Preparation, and Development Practices		
Practice Number	Practice	Points
501.1(1)	NGBS Certified Development	15
503.7(1)	Environmentally Sensitive Areas Not Disturbed	4
501.1(2)	Infill, Greyfield, Brownfield Lots	10-15
501.2(4)	Community Resources	4
501.2(1-3), 501.2(5)	Multi-modal Transportation	19
501.2(6)	Bicycle parking	1-6
505.1	Driveways and parking area	19
505.6	Multi-Unit Plug-In Electric Vehicle Charging	4

LEED NC Version 4 Sustainable Sites		
Type	Credit	Points
Prerequisite	Construction Activity Pollution Prevention	0
Credit	Site Assessment	1
Credit	Site Development – Protect or Restore Habitat	2
Credit	Open Space	1
Credit	Rainwater Management	3
Credit	Heat Island Reduction	2
Credit	Light Pollution Reduction	1

Comparable NGBS Lot Design, Preparation, and Development Practices		
Practice Number	Practice	Points
504.3(1)	Sediment and Erosion Controls	5
503.4(1)	Site Assessment	7
503.4(1)	Hydrologic Assessment	10
503.7(2)	Environmentally Sensitive Areas Restored	4
503.6(1-3)	Wildlife Habitat	9
505.5	Community Gardens	3
503.4(3)	Low Impact Development	10
505.2	Heat Island Mitigation	10
503.6(4)	Outdoor Lighting	3

Additional NGBS Lot Design, Preparation, and Development Practices		
Practice Number	Practice	Points
502.1	Project Team, Mission Statement, and Goals	4
503.1	Natural Resources	3-31
503.2	Slope Disturbance	1-27
503.3	Soil Disturbance and Erosion	5-15
503.4(4)	Permeable Materials	5-10
503.5	Landscape Plan	1-52
503.8	Demolition of Existing Buildings	5-6
504.1	On-Site Supervision and Coordination	4
504.2	Trees and Vegetation	3-12
504.3(2-9)	Soil Disturbance and Erosion Implementation	3-33
505.3	Density	4-8
505.4	Mixed-use Development	8

Prerequisites: LEED requires a Construction Activity Pollution Plan.
 NGBS does not have any mandatory practices in the Lot Design Chapter.

Point Distribution: LEED: 26 points available
 NGBS: 342 points available

Analysis:

LEED and the NGBS include many similar practices. In fact, the NGBS includes at least one practice for each of the LEED Location and Transportation and Sustainable Sites items.

The NGBS offers 12 additional practices not covered in LEED. These include: including establishing a project team, mission statement, and written goals; minimizing the disturbance of slopes; landscape plan to limit water and energy use and enhance natural environment; onsite supervision during lot clearing; preservation of trees and vegetation; on-site density; and mixed use development. The NGBS Lot Design, Preparation, and Development chapter is more process-oriented than the other NGBS chapters, because environmentally-sensitive strategies differ depending on locale, topography, climate, and so on.

One of the biggest differences between LEED and the NGBS is the greater diversity of practices available through the NGBS. The NGBS was intentionally designed to apply to a wide range of residential sites, from the rural single-family home, to a neo-traditional neighborhood townhouse, to the high-rise apartment building. As a result, many NGBS Chapter 5 practices may not be relevant at all 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 to slope disturbance minimization and many of the natural resource preservation points.

For Silver level certification, at least 64 points must be achieved within this chapter. The NGBS requires at least 22% of total points toward Silver be attained from the Lot Design chapter.

Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^(a) ^(b)			
			BRONZE	SILVER	GOLD	EMERALD
1.	Chapter 5	Lot Design, Preparation, and Development	50	64	93	121
Total Points:			231	334	489	611

Water Efficiency

LEED NC includes a Water Efficiency chapter that address indoor and outdoor water use, cooling towers, and water metering. The NGBS includes a comparable Water Efficiency chapter.

LEED NC Version 4 Water Efficiency		
Type	Credit	Points
Prerequisite	Outdoor Water Use Reduction	0
Prerequisite	Indoor Water Use Reduction	0
Prerequisite	Building-Level Water Metering	0
Credit	Outdoor Water Use Reduction	2
Credit	Indoor Water Use Reduction	6
Credit	Cooling Tower Water Use	2
Credit	Water Metering	1

Comparable NGBS Water Efficiency Practices		
Practice Number	Practice	Points
801.6	Irrigation Systems	Mandatory, 3-18
801.5	Water Closets and Urinals	1-21
801.4	Lavatory Faucets	1-12
801.3	Showerheads	1-24
801.2	Water-Conserving Appliances	2-39
<i>Not Addressed</i>		
<i>Not Addressed</i>		

Additional NGBS Water Efficiency Practices		
Practice Number	Practice	Points
801.1	Indoor Hot	11-81
801.7	Rainwater Collection and Distribution	5-70
801.8	Sediment Filters	1
802.1	Reclaimed, Gray, and Recycled Water	5-20
802.2	Reclaimed Water, Graywater, or Rainwater Pre-piping	3 per roughed-in system
802.3	Automatic Shutoff Water Devices	2
802.4	Engineered Biological System or Intensive Bioremediation System	20
802.5	Recirculating Humidifier	1
802.6	Advanced Wastewater Treatment System	20

Prerequisites:

LEED requires:

- Reduced outdoor water use through either no or reduced irrigation;
- A 20% reduction of indoor water use; and
- Building-level water metering.

NGBS requires that where irrigation is installed, an irrigation plan and implementation are executed by a qualified professional certified by EPA WaterSense or equivalent.

Point Distribution:

LEED: 11 points available

NGBS: 343 points available

Analysis:

For Water Efficiency, LEED and NGBS overlap in intent and practices. LEED's water efficiency chapter is a design standard with a prerequisite for a 20% reduction in the water use baseline. NGBS is more

prescriptive as to how building reduce water use and requires Silver certified building to achieve greater water savings than a Bronze certified building.

NGBS point assignments are intended to be relative to the expected amount of water savings. Assignment of points for practices in the NGBS Water Efficiency Chapter were based on four factors: cold water savings, hot water savings, energy intensity, and longevity of the appliance/fixture/technology. A review of typical household indoor and outdoor water usage was done to establish an idealized household using fixtures meeting current mandatory requirements for flow rates. Water savings (gallons) were estimated for each of the practices. Points were assigned to each practice relative to the amount of water saved. The point values were then adjusted based on energy intensity (using a national average) and longevity.

The LEED rating system includes items for whole-building and advanced water metering. The Building-Level Water Metering prerequisite requires property managers to commit to sharing whole-project water usage data with USGBC for at least 5 years. The NGBS does not a similar requirement.

The LEED rating system also includes a prerequisite for cooling tower water conservation. Cooling towers are less commonly represented in residential construction. As such, the NGBS does not include a similar item.

For LEED, the indoor water use prerequisite and credit are based on fixture and appliance efficiency. Structural waste from hot water supply systems design is not addressed. This is a significant area of focus in the NGBS, with up to 81 points available.

The NGBS addresses several additional topics not included within the LEED rating system, including: capture and pre-piping for reclaimed, gray, and rainwater; sediment filters designed to protect plumbing fixtures; and leak detection and automatic shut-off devices.

For Silver level certification, at least 39 points must be achieved within this chapter. The NGBS requires at least 12% of total points toward Silver be attained from the Water Efficiency chapter.

Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^{(a) (b)}			
			BRONZE	SILVER	GOLD	EMERALD
4.	Chapter 8	Water Efficiency	25	39	67	92
Total Points:			231	334	489	611

Energy & Atmosphere

LEED NC has an Energy and Atmosphere chapter, and the NGBS has an Energy Efficiency chapter. Within both of these chapters, energy performance, energy metering, and renewable energy topics are addressed.

LEED NC Version 4 Energy & Atmosphere			Comparable NGBS Energy Efficiency Practices		
Type	Credit	Points	Practice Number	Practice	Points
Prerequisite	Fundamental Commissioning and Verification	0	705.6	Installation and Performance Verification	3-24
Prerequisite	Minimum Energy Performance	0	701	Mandatory Requirements	Mandatory, 0
Prerequisite	Building-Level Energy Metering	0	<i>Not Addressed</i>		
Prerequisite	Fundamental Refrigerant Management	0	<i>Not Addressed</i>		
Credit	Enhanced Commissioning	6	705.5	HVAC Design and Installation	1-4
<i>Also Addressed within Operations, Maintenance, and Building Owner Education Chapter</i>					
Credit	Optimize Energy Performance	18	701.1; 702; 703; 704	Successful compliance with one of 4 compliance paths: 1. Alternative Bronze/Silver 2. Performance Path 3. Prescriptive Path 4. HERS Index Target Path	Mandatory, 30-70
Credit	Advanced Energy Metering	1	705.7	Submetering System	1
Credit	Demand Response	2	706.9	Automatic Demand Response	1
Credit	Renewable Energy Production	3	706.5	On-Site Renewable Energy System	2 per KW / number of dwelling units
Credit	Enhanced Refrigerant Management	1	<i>Not Addressed</i>		
Credit	Green Power and Carbon Offsets	2	706.2	Renewable Energy Service Plan	1-2

Additional NGBS Energy Efficiency Practices		
Practice Number	Practice	Points
705.2	Lighting	1-21
705.3	Induction Cooktop	1
705.4	Return Ducts and Transfer Grilles	2
706.1	Energy Consumption Control	1-3
706.3	Smart Appliances and Systems	1-2
706.4	Pumps	1-5
706.6	Parking Garage Efficiency	2
706.7	Grid-Interactive Electric Thermal Storage System	1
706.8	Electrical Vehicle Charging Station	2

Prerequisites: LEED has four Energy & Atmosphere prerequisites: (1) Fundamental Commissioning and Verification; (2) Minimum Energy Performance; (3) Building-Level Energy Metering; and (4) Fundamental Refrigerant Management. To demonstrate minimum energy performance under LEED, there are two options. A project team can choose between whole-building energy simulation and prescriptive compliance via the ASHRAE Advanced Energy Design Guide.

NGBS has a mandatory practice for minimum energy performance. This section outlines energy efficiency compliance options and identifies several prescriptive mandatory items that must be addressed regardless of selected path. These mandatory items address HVAC systems, duct systems, and insulation and air sealing. The NGBS has four compliance options (with compound requirements) that are intended to ensure the project's energy-related systems are installed and commissioned according to the owner's project requirements, basis of design and construction documents. A project team can choose between Alternative Bronze or Silver (ENERGY STAR Certified Homes or ENERGY STAR Multifamily High Rise certification); Performance (requires whole-building energy simulation); Prescriptive, and the HERS Index Target paths.

Point Distribution: LEED 33 points are available.
NGBS 294 points are available.

Analysis:

At the minimum certification levels, LEED and NGBS are on-par. LEED NC requires 5% above ASHRAE 90.1-2010 for minimum energy performance. The NGBS requires energy performance on-par with IECC 2015. ASHRAE 90.1-2010 performance is approximately 4.5% below IECC 2015⁷. As such, the LEED NC energy baseline is 0.5% higher than that of NGBS Bronze.

The NGBS is significantly more stringent than LEED with regard to minimum energy performance at the higher certification levels (Silver, Gold, Emerald/Platinum). LEED does not require higher energy performance for higher certification levels (Silver, Gold, Platinum). However, the NGBS requires 7.5% higher energy performance for Silver level certification. NGBS Silver is designed to offer 7% higher performance than LEED NC.

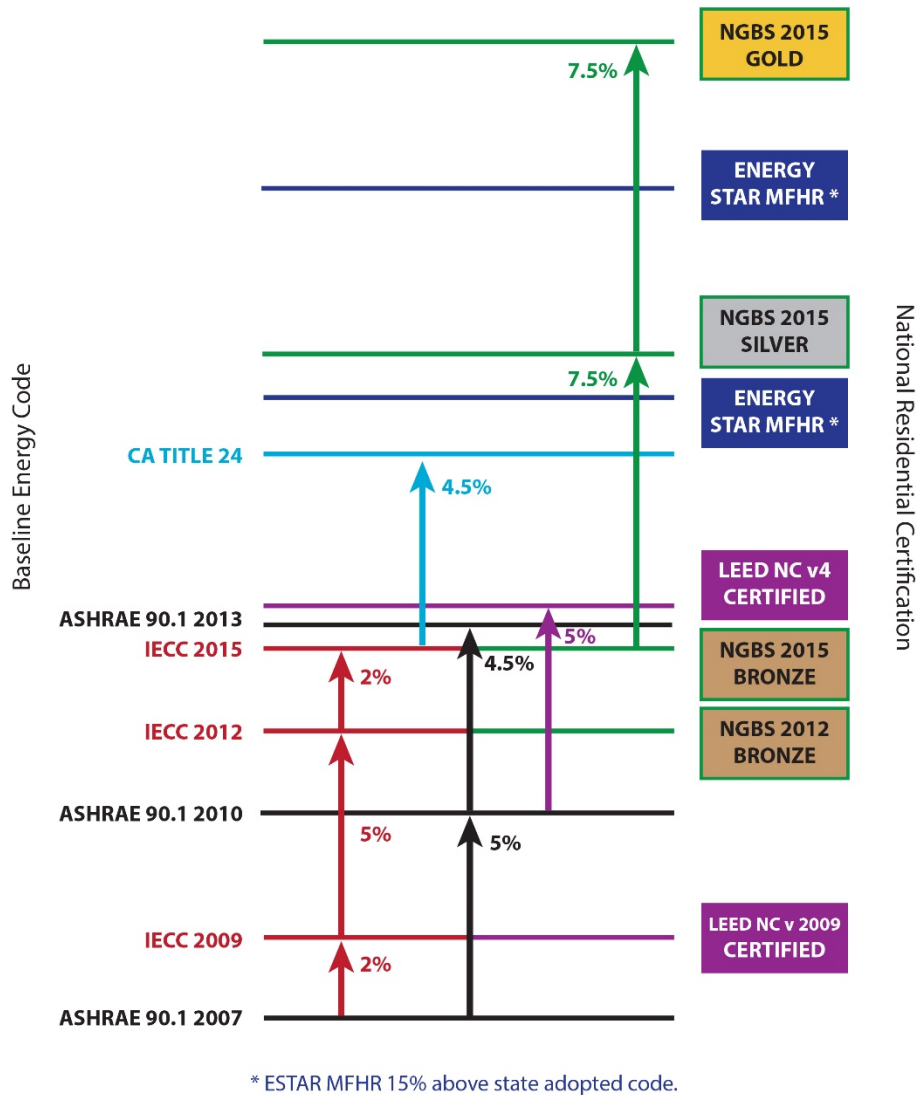
⁷ Zhang, J., Rosenberg, M., Xie, Y., Hart R., Athalye, R., Liu, B., Zhuge, J. (2015, August). *Energy And Energy Cost Savings Analysis of the 2015 IECC for Commercial Buildings*.

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ENERGY EFFICIENCY COMPARISON FOR MID- TO HIGH-RISE RESIDENTIAL BUILDINGS



LEED and NGBS both offer multiple compliance options to demonstrate energy performance. The NGBS offer more compliance options and greater flexibility.

LEED and NGBS both specify performance verification. The NGBS is more strict with regard to who is qualified to perform verification.

LEED’s fundamental commissioning prerequisite outlines a set of activities to evaluate mechanical, electrical, plumbing, and renewable energy systems and assemblies meet ASHRAE guidelines; specifies the role of a “commissioning agent” to conduct those activities; and requires that an operation and maintenance plan be developed specific to the building’s energy systems.

The NGBS does not require building commissioning as per LEED; however, the intent of many of the NGBS practices is to ensure the project’s energy-related systems are installed and calibrated according to the owner’s project requirements, basis of design and construction documents. The NGBS identifies specific energy efficiency testing to be conducted, including air leakage, HVAC airflow, and HVAC duct leakage testing. These tests must be conducted by a qualified third-party professional. (Operation and maintenance plan requirements are also required by NGBS but included in the Operation, Maintenance, and Building Owner Education chapter.)

For LEED, commissioning is conducted by a “Commissioning Agent.” The Commissioning Agent can be an employee of the owner company, independent consultant, or employee of the project’s design or construction firm. For NGBS, verification must be conducted by an accredited NGBS Green Verifier. Home Innovation’s NGBS Green Verifier Agreement and program policies strictly require independent third-party review to ensure no conflict of interest. Home Innovation does not allow member of an owner company or anyone from the design or construction firms to perform on-site verification.

Refrigerant Management: The only LEED items not without comparable NGBS practices are those related to refrigerant management. This topic is less relevant to residential HVAC systems.

Innovative Practices: The NGBS includes 9 practices not addressed by LEED. The NGBS offers innovative practices applicable to residential construction, including lighting and lighting controls, induction cooktops, energy consumption control, smart appliances, grid-interactive storage, and electrical vehicle charging.

For Silver level certification, at least 45 points must be achieved within this chapter. The NGBS requires at least 14% of total points toward Silver be attained from the Energy Efficiency chapter.

Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^{(a) (b)}			
			BRONZE	SILVER	GOLD	EMERALD
3.	Chapter 7	Energy Efficiency	30	45	60	70
Total Points:			231	334	489	611

Materials & Resources

LEED NC includes a Materials and Resources chapter, which addresses recycling, construction waste management, and sustainable products. The NGBS addresses these topics, as well as many additional topics, within its Resource Efficiency chapter.

LEED NC Version 4 Materials & Resources			Comparable NGBS Resource Efficiency Practices		
Type	Credit	Points	Practice Number	Practice	Points
Prerequisite	Storage and Collection of Recyclables	0	607.1(1)	Built-In Recycling Collection	3
Prerequisite	Construction and Demolition Waste Management Planning	0	605.1	Construction Waste Management Plan	6
Credit	Building Life-Cycle Impact Reduction	5	603.1	Reuse of Existing Building	1-12
			603.2	Salvaged Materials	1-9
			610.1.1	Whole-Building Life Cycle Assessment	2-15
Credit	Building Product Disclosure and Optimization – Environmental Product Declarations	2	611.4	Product Declarations	5
			610.1.2	Life Cycle Assessment for a Product or Assembly	2-10
Credit	Building Product Disclosure and Optimization – Sourcing of Raw Materials	2	606.1	Biobased Products	3-8
			606.2	Wood-Based Products	3-4
			604.1	Recycled Content	1-6
			609.1	Regional Materials	1-10
Credit	Building Product Disclosure and Optimization – Material Ingredients	2	611.2	Sustainable Products	3-9
Credit	Construction and Demolition Waste Management	2	605.2	On-Site Recycling	7
			605.3	Recycled Construction Materials	1-6

Additional NGBS Resource Efficiency Practices		
<i>Practice Number</i>	<i>Practice</i>	<i>Points</i>
601.1	Conditioned Floor Area	Mandatory, 3-14
601.2	Material Usage	3-9
601.3	Building Dimensions and Layouts	1-13
601.4	Framing and Structural Plans	4
601.5	Prefabricated Components	4-13
601.6	Stacked Stories	2-8
601.7	Prefabricated Materials	1-12
601.8	Foundations	3
601.9	Above-Grade Walls Systems	4
602.1.1	Capillary Breaks	Mandatory, 0-3
602.1.2	Foundation Waterproofing	4
602.1.3	Foundation Drainage	Mandatory, 0-4
602.1.4	Crawlspaces	Mandatory, 0-14
602.1.5	Termite Barrier	4-8
602.1.6	Termite-Resistant Materials	2-12
602.1.7	Moisture Control Measures	Mandatory, 2-14
602.1.8	Water-resistive barrier	Mandatory, 0
602.1.9	Flashing	Mandatory, 0-18
602.1.10	Exterior Doors	2-6 points
602.1.11	Tile Backing Materials	Mandatory, 0
602.1.12	Roof Overhangs	4
602.1.13	Ice Barrier	Mandatory, 0
602.1.14	Architectural Features	Mandatory, 1-5
602.2	Roof Surfaces	3
602.3	Roof Water Discharge	4
602.4	Finished Grade	Mandatory, 0-2
603.3	Scrap Material	4
606.3	Manufacturing Energy	2-6
607.1(2)	Composting	3
607.2	Food Waste Disposers	1
608.1	Resource-Efficient Materials	3-9
611.3	Universal Design Elements	1-12

Prerequisites: The LEED Materials & Resources chapter requires: (1) buildings to have a place to collect and store recyclables; and (2) a construction and demolition waste management plan be developed and implemented.

The NGBS Resource Efficiency chapter includes significantly more mandatory items. The NGBS incentivizes smaller units and thus overall building size through points and penalizes larger units by requiring additional points to attain certification at any level. Numerous mandatory practices address moisture management and drainage.

Point Distribution: LEED: 13 points available
NGBS: 346 points available

Analysis:

The NGBS Resource Efficiency chapter is much more robust than the LEED Material & Resources chapter.

All LEED credits have at least one comparable practice included within the NGBS rating system.

In addition, there are over 30 practices included within the NGBS rating systems that are not addressed by LEED.

The NGBS includes multiple practices that rewards buildings are designed and constructed to conserve material use. The NGBS penalizes buildings with large units. NGBS requires that buildings with oversized units attain additional points to achieve certification at any level. In addition, the NGBS rewards advanced framing, building dimensions and layouts that are designed to reduce cuts and waste, use of detailed framing and structural plans, use of prefabricated components, stacked stories, prefinished materials, and foundation systems that minimize soil disturbance.

The NGBS offers multiple practices that are designed to manage moisture. Moisture not only impacts the long-term performance of materials but also can adversely affect indoor air quality. LEED does not include similar practices on this important topic. Many of these items are mandatory for certification, including:

- Installation of a capillary break and vapor retarder at concrete slabs and crawlspaces;
- Installation of exterior drain tile for below grade spaces;
- Dampproof walls are required for walls below finished grade;
- Insulation within cavities is dry when enclosed by drywall;
- Water-resistive barrier and/or drainage plan system is installed behind exterior veneer and/or siding;
- Flashing is provided to minimize water entry into wall or roof assemblies;
- Tile backed materials are provided in wet areas;
- Horizontal ledgers are sloped away for gravity drainage; and
- Finished grade is sloped to facilitate drainage away from the building.

The NGBS rewards points for products manufactured with energy derived from renewable sources.

Organic waste management is addressed by two different practices. One practice awards a point where food waste disposals are installed. Another practice awards a point where compost facilities are provided.

Finally, the NGBS addresses Universal Design, a concept that supports residents aging-in-place.

For Silver level certification, at least 59 points must be achieved within this chapter. The NGBS requires at least 22% of total points be attained from the Resource Efficiency chapter. The NGBS requires that at least 18% of the total points toward Silver certification be attained from the Resource Efficiency Chapter.

Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^{(a) (b)}			
			BRONZE	SILVER	GOLD	EMERALD
2.	Chapter 6	Resource Efficiency	43	59	89	119
Total Points:			231	334	489	611

Indoor Environmental Quality

LEED NC and the NGBS both include an Indoor Environmental Quality chapter that pollutant control, building ventilation, low-emitting products, and thermal comfort.

LEED NC Version 4 Indoor Environmental Quality		
Type	Credit	Points
Prerequisite	Minimum Indoor Air Quality Performance	0
Prerequisite	Environmental Tobacco Smoke Control	0
Credit	Enhanced indoor Air Quality Strategies	2
Credit	Low-Emitting Materials	3
Credit	Construction Indoor Air Quality Management Plan	1
Credit	Indoor Air Quality Assessment	2
Credit	Thermal Comfort	1
Credit	Interior Lighting	2
Credit	Daylight	3
Credit	Quality Views	1
Credit	Acoustic Performance	1

Comparable NGBS Indoor Environmental Quality Practices		
Practice Number	Practice	Points
901.1	Space and Water Heating Options	Mandatory, 0-32
902.2.1	Building Ventilation Systems	Mandatory, 3-8
902.2.2	Ventilation Airflow Testing	4
902.3	Radon Control	Mandatory, 7-10
901.14	No Smoking Areas	1-2
902.1	Spot Ventilation	Mandatory, 0-28
901.13	Building entrance pollutant controls	1-2
902.2.3, 902.2.4	Ventilation Filtration	2-3
901.12	Carbon Monoxide (CO) Alarms	Mandatory, 0
901.3	Garages	Mandatory, 2-10
901.9	Interior Architectural Coatings	1-8
901.10	Interior Adhesives and Sealants	5-8
901.7	Floor Materials	1-8
901.4	Wood Materials	Mandatory, 2-10
901.11	Insulation	4
904.1	Indoor Air Quality (IAQ) During Construction	2
902.4	HVAC System Protection	3
904.2	Indoor Air Quality (IAQ) Post Completion	3
905.1	Humidity Monitoring System	2
903.3	Relative Humidity	7
<i>Also Addressed within Energy Efficiency Chapter</i>		
<i>Addressed within Energy Efficiency Chapter</i>		
<i>Not Addressed</i>		
<i>Not Addressed</i>		
<i>Not Addressed</i>		

Additional NGBS Indoor Environmental Quality Practices		
<i>Practice Number</i>	<i>Practice</i>	<i>Points</i>
901.5	Cabinets	3-5
901.6	Carpets	Mandatory, 0
901.8	Wall Coverings	4
902.5	Central Vacuum System	3
902.6	Living Space Contamination	Mandatory, 0
903.1	Plumbing	2-5
903.2	Duct Insulation	1-3
905.2	Kitchen Exhaust	2

Prerequisites: LEED requires compliance with ASHRAE 62.1 for mechanically and naturally ventilated spaces, as well as several residential pollutant control requirements. LEED also requires environmental tobacco smoke control.

NGBS has 9 Mandatory practices that relate to pollutant source controls (i.e. fireplaces and direct heating equipment; solid fuel-burning appliances; attached garages; wood materials; and carpets), and pollutant control (spot ventilation, building ventilation when measured air infiltration rate is low; radon control, and living space contaminants.)

Point Distribution: LEED: 16 points available
NGBS: 222 points available

Analysis:

The Indoor Environmental Quality chapters in LEED and the NGBS largely overlap with regard to intent and practices.

Most LEED items that are relevant to residential construction have one or more comparable NGBS practices.

LEED NC requires compliance with ASHRAE 62.1 for mechanically and naturally ventilated spaces. The NGBS does not specify compliance with ASHRAE 62.1 but includes many space and water heating and ventilation practices that offer similar benefit.

LEED NC requires that residential buildings prohibit smoking or compartmentalize smoking areas. While it would be impractical to restrict tobacco use within some residential buildings, the NGBS does not include a similar mandatory item. Instead, the NGBS awards 1 point where smoking is prohibited in interior multifamily common areas and 2 points where smoking is prohibited within 25 feet of multifamily building entries, air intakes, and operable windows.

Both LEED and NGBS include practices related to pollutant control, low-emitting products, IAQ best practices for during and after construction, and thermal comfort. NGBS offers 8 additional practices designed to control pollutant sources that are not available in LEED.

The LEED credits pertaining to Daylight, Quality Views, and Acoustic Performance are not represented within the NGBS. Daylight strategies are not as applicable to residential buildings, as the residential building code requires operable windows be present in every unit. Code requirements ensure that some

level of daylight is delivered to every resident. This is different than commercial building design, where there may be large open areas dedicated to multiple workspaces, as well as interior offices with little or no daylight. While the NGBS does not have a directly comparable daylight practice; there some related practices related to dynamic glazing, window shading, and lighting controls for multifamily common areas within the Energy Efficiency chapter. The LEED Quality Views and Acoustic Performance credits rewards buildings that contribute to improved resident wellbeing from views of nature and reduced HVAC and background noise. The NGBS does not include comparable practices. The NGBS Consensus Committee that developed the rating system prioritized requirements that directly contributed to building performance over practices that solely bolster resident well-being.

For Silver level certification, at least 42 points must be achieved within this chapter. The NGBS requires at least 13% of total points toward Silvers be attained from the Indoor Environmental Quality chapter.

Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^{(a) (b)}			
			BRONZE	SILVER	GOLD	EMERALD
5.	Chapter 9	Indoor Environmental Quality	25	42	69	97
Total Points:			231	334	489	611

Additional LEED Categories

LEED NC includes dedicated chapters for Integrative Process, Innovation, and Regional Priority.

Integrative Process: LEED NC includes an Integrative Process credit that be achieved by executing activities in the pre-design and design phases that explore the interrelationships among systems.

While the NGBS does not include a practice specifically related to Integrative Process, the intent of this credit is embedded within the NGBS Green Certification process. During the pre-design phase, a project team hires an accredited NGBS Green Verifier to guide them through the certification process and verify compliance. NGBS Green Verifiers typically meet with project teams in the design phase to help them score their project to their desired NGBS certification level and ensure proper details are reflected in plans and other construction documents. Verifiers will also offer specialized trainings to project teams and trades to ensure that all team members understand the project goals and how their efforts contribute toward certification achievement.

Integrative Process		Possible Points: 1
Credit 1	Integrative Process	1

Innovation LEED NC has a dedicated Innovation chapter. In contrast, the NGBS recognizes and rewards innovative green practices in each of the green building categories as opposed to a separate chapter.

LEED also assigns a point to projects that use a LEED AP on the project team. The NGBS does not reward any specific professional designation for design and construction professionals. However, a project team must work with an independent third-party NGBS Green Verifier who guides them through the construction process and verifies that all green design and construction practices claimed are incorporated appropriately.

Innovation in Design		Possible Points: 6
Credit 1	Innovation	1-5
Credit 2	LEED Accredited Professional	1

Regional Priority: LEED specifically awards points for regional priority.

The NGBS does not have a similar category. The Consensus Committee believed that the NGBS's expansive point-based system allowed projects to recognize regional priorities by the practices they select to earn points toward certification. As a result, we typically see projects in the Southwest implement additional water saving practices while buildings in the Northeast typically emphasize additional energy efficiency practices.

Regional priority		Possible Points: 4
Credit 1	Regional Priority	1-4

Operation, Maintenance, and Building Owner Education

The NGBS includes a chapter for Operation, Maintenance, and Building Owner Education. This chapter includes practices for building construction, operations, and maintenance manuals; training of building owners, public education, and post-occupancy assessment. Many of the items are mandatory.

No such chapter exists within the LEED rating system.

NGBS Operation, Maintenance, and Building Owner Education		
Practice Number	Practice	Points
1002.1	Building Construction Manual	Mandatory, 0-2
1002.2	Operations Manual	Mandatory, 0-4
1002.3	Maintenance Manual	Mandatory, 0-4
1002.4	Training of Building Owners	Mandatory, 0
1003.1	Public Education	1-2
1004.1	Post-Occupancy Assessment	1-4

Prerequisites: LEED does not have a comparable stand-alone section to ensure that buildings are operated and maintained to preserve the benefits of the green features.

NGBS requires all certified multifamily buildings to develop and distribute a construction manual, an operations manual, and a maintenance manual to their responsible parties (property management company, building maintenance team, equipment maintenance team, and tenant). Further, to facilitate exchange of information in the event of future transfer of ownership and/or management at least one responsible party must receive all three manuals.

Point Distribution: LEED: 0 points available
NGBS: 16 points available

Analysis:

The impact of the building on the environment does not end with construction. Poor operational and maintenance practices can offset many of the efforts that a designer and builder invested in a green apartment building. This NGBS section provides building owners with educational and technical resources to take advantage of the building’s green features and to further minimize the environmental impact of the building over its lifetime. Building owners can ultimately benefit from reduced utility bills, reduced maintenance costs, improved comfort and indoor air quality, enhanced living standards, and increased value.

For Silver level certification, at least 10 points must be achieved within this chapter. The NGBS requires at least 3% of the total points toward Silver certification be attained from the Operation, Maintenance, and Builder Owner Education chapter.

Threshold Point Ratings for Green Buildings

Green Building Categories			Rating Level Points ^{(a) (b)}			
			BRONZE	SILVER	GOLD	EMERALD
6.	Chapter 10	Operation, Maintenance, and Building Owner Education	8	10	11	12
Total Points:			231	334	489	611

CONCLUSION

As demonstrated above, the 2015 NGBS is clearly equivalent to LEED NC v4 when individual green categories are compared, and far more stringent than LEED NC with regard to both the level of environmental performance as well as comprehensiveness of green practices as demonstrated by the minimum point threshold requirements for each category of green building practices. If the objective is to facilitate green, high performance buildings, acceptance of the NGBS as a choice for residential projects is an effective means to that end.

Furthermore, because the NGBS and Home Innovation's certification program were developed specifically for residential construction it is uniquely suited as a green building standard for multifamily construction. Until the NGBS Green certification was released, residential construction lagged in green building certification. Now builders and municipalities alike have a credible and rigorous green certification program to promote for low and high-rise residential buildings.



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