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DETERMINING EQUIVALENCY

COMPARISON:
2020 NATIONAL GREEN BUILDING STANDARD (NGBS) AND LEED RESIDENTIAL BD+C MULTIFAMILY HOMES v4.1

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OVERVIEW SUMMARY

By any measure, NGBS Green certification based on the 2020 National Green Building Standard ICC-700 and LEED RESIDENTIAL v4.1 are equivalent regarding expected building performance. There are differences in how the two programs are structured, the specific compliance criteria, and the verification protocols. Yet these differences do not impact on the building performance expectations. There are also many similarities in the two programs, and the similarities have grown in recent LEED versions with LEED RESIDENTIAL becoming more NGBS-like.

LEED is unsurprisingly the most widely recognized program because it was the first national program; the rating system's parent organization, the U.S. Green Building Council (USGBC), is a large membership association that offers a professional accreditation for industry professionals; and USGBC has lobbied for many years for LEED's exclusive adoption by government agencies. But that does not make it better.

Government agencies, legislative bodies, and financial institutions increasingly recognize NGBS and LEED as equivalent for multifamily buildings. Below is a detailed comparison of LEED RESIDENTIAL v4.1 and the 2020 NGBS.

NATIONAL GREEN BUILDING STANDARD DEVELOPMENT

The National Green Building Standard ICC-700 (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 the first 2008 NGBS version, each subsequent NGBS version has been approved by the American National Standards Institute (ANSI).[1]

The NGBS is also the first and solely residential green building standard to be part 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. Further, the NGBS is the sole compliance path in the IgCC for residential buildings under four stories. The IgCC was developed as a collaboration between ICC, USGBC, AIA, and ASHRAE.

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. Until the NGBS was developed, residential multifamily building certifications lagged other building types such as office space, education facilities, and medical buildings. Nationwide, LEED is only used widely for multifamily buildings in jurisdictions where there is a mandate or financial incentives. If LEED is not mandated, multifamily buildings typically select another green certification program. As a result, to provide a more relevant green building rating system for residential buildings, USGBC recently overhauled the LEED rating system to win over residential buildings in places where LEED is not mandated. USGBC's remedy to their rating systems incompatibility with multifamily is the development of the new LEED v4.1 RESIDENTIAL BD+C MUTIFAMILY HOMES, which is the subject of this analysis.

[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 January 2020.

Despite the impeccable ANSI standard development process and ICC sponsorship, the NGBS sometimes suffers from the misperception that it is not as stringent as the USGBC LEED rating systems. This is simply not true.

The NGBS's compliance criteria is just as rigorous, if not more, than the LEED rating systems. This is true in comparing older LEED versions, and it remains true with the new LEED v4.1. Further, when evaluating green building certifications, compliance criteria are only part of the equation. Equally important are the certification program policies, procedures, and conformance verification criteria. In this regard, the NGBS Green program is rigorous beyond other green building certification programs including LEED RESIDENTIAL.

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 RESIDENTIAL BD+C MULTIFAMILY HOMES DEVELOPMENT

USGBC's development process suggests a consensus-based approach to development of its LEED rating system; however, it is not a true consensus standard. To participate in the LEED rating system development an individual must be a USGBC member. This factor alone would disqualify LEED from being accepted as a true consensus standard, because the development process is not open to all stakeholders and the public. 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.

Does this make the LEED rating systems bad? No. But in the instance where a voluntary, consensus standard such as the NGBS does exist, and is supported by all the foundational principles that underpin voluntary consensus standards, it is hard to understand how a legislative body can recognize a proprietary, non-consensus rating system such as LEED and at the same time reject the NGBS.

Synergy in Rating System Development Between the NGBS and LEED

Any analysis on program equivalency between NGBS and LEED would be disingenuous and incomplete if it ignores how over the past decade the NGBS has influenced the content of the LEED rating systems, and at the same time, how the LEED rating system has influenced the development of the NGBS. What is apparent from this comparison of LEED RESIDENTIAL 4.1 and the 2020 NGBS as compared to previous analysis of LEED NC, is that the LEED RESIDENTIAL rating system is ***more similar*** and includes ***more NGBS-like practices***. For example, LEED NC didn't previously include any of the moisture management practices included in all versions of the NGBS. Now, LEED RESIDENTIAL includes practices to address moisture management just like the NGBS. These LEED revisions highlight USGBC's acknowledgement that LEED NC simply did not work well with multifamily without provisions and practices specifically designed for residential construction. USGBC moved to two separate rating systems, LEED NC for office space and LEED RESIDENTIAL for multifamily affirmed the industry's need for a rating system that works with residentially used buildings, just like the NGBS.

Further, many of the individuals involved in the development of both rating systems are the same. The sphere of green professionals willing, able, and technically expert to devote their time to such a green standards development process is relatively small, therefore, many of the same individuals work on

LEED, the NGBS, and other rating systems such as Green Globes. Second, the number of green building issues is finite – both LEED and the NGBS rating systems are inevitably trying to solve the same problems, mitigate the same issues, and accelerate the same innovations. This is evidenced in the closely overlapping green building categories between the two rating systems. And, over the years, the green practices embedded in the rating systems have become more similar than different.

This reaffirms our position that choice in rating systems can provide great benefit to agencies, investors, developers, and other industry professionals, provided that the choices are equally credible and rigorous. This has been the conclusion of the federal government that recognizes LEED and the NGBS. This has been the conclusion of institutional investors and Fannie Mae, and Freddie Mac, all of which recognize LEED and the NGBS side-by-side. This has been the conclusion of the Virginia Housing Development Authority and other local Virginia jurisdictions that recognizes LEED and NGBS. Myriad organizations that set policies to guide financial and regulatory decisions have determined that LEED and the NGBS are functional green building rating system equivalents.

NGBS vs. LEED RESIDENTIAL BD+C Multifamily Homes V4.1 Scope

The NGBS is designed specifically for the buildings in which we live – multifamily buildings, mixed-use buildings where there is a residential component, assisted living, student housing, hotels, and other residential board and care facilities. LEED New Construction (NC) is intended for use by a wide array of commercially permitted buildings, which includes multifamily buildings. While commercial buildings and residentially-used buildings may share construction types and methods, occupancy matters, and, thus, the NGBS is uniquely suited to residential occupancy.

The NGBS scope covers single-family home, multifamily buildings, the residential portions of mixed-use buildings, mixed-use buildings where the residential portion is greater than 50% of the gross floor area, building conversions, renovations and additions of existing buildings, and land developments.[2] (This comparison report addresses the new construction compliance path.) There are no restrictions based on 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, “or sleeping unit —i.e., “a room or space in which people sleep, and can include permanent provisions for living, eating, and either sanitation and kitchen facilities but not both.”

CATEGORIES OF GREEN PRACTICES

The NGBS and LEED RESIDENTIAL 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.

[2] This report covers the 2020 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. See **2020 NGBS 101.2.1 Residential designation** for the occupancies specifically covered in the NGBS scope. Previous NGBS versions did not include the non-residential portion of mixed-use buildings.

LEED RESIDENTIAL 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 RESIDENTIAL 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, Chapter 5: Lot Design, Preparation, & Development.

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

LEED RESIDENTIAL 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.

Finally, the NGBS has a category for Construction, Operation, and Maintenance Manuals and Training for Multifamily Buildings. LEED NC has no comparable category.

NGBS	LEED RESIDENTIAL
6 categories of green practices: • Lot Design, Preparation, & Development • Resource Efficiency • Energy Efficiency • Water Efficiency • Indoor Environmental Quality • Operation, Maintenance, and Building Owner Education *(* Each NGBS category includes an innovative practices section.)*	9 categories of green practices: • Integrative Process • Sustainable Sites • Location & Transportation • Water Efficiency • Energy & Atmosphere • Materials & Resources • Indoor Environmental Quality • Innovation* • Regional Priority

NGBS VS. LEED RESIDENTIAL MANDATORY REQUIREMENTS COMPARISON

Both NGBS and LEED have mandatory practices necessary to attain certification at any level.

LEED RESIDENTIAL has 16 prerequisites. For **every** LEED prerequisite, the NGBS has an identical or equivalent practice that is either mandatory or awards points toward certification: 5 of these practices are mandatory for NGBS Green certification, and 11 are voluntary and earn points toward certification. For many practices, the NGBS's minimum point threshold requirements for each chapter and far higher point requirements for certification make it less consequential that an NGBS practice is voluntary, especially at higher certification levels. Buildings must incorporate an increasing number of practices to earn points in each chapter, meaning that the voluntary practices relevant for that building type (such as multifamily) are far more likely to be selected and incorporated into the design.

Importantly, the LEED prerequisite for Minimum Energy Performance at the Certified level is identical to the NGBS mandatory energy efficiency performance requirement, however, at certification levels above Certified/Bronze the NGBS's energy efficiency requirements are more stringent.

In comparison, the NGBS has 45 Mandatory practices, 35 of which are not required by LEED. Many of these practices address critical green building issues such as building durability (i.e., moisture management), minimum energy efficiency, pollutant control, and building owner and resident education. Some, but not all of these NGBS mandatory practices are covered by LEED credits, with the notable exception being the NGBS mandatory practices in Chapter 10 for operation, maintenance, and building training.

NGBS VS. LEED RESIDENTIAL CERTIFICATION REQUIREMENTS

LEED offers four levels of certification Certified, Silver, Gold, and Platinum. NGBS offers four certification levels for multifamily buildings or the residential portion of mixed-use buildings: Bronze; Silver; Gold; and Emerald. Non-residential space in a mixed-use multifamily building can earn one level - Certified.

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 RESIDENTIAL 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

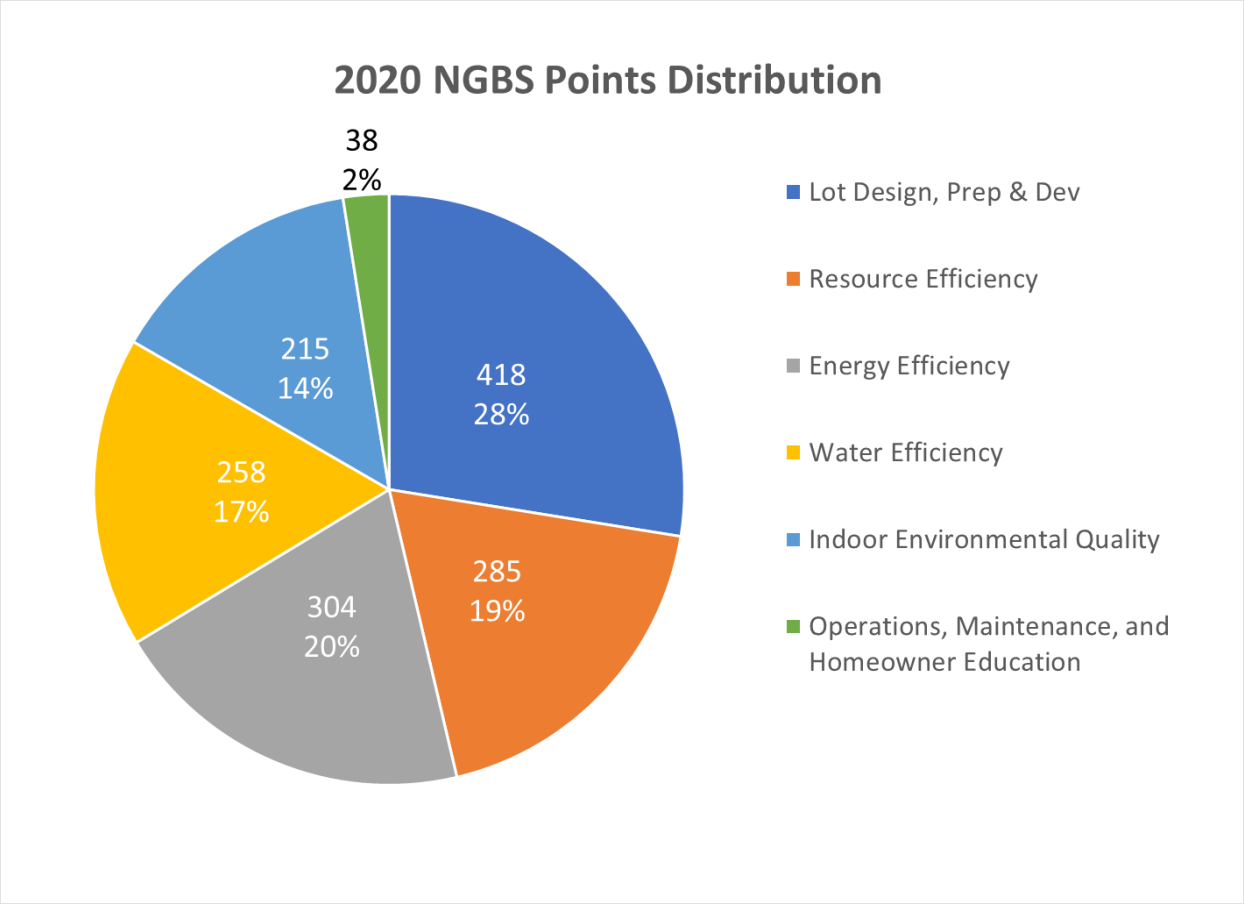
Green Building Categories			Rating Level Points [a] [b]			
			BRONZE	SILVER	GOLD	EMERALD
1.	**Chapter 5**	Lot Design, Preparation, and Development	**50**	**64**	**93**	**121**
2.	**Chapter 6**	Resource Efficiency	**43**	**59**	**89**	**119**
3.	**Chapter 7**	Energy Efficiency	**30**	**45**	**60**	**70**
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 m^2), 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.

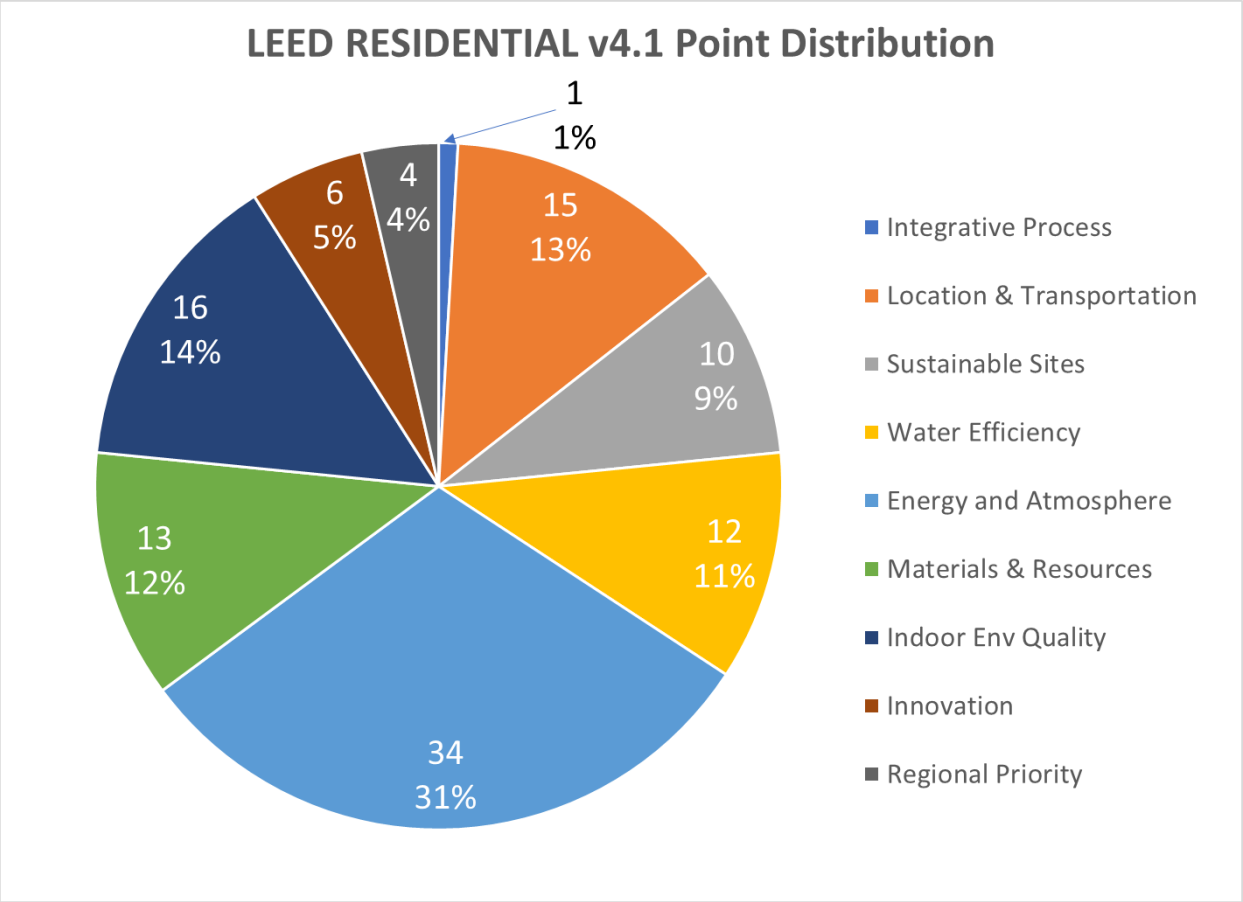
NGBS VS. LEED RESIDENTIAL POINT DISTRIBUTION

LEED and NGBS both address the same categories of green practices, but the distribution of practices available under category differ. The NGBS is more balanced, comprehensive, and offers more choices.



The chart above illustrates the number and relative point percentage available in each NGBS catagory 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 28% of the available points.

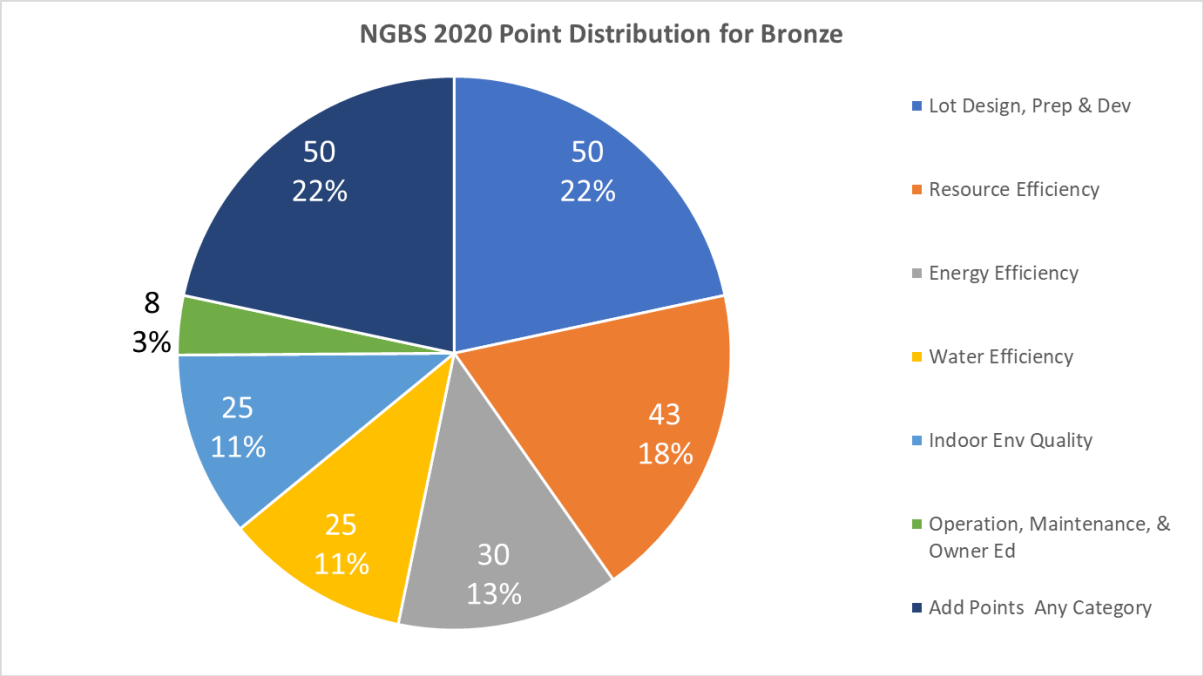
The next chart illustrates the percentage of points available in each LEED catagory of green building practices. There is a greater range in the points avialable under each category. About two-thirds of points are available from just three of the 9 LEED categories (Energy & Atmosphere; Indoor Environmental Quality; Location and Transportation). Less than ten percent are available under the Sustainable Sites (9%), Regional Priority (4%), and Integrative Process (1%) categories.



UNDERSTANDING THE IMPORTANCE OF POINT THRESHOLDS FOR ENERGY EFFICIENCY

Because LEED does not require higher levels of performance in every green category like the NGBS does, one can not assume that because LEED has a higher percentage of points available in Energy and Atmosphere that LEED buildings will be more energy efficient. Higher levels of LEED certification also do not guarentee that a LEED building will be more energy efficient. A LEED Platnimum building is not required to be more energy efficienct that a LEED Certified building. This is not the case with the NGBS, which mandates successively higher levels of performance with higher certification levels. As discussed below, a building certified to the 2020 NGBS Bronze level is expected to be as energy efficient as a LEED certified building.

POINT THRESHOLD FOR NGBS CERTIFICATION AT THE BRONZE LEVEL



The above chart shows the NGBS points required for a Bronze level certification. The threshold point requirements for each chapter are relatively balanced. While it might appear that the Energy Efficiency points required is relatively low, the NGBS sets the Bronze baseline performance at the 2018 IECC to ensure the energy efficiency consumption target is met. Furthermore, a Bronze certified building must attain the minimum performance level for each chapter and then an additional 50 points from any category. Our analysis of previous NGBS Green certified buildings is that architects and building owners are making smart performance decisions for these points. For buildings in the Northeast where energy costs are high and the climate is cold, these buildings will often earn these additional points for Energy Efficiency practices, while buildings in the Southwest will often earn additional points for Water Efficiency practices.

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. Home Innovation has been a US Department of Energy Building America Research team for 15 years.[3] 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

[3] The U.S. Department of Energy's Building America Program is an industry-driven, cost-shared research program to accelerate the development and adoption of advanced building energy technologies and practices in new and existing homes.

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.

As testament to Home Innovation's competency as an independent, third-party certification agency, in 2017 the US Environmental Protection Agency (EPA) initially selected Home Innovation to serve as one of only two Multifamily Review Organization (MRO) for the ENERGY STAR Multifamily High-Rise (MFHR) Program. Home Innovation continues as an MRO for both MFHR and the EPA's recently released ENERGY STAR Multifamily New Construction (MFNC) programs.

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 HomeInnovation.com/FindNGBSVerifier. Verifiers must possess experience in residential construction and green building. Many verifiers are Home Energy Rating System (HERS) raters and/or LEED Accredited Professionals. 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 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.

Both LEED and NGBS Green require a preliminary meeting with the project team to conduct a preliminary rating of the project. At this meeting the LEED Rater or the NGBS Green Verifier will determine the targeted NGBS/LEED certification level; the NGBS/LEED credits the project will pursue in order to meet the targeted certification level; and the individuals accountable for meeting the NGBS/LEED requirements for each measure.

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.

Further, Home Innovation retains QA oversight for Verifiers and the verification services they provide. For LEED, GBCI outsources this responsibility to an outside party.

LEED VERIFICATION

LEED RESIDENTIAL verification has changed considerably from LEED NC verification – it has been revised to be much more like NGBS Green verification. However, NGBS Green remains more rigorous.

For LEED verification, according to GBCI, "The Green Rater's role is not to opine on the quality of design or the quality of construction of a LEED Residential project. The project team is wholly responsible for the design and construction quality of their LEED Residential project." This philosophy is diametrically opposed to the NGBS Green certification program's philosophy. An NGBS Green Verifier is required to determine a building's NGBS conformance and this includes if the construction quality meets the NGBS's requirements.

The LEED verification manual states that photo documentation may be used as a substitute for onsite verification.[4] NGBS Green does not allow photos to substitute for in-site verification.

Both programs allow sampling for verification purposes; however, NGBS Green's sampling policy is more stringent regarding how many units can be sampled and who can sample. This is another reason that the NGBS Green program is more stringent.

One of the biggest differences between LEED and NGBS Green is the certification timing, LEED will certify the building before the building is complete – only 60% of the building's gross floor area must be complete for LEED certification. NGBS Green does not certify the building until construction is complete, the verification reports have been reviewed and accepted, and quality assurance is completed.

NGBS VS. LEED NC VERIFICATION REQUIREMENTS COMPARISON

	NGBS	LEED RESIDENTIAL
On-site Inspections	Every NGBS new construction project is required to be inspected at least twice by an independent, third-party Accredited Verifier. There is no self-certification.	LEED Residential requires on-site verification by a LEED Green Rater. Not all units are required to be inspected (see below)
Visual Inspection Required	Practices must be visually inspected to receive points; documentation, photos, or written assertions are not allowed as alternatives	Photo documentation allowed
Sampling of Visual Inspection Practices	Allowed by Master Verifiers[5] only	Yes
Sampling Protocol	1 in 7 can be sampled in a building with more than 20 units	1 in 10 units; if photos used for documentation sampling set applies
Certification Issued	Certification only issued after final verification AND Home Innovation QA completed	Certification issued when 60% of building's square footage is complete.[6]

[4] See page 15, LEED Residential QA Manual

[5] Currently there are only 20 NGBS Green Master Verifiers nationwide out of 270 total Verifiers.

[6] https://www.usgbc.org/leed/v41

CREDIBILITY AND RIGOR OF THE NGBS COMPARED TO LEED

Several third-party studies have been published to demonstrate the affordability and/or rigor of the NGBS.[7]

- *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

NGBS is considered as on par or more stringent than LEED or Green Communities as a green building rating system for residential projects. Below is a sampling of where the NGBS is recognized – the full list is available here.

- On the federal level, HUD recognizes the NGBS by name specifically as on par with LEED and Green Communities.[8] In funding notices for jurisdictions affected by natural disasters, the agency cites 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 recognize NGBS Green for financing incentives in the same tier, or higher, than LEED.
- 25 states recognize, mandate, or incentivize NGBS certification through their Qualified Allocation Plan for the federal Low-Income Housing Tax Credit Program.[9]
- 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.
- Between 2009 and 2012, Delaware provided 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.

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[7] Many government agencies and financial institutions, such as Fannie Mae and Prudential, have also completed detailed analyses to compare the NGBS and LEED as part of their due diligence to accept the NGBS for their incentives or regulatory programs, however, these studies have not been released publicly. See discussion on page 13 of this report.

[8] 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.

[9] http://www.homeinnovation.com/services/certification/green_homes/resources/ngbs_incentives_summary/qap_recognition.

To date, most jurisdictions recognize the NGBS as an alternative compliance path for any regulatory or incentive green building program. For a more complete listing of where NGBS has been recognized, visit our summary of incentives.

NGBS VS. LEED RESIDENTIAL 4.1 COMPARISON

Below is a chapter comparison of LEED RESIDENTIAL 4.1 vs. the 2020 NGBS.

Location and Transportation / Sustainable Sites

LEED RESIDENTIAL 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 LEED Location & Transportation topics in Chapter 5 Lot Design, Preparation, and Development.

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

LEED RESIDENTIAL Version 4.1 | Location & Transportation (LT)		
Type	***Credit***	***Points***
Credit	LEED for Neighborhood Development Location	15
Credit	Previously Developed Land *or* Sensitive Land Protection	1-2
Credit	High Priority Site	1
Credit	Surrounding Density and Diverse Uses	1-5
Credit	Access to Quality Transit	1-3
Credit	Bicycle Facilities	1
Credit	Reduced Parking Footprint	1
Credit	Electric Vehicles	2

NGBS Chapter 5: Lot Design, Preparation, & Development Practices		
Practice Number	***Practice***	***Points***
501.1(1)	Certified Development (NGBS or equivalent)	15
501.1(2)	Infill, Greyfield, Brownfield Lots	10-15
503.7(1)	Environmentally Sensitive Areas Not Disturbed	4
501.1(2)	Infill, Greyfield, Brownfield Lots	10-15
501.2(4)	Community Resources / Walkability	4-5
505.3	Density	4-8
505.5	Mixed-use development	8
505.8	Street network	5
501.2(1-3), 501.2(5)	Multi-modal Transportation	Up to 19
501.2(6)	Bicycle parking	2-6
501.2	Bike Sharing Program	5
501.2(7)	Car Sharing	5
505.1	Driveways and parking area	Up to 16
505.6	Multi-Unit Plug-In Electric Vehicle Charging	Up to 10
505.7	Residential CNG vehicle refueling	4

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

NGBS Chapter 5: Lot Design, Preparation, & Development Practices		
Practice Number	***Practice***	***Points***
503.3	Soil Disturbance and Erosion	Up to 15
503.4(1)	Site Assessment	7
503.4(2)	Hydrologic Assessment	10
503.7(2)	Environmentally Sensitive Areas Restored	4
503.6(1-3)	Wildlife Habitat	9
505.5	Community Gardens	3
505.10	Exercise and Recreation Space	9
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
503.4(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
505.9	Smoking Prohibitions	3-9

Prerequisites: LEED requires a Construction Activity Pollution Plan.

NGBS does not have mandatory practices in Chapter 5 Lot Design.

Point Distribution: LEED: 39 points available
NGBS: 418 points available

Analysis:

LEED and the NGBS share many similar practices and are functional equivalents for site selection, lot design, location, and transportation. The NGBS includes at least one practice for each of the LEED Location and Transportation and Sustainable Sites items.

The NGBS offers ten additional practices not included in LEED: establishing a project team, developing a mission statement and written goals; minimizing slope disturbance; creating a landscape plan to limit water and energy use and enhance the natural environment; onsite supervision during lot clearing; preservation of trees and vegetation; and increasing the project's density. NGBS Chapter 5 Lot Design,

Preparation, and Development is more process-oriented than other NGBS chapters, because environmentally sensitive strategies differ depending on locale, topography, climate, and so on.

There are two big differences between LEED and NGBS regarding site selection. One difference is the greater diversity of NGBS practices compared to LEED. The NGBS is designed to apply to a wide range of sites, from the rural single-family home, to a neo-traditional neighborhood of townhouses, to the high-rise urban apartment building. As a result, many NGBS Chapter 5 practices are not relevant at all sites 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.

The second difference is that the NGBS has practices and awards points toward certification for lot design separately from lot construction. This is to ensure that green site practices figure prominently in the design process ***and in addition*** during construction. The NGBS Consensus Committee was pragmatic in their recognition that the design team is different than the on-site team. The NGBS rewards *both* teams when a site is designed and constructed to have fewer environmental impacts.

For Bronze level certification, at least 50 points must be achieved within this chapter. The NGBS requires at least 22% of total points toward Bronze be attained from the Chapter 5 Lot Design.

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 RESIDENTIAL includes a Water Efficiency chapter that address indoor and outdoor water use, and water metering. NGBS Chapter 8: Water Efficiency is comparable.

Previously, LEED only offered a performance path to compliance for water efficiency. LEED RESIDENTIAL now offers a prescriptive path in addition to that existing performance compliance option. The reverse is true for the NGBS. The NGBS previously only offered a prescriptive path for water efficiency compliance and now the 2020 NGBS offers a performance path, the Water Rating Index (WRI).

LEED RESIDENTIAL Version 4.1 | Water Efficiency		
Type	***Credit***	***Points***
Prerequisite	Water Use Reduction	0
Prerequisite	Building-Level Water Metering	0
Credit	Water Use Reduction	1-10
Credit	Water Metering	1-2

NGBS Chapter 8: Water Efficiency Practices		
Practice Number	***Practice***	***Points***
804	Water Performance Path (WRI)	Score varies by level
802.10.1	Pools and Spa Meter	Mandatory
802.3	Water Usage Metering	Capped at 50% of earned Chapter 8 points
801.6	Irrigation Systems	Mandatory, 3-18
801.5	Water Closets and Urinals	1-21
802.5	Lavatory Faucets	Up to 21
802.5.2	Kitchen Faucets	Up to 4
802.5.3	Auto faucet	3
801.3	Showerheads	Up to 20
801.2	Water-Conserving Appliances	2-18
804	Water Performance Path (WRI)	Score varies by level, points are available for any score lower than 70
1004	Verification System	1-3

Additional NGBS Water Efficiency Practices		
Practice Number	***Practice***	***Points***
802.1	Indoor Hot Water	11-81
802.7	Rainwater Collection and Distribution	5-70
802.8	Sediment Filters	1
802.9	Water treatment devices	7
802.9.2	Reverse Osmosis	3
802.10	Pools and Spas	10
803.1	Reclaimed, Gray, and Recycled Water	5-20
803.2	Reclaimed Water, Graywater, or Rainwater Pre-piping	3 per roughed-in system
803.3	Automatic Shutoff Water Devices	2
803.4	Engineered Biological System or Intensive Bioremediation System	20
803.5	Recirculating Humidifier	1
803.6	Advanced Wastewater Treatment System	20

Prerequisites: LEED requires:

- A 20% reduction of indoor water use or 3 points in WE credit; and
- Building-level water metering.

NGBS requires:

- A WRI score of 70 or lower which is roughly equivalent to a 30% reduction in water use or 25 points from Chapter 8 Water Efficiency.
- A separate water meter for pools and spas.

Point Distribution: LEED: 12 points available
NGBS: 258 points available

Analysis:

For Water Efficiency, LEED and NGBS overlap in intent, practices, and compliance options. The NGBS has a more stringent water efficiency performance path but the rating systems are equivalent regarding their prescriptive compliance path for water efficiency.

LEED offers a choice of performance path with a minimum 20% reduction in the water use baseline or a prescriptive path where the building must earn 3 points. NGBS offers a choice of performance path with a minimum 30% reduction in the water use baseline or a prescriptive path where the building must earn 25 points. NGBS Green certified buildings at the Bronze certification level that use the WRI performance path will be at least 10% more efficient than a Certified LEED building.

The NGBS Consensus Committee assigned points to practices in Chapter 8 Water Efficiency based on the expected water savings from each practice. Point assignments are based on four factors: cold water savings, hot water savings, energy intensity, and longevity of the appliance/fixture/technology. The Committee reviewed typical household indoor and outdoor water usage to establish a baseline household water use using flow rates for fixtures meeting current mandatory building code requirements[10]. Water savings (gallons) were estimated for each practice and 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 share whole-project water usage data with USGBC for at least 5 years. The NGBS does not a similar mandatory practice but has a voluntary practice that awards points for post-occupancy water use metering.

For LEED, the water use reduction prerequisite and credit are based on fixture and appliance efficiency. LEED does not address structural waste from hot water supply systems design which is a significant area of focus in the NGBS, with up to 29 points available.

The NGBS includes several additional water efficiency practices not included in 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.

[10] For the 2020 NGBS the code baseline is the 2018 IBC, IRC, and IECC.

For Bronze level certification, at least 25 points must be achieved within this chapter. The NGBS requires at least 11% 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 RESIDENTIAL has an Energy and Atmosphere (EA) chapter, and the NGBS has Chapter7: Energy Efficiency. Energy performance, energy metering, and renewable energy topics are addressed in both.

LEED RESIDENTIAL Version 4.1 | Energy & Atmosphere		
Type	***Credit***	***Points***
Prerequisite	Fundamental Systems Testing and Verification	0
Prerequisite	Minimum Energy Performance	0
Prerequisite	Energy Metering	0
Prerequisite	Fundamental Refrigerant Management	0
Credit	Enhanced Commissioning	1-6
Credit	Optimize Energy Performance	1-18
Credit	Whole Building Energy Monitoring and Reporting	1
Credit	Grid Harmonization	1-2

NGBS Chapter 7 Energy Efficiency Practices		
Practice Number	***Practice***	***Points***
701.4.1	HVAC system sizing	Mandatory
701.4.2	Duct systems	Mandatory
701.4.3	Insulation and air sealing	Mandatory
703.1.1	Building thermal envelope compliance	Mandatory
703.1.2	Building envelope leakage	Mandatory
705.6.1	Installation and Performance Verification[11]	3
701	Minimum Energy Efficiency Requirements	Mandatory, 0
706.7	Energy Consumption control	1-3
Not Addressed[12]		
705.5	HVAC Design and Installation	1-4
Also Addressed in Chapter 10 Operations, Maintenance, and Building Owner Education		
701.1; 702; 703; 704	Successful compliance with one of 4 compliance paths: 1. Alternative Bronze/Silver 2. Performance Path 3. Prescriptive Path 4. ERI Target Path	Mandatory, 30-70
705.7	Submetering System	1
706.14	Third-party utility benchmarking service	1-3
1004.1	Post Occupancy Performance Assessment	1-3
706.10	Automatic Demand Response	1
706.11	Grid interactive Battery Storage System	2
706.12	Smart Ventilation	1

[11] While this NGBS practice is voluntary and awards points, for NGBS Green certification, commission and verification is de facto mandatory. No building can earn NGBS Green certification from Home Innovation unless it complies with the third-party inspection requirements of this practice and all other NGBS practices.

[12] "CFC" production was phased out in the mid-1990s and replaced with "HCFC" refrigerants like R-22. Now R-22 is on a long-term phase out with 2020 as the last production year. For residential equipment, R-22 has largely been replaced with "HFC" blends (commonly R-410A). New equipment does not have CFC refrigerant, but it could have HCFC refrigerant (R-22) until the industry uses up that inventory, but inventory currently low.

Credit	Renewable Energy	1-5		706.5	On-Site Renewable Energy System	2 per KW / number of dwelling units
				706.2	Renewable Energy Service Plan	1-2
Credit	Enhanced Refrigerant Management	1		706.13	Alternative Refrigerant	1-2
Credit	Domestic Hot Water Pipe Insulation	1		705.6.3	Insulating hot water pipes	1

Additional NGBS Energy Efficiency Practices		
Practice Number	***Practice***	***Points***
705.2	Lighting Controls	1-21
705.3	Induction Cooktop	1
705.4	Return Ducts and Transfer Grilles	2
705.6.3	Insulating hot water pipes	1
705.6.4	Portable Hot Water Demand Re-circulation System	1-2
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
706.9	CNG Vehicle Refueling station	1
706.12	Smart Ventilation	1
706.15	Entryway air seal	2-4

Prerequisites: LEED has four EA prerequisites: (1) Fundamental System Testing and Verification; (2) Minimum Energy Performance; (3) Energy Metering; and (4) Fundamental Refrigerant Management. To demonstrate minimum energy performance, there are three options: (1) ASHRAE Standard 90.1-2016 compliance, (2) Prescriptive Path compliance based on the New Building Institute Multifamily Guide, or (3) Dwelling unit energy simulation that meets or exceeds the ENERGY STAR v3 HERS Index Target.

The 2020 NGBS sets the 2018 IECC as the energy performance baseline. While the NGBS sets a different metric for the baseline energy performance, (the 2018 IECC for the NGBS vs ASHRAE 90.1 for LEED) the performance targets of both baselines ***are almost identical***.[13] NGBS Section 701 sets the mandatory energy efficiency prerequisites to ensure compliance with the 2018 performance baseline. 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.

[13] See energy efficiency comparison chart below.

Like LEED, the NGBS offer multiple paths for demonstrating energy performance:

- Performance
- Prescriptive
- ERI Target
- Alternative Bronze and Silver (ESCH or ESMFHR certification) [14]
- Alternative Gold (IgCC compliance)
- Alternative Gold for Tropical Zones (IECC compliance and prescriptive measures)

The NGBS Prescriptive Path compliance requires a building to earn sufficient points in Chapter 7 to meet the desired certification level. Each point earned in NGBS Chapter 7 is roughly equivalent to 0.05% reduction in energy consumption according to an analysis completed by the US Department of Energy. (Thus, a Silver level building would be approximately 7.5% more energy efficient than a 2018 IECC code minimum building.)

Most energy efficiency compliance paths require at least two additional energy efficiency practices above the 2018 IECC performance baseline, either two from Section 705 (Additional Practices) or one from Section 705 and one from Section 706 (Innovative Practices).[15] These practices would offer at least 0.1% energy savings beyond that mandated by the specific energy efficiency compliance pathways.

Point Distribution: LEED 34 points are available.
NGBS 304 points are available.

Analysis:

At the minimum certification levels, LEED RESIDENTIAL and NGBS are on-par for energy efficiency. LEED RESIDENTIAL requires compliance with ASHRAE 90.1-2016 for minimum energy performance. The NGBS requires energy performance on-par with IECC 2018. ASHRAE 90.1-2016 is an alternative compliance path for the 2018 IECC.

At the higher certification levels (Silver, Gold, Emerald/Platinum) the NGBS is more stringent than LEED regarding minimum required energy performance. LEED does not require higher energy performance for higher certification levels (Silver, Gold, Platinum). The NGBS requires 7.5% higher energy performance above Bronze for Silver level certification; 7.5% higher energy performance above Silver for Gold level certification; and 5% higher energy performance above Gold for Emerald certification level.

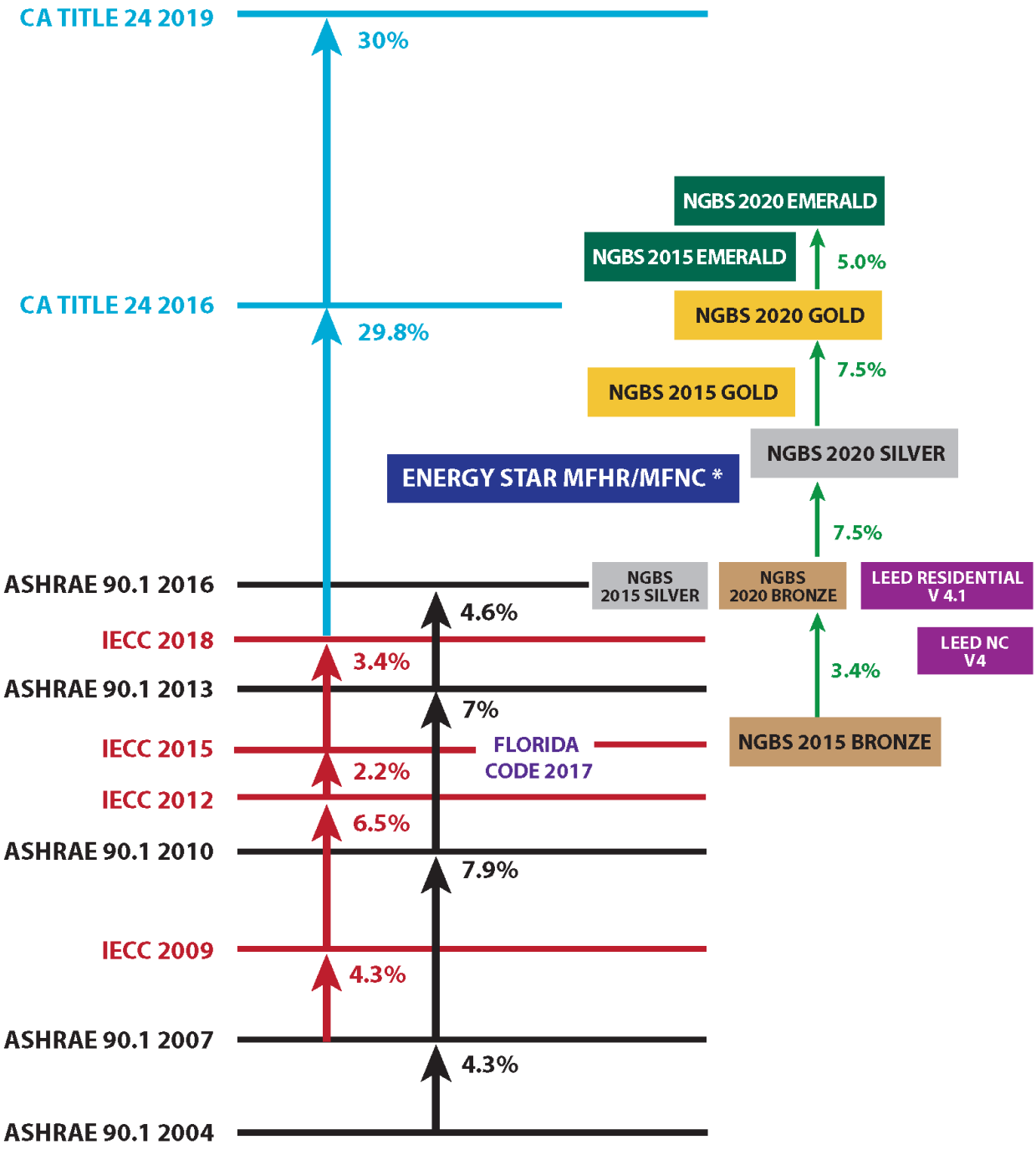
LEED and NGBS both offer multiple compliance options to demonstrate energy performance. The NGBS offer more compliance options and greater flexibility without less rigor.

[14] An ENERGY STAR MFHR V1.0 Rev. 03 certified building can earn Bronze for NGBS Chapter 7; an ENERGY STAR MFHR V1.0 Rev. 03 with a baseline of ASHRAE 90.1-2010) earns Silver for NGBS Chapter 7. Home Innovation also recognizes ENERGY STAR MFNC as an alternative to ENERGY STAR MFHR.

[15] Buildings following the Alternative Bronze or Silver compliance paths based on ENERGY STAR compliance and the alternative compliance path for Tropical Zone buildings do not need to include the two additional practices.

2015 AND 2020 NGBS ENERGY EFFCIENCY COMPARISON

MID- AND HIGH-RISE MULTIFAMILY BUILDINGS



* ENERGYSTAR MFHR and ENERGYSTAR MFNC 15% above state adopted code

Visit https://www.energycodes.gov/state-code-adoption-tracking-analysis for the respective state adopted codes

Updated November 6, 2020

LEED and NGBS both specify performance verification. The NGBS is stricter regarding 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 EA LEED prerequisite without a comparable NGBS practices is the refrigerant management credit and the NGBS has a voluntary credit that deals with this issue. This topic is less relevant to residential HVAC systems, which is why it is not mandatory withing the NGBS.

Innovative Practices: The NGBS includes 13 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 Bronze level certification, at least 30 points must be achieved within this chapter. The NGBS requires at least 13% of total points toward Bronze 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 RESIDENTIAL includes a Materials and Resources chapter, which addresses recycling, construction waste management, and sustainable products. The NGBS addresses these topics, within its Resource Efficiency chapter; however, the NGBS Resource Efficiency chapter is broader covering important green building issues, such as enhanced durability, reduced maintenance, regional materials, universal design, and resilience.

LEED RESIDENTIAL Version 4.1 | Materials & Resources		
Type	***Credit***	***Points***
Prerequisite	Storage and Collection of Recyclables	0
Prerequisite	Construction and Demolition Waste Management Planning	0
Credit	Building Life-Cycle Impact Reduction	2-5
Credit	Environmentally Preferable Products	1-6
Credit	Construction and Demolition Waste Management	1-2

NGBS Chapter 6: Resource Efficiency Practices		
Practice Number	***Practice***	***Points***
607.1	Recycling and composting	6
605.1	Hazardous Waste	Mandatory
605.2	Construction Waste Management Plan	6
603.1	Reuse of Existing Building	1-12
603.2	Salvaged Materials	1-9
610.1.1	Whole-Building Life Cycle Assessment	2-15
610.1.2.1	Product LCA	Up to 10
610.1.2.2	Building Assembly LCA	Up to 10
611.1	Product Declarations	5
606.1	Biobased Products	3-8
606.2	Wood-Based Products	3-4
606.3	Manufacturing Energy	2-6
604.1	Recycled Content	1-6
609.1	Regional Materials	1-10
611.2	Sustainable Products	3-9
605.2	On-Site Recycling	7
605.3	Recycled Construction Materials	1-6

Additional NGBS Resource Efficiency Practices		
Practice Number	***Practice***	***Points***
601.1	Conditioned Floor Area	Mandatory, 3-14
601.2	Material Usage	3-9
601.3	Building Dimensions and Layouts	3-13
601.4	Framing and Structural Plans	4
601.5	Prefabricated Components	4-13
601.6	Stacked Stories	2-8
601.7	Prefinished Materials	1-12
601.8	Foundations	3
602.1.1	Capillary Breaks	Mandatory, 0-3
602.1.2	Foundation Waterproofing	4
602.1.3	Foundation Drainage	Mandatory, 0-6
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
602.1.12	Roof Overhangs	4
602.1.13	Ice Barrier	Mandatory
602.1.14	Architectural Features	Mandatory, 1-5
602.1.15	Kitchen and vanity cabinets	2
602.2	Roof Surfaces	3
602.3	Roof Water Discharge	4
602.4	Finished Grade	Mandatory, 0-2
603.3	Scrap Material	4
607.1(2)	Composting	3
607.2	Food Waste Disposers	1
608.1	Resource-Efficient Materials	3-9
612.3	Universal Design Elements	1-12
613	Resilient Construction	2-15

Prerequisites: The LEED M&R 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 apartments through points and penalizes larger apartments by requiring additional points for the building to attain certification at any level. The NGBS requires the building to have a plan for the proper handling and disposal of hazardous waste. Numerous mandatory practices address moisture management and drainage. A small subset of the NGBS moisture management practices have comparable to the requirements in the LEED EQ chapter, but many NGBS mandatory moisture practices are not represented at all in LEED RESIDENTIAL.

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

Analysis:

The NGBS Resource Efficiency chapter is more robust and has more mandatory provisions than the LEED Material & Resources chapter.

Every LEED credit has at least one comparable NGBS practice. In addition, there are over 30 NGBS practices that deal with building materials and resources not addressed by LEED.

The NGBS includes multiple practices that rewards buildings designed and constructed to conserve construction materials. The NGBS penalizes buildings with large apartments. NGBS requires that buildings with oversized units attain additional points to achieve certification at any level to compensate for the additional material use. 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 designed to manage moisture. Moisture impacts the long-term performance of materials and can adversely affect indoor air quality. LEED does not include similar practices to address moisture management. Many of these NGBS practices are mandatory, 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 and Resiliency.

For Bronze level certification, at least 43 points must be achieved within Chapter 6. The NGBS requires at least 18% of total points 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 RESIDENTIAL and the NGBS both include an Indoor Environmental Quality chapter that pollutant control, building ventilation, low-emitting products, and thermal comfort.

LEED RESIDENTIAL Version 4.1 | Indoor Environmental Quality		
Type	***Credit***	***Points***
Prerequisite	Minimum Indoor Air Quality Performance	0
Prerequisite	Combustion Venting	0
Prerequisite	Garage Pollutant Protection	0
Prerequisite	Radon-Resistant Construction	0
No equivalent LEED prerequisite or credit		
Prerequisite	Interior Moisture Management	0
Prerequisite	Environmental Tobacco Smoke Control	0
Prerequisite	Compartmentalization	0
Credit	Enhanced Compartmentalization	1

NGBS Chapter 9 Indoor Environmental Quality Practices		
Practice Number	***Practice***	***Points***
901.1-901.2.2	Space and Water Heating Options	Mandatory, 0-32
902.1.6	Ventilation for Multifamily Common Areas	3
902.2.1	Building Ventilation Systems	Mandatory, 3-8
902.2.2	Ventilation Airflow Testing	4
901.1-901.2.2	Pollutant Source Control via spot ventilation	Mandatory, 0-32
901.13	Carbon Monoxide Alarms	Mandatory
901.1.2	Air handling equipment	5
901.3	Garages	Mandatory
902.3	Radon Control	Mandatory, 6-12
902.3.1	Radon reduction option	
902.3.2	Radon Testing	Mandatory
602.1.10	Tile backing materials	Mandatory
602.17	Moisture Control Measures	Mandatory, 2-8
901.6	Carpet	Mandatory
902.1.1	Spot Ventilation	Mandatory
505.9	Smoking Prohibitions	3-9
701.4.3.	Insulation and Air sealing	Mandatory
902.6	Living Space Contaminants	Mandatory
703.2.4	Building envelope leakage	1-11

Credit	No Environmental Tobacco Smoke	1		901.15	Non-smoking areas	1-2
Credit	Enhanced Indoor Air Quality Strategies	1-4		901.14	Building entrance pollutants control	1-2
				902.1.2	Automatic timer	2-11
				902.2.1	Building ventilation	3-10
				902.2.2	Ventilation Airflow Testing	4
				902.2.3-902.2.4	Merv filters	2-5
				905.3	Enhanced air infiltration	2
Credit	Low-Emitting Materials	1-4		901.9	Interior Architectural Coatings	1-8
				901.8	Wall coverings	4
				901.9	Interior Architectural Coatings	1-9
				901.10	Interior Adhesives and Sealants	5-8
				901.11	Insulation	4
				901.4	Wood Materials	Mandatory, 2-10
				901.5	Cabinets	5
				901.12	Furniture and Furnishings	4
Credit	Indoor Air Quality Assessment	1-2		902.4	HVAC System Protection	3
				904.1	Indoor Air Quality (IAQ) During Construction	2
				904.2	Indoor Air Quality (IAQ) Post Completion	3
Credit	Thermal Comfort	1		905.1	Humidity Monitoring System	2
				903.3	Relative Humidity	7
				Also Addressed within Energy Efficiency Chapter		
Credit	Daylight and Quality Views	1		*Not Addressed*		
Credit	Acoustic Performance	1-2		905.4	Sound barrier	4

Additional NGBS Indoor Environmental Quality Practices		
Practice Number	***Practice***	***Points***
901.8	Wall Coverings	4
902.5	Central Vacuum System	3
902.6	Living Space Contamination	Mandatory, 0
903.1	Plumbing (moisture management)	2-5
903.2	Duct Insulation (moisture management)	1-3
904.3	Microbial growth and moisture inspection	Mandatory
905.1	Humidity monitoring system	2
905.2	Kitchen Exhaust	2
905.5	Evaporative coil mold protection	2

Prerequisites: LEED requires dwelling unit ventilation that complies with ASHRAE 62.1-2016 and kitchen and bathroom local exhaust. LEED also requires combustion venting, compartmentalization, garage pollutant protection, radon resistant construction, and smoking prohibitions.

Like LEED, the NGBS also mandates local kitchen and bathroom exhaust combustion venting, compartmentalization, garage pollutant protection, and radon resistant construction. In total, the NGBS has 11 Mandatory practices that relate to pollutant source controls, and pollutant control. The NGBS mandates whole-building ventilation for dwelling units only when the maximum air infiltration rate is less than 5.0 ACH50, otherwise whole-building ventilation is voluntary and awards points.

Point Distribution: LEED: 16 points available

NGBS: 215 points available

Analysis:

LEED's Environmental Quality chapter and the NGBS Chapter 9 Indoor Environmental Quality overlap considerably regarding intent and practices.

Most LEED items are represented in NGBS practices. The NGBS has Indoor Environmental Practices not represented by LEED. For example, the NGBS requires Radon Testing in Zone 1.

LEED RESIDENTIAL requires whole-building ventilation by specifying compliance with ASHRAE 62.1 for mechanically and naturally ventilated spaces. The NGBS does not specify compliance with ASHRAE 62.1 unless the building maximum air infiltration rate is less than 5.0 ACH50. If the buildings air infiltration rate is greater than 5.0 ACH50 whole-building ventilation is voluntary and awards points toward certification. The NGBS mandates space and water heating and ventilation practices that achieve similar benefits to whole-building ventilation by specifically controlling pollutants at their source.

LEED RESIDENTIAL requires that residential buildings prohibit smoking in common areas and outside the building. The NGBS does not mandate smoking prohibitions, but instead awards points toward certification.

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 not available in LEED.

The LEED credit pertaining to Daylight and Quality Views is not represented in the NGBS. Daylight strategies are not as appliable 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 NGBS Chapter 7: Energy Efficiency.

For Bronze level certification, at least 25 points must be achieved within this chapter. The NGBS requires at least 11% of total points toward Bronze 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 RESIDENTIAL includes four additional categories each with one practice: (1) Integrative Process for 1 point; (2) Innovation for 1-5 points; (3) LEED Accredited Professional for 1 point, and (4) Regional Priority for 1-4 points.

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

The NGBS does not include a practice specifically related to Integrative Process, instead this credit's intent is embedded in the NGBS Green Certification process. During the pre-design phase, a project team hires an accredited NGBS Green Verifier to guide them through the verification and certification process. 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, specs, and other construction documents. Verifiers will also offer specialized trainings to project teams, subcontractors, 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 RESIDENTIAL has a dedicated Innovation credit. In contrast, the NGBS recognizes and rewards innovative green practices in each of the green building categories as opposed to a separate chapter.

LEED Accredited Professional LEED RESIDENTIAL assigns a point to projects that use a LEED AP on the project team. The NGBS does provide certification points for specific professional designation for design and construction professionals. NGBS Green mandates that the project team hire an accredited NGBS Green Verifier who has been trained in a manner identical to a LEED AP but doesn't award points toward certification.

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

Regional Priority: LEED awards 1-4 points for regional priority.

The NGBS does not have a similar category because its expansive point-based system and extensive green practice choices allow a project team to earn points for practices deemed a regional priority. For example, we typically see projects in the Southwest implement additional water saving practices, while buildings in the Northeast typically emphasize additional energy efficiency practices. The new Resilient Construction practice encourages fortified design and construction but would only be selected in areas facing those specific natural hazards.

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

Operation, Maintenance, and Building Owner Education

NGBS Chapter 10: Operation, Maintenance, and Building Owner Education includes practices for building construction, operations, and maintenance manuals; training of building owners; resident manuals and training; public education; post-occupancy assessment; and an innovation practice for using a green Appraisal Institute addendum for valuation. Many of these 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, 3-4
1002.2	Operations Manual	Mandatory, 1-5
1002.3	Maintenance Manual	Mandatory, 1-5
1002.4	Training of Building Owners	Mandatory, 2-8
1002.5	Multifamily Occupant Manual	Mandatory, 8
1002.6	Training of Multifamily Occupants	1-3
1003.1	Public Education	1-2
1004.1	Post-Occupancy Assessment	1-4
1005.1	Appraisals	2-6

Prerequisites: LEED does not have any comprehensive practice(s) to ensure certified buildings are operated and maintained by owners, maintenance staff, and/or residents to ensure the benefits of the green features continue post-occupancy. In the EA chapter, there is a LEED requirement for an HVAC operations and maintenance plan. But that requirement does not extend to other aspects of the buildings operation and maintenance.

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. Additionally, the NGBS requires residents to also receive a manual and training.

Point Distribution: LEED: 0 points available
NGBS: 39 points available

Analysis:

The impact of the building on the environment does not end with construction. Rather, given the typical multifamily building lifespan the construction impacts on the environment are rather small compared to the potential impacts post-construction. Poor operational and maintenance practices can offset many, if not all, of the efforts that a designer and builder invested in a green apartment building. NGBS Chapter 10 provides building owners, maintenance staff, and residents 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 and residents can ultimately benefit from reduced utility bills, reduced maintenance costs, improved comfort and indoor air quality, enhanced living standards, and increased value.

For Bronze level certification, at least 8 points must be achieved within this chapter. The NGBS requires at least 3% of the total points toward Bronze certification be attained from the Operation, Maintenance, and Builder Owner Education chapter, however, despite the small number of points required for Bronze certification, this chapter has many mandatory practices for certification.

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 2020 NGBS is clearly equivalent to LEED RESIDENTIAL v4.1 when individual green categories are compared. The NGBS is more comprehensive and more stringent than LEED v4.1 in compliance requirements because of the minimum point thresholds required to earn certification at any level. Furthermore, because the NGBS and Home Innovation's certification program were developed specifically for residential construction, NGBS Green is uniquely suited as a green building standard for multifamily construction.

There is not a single path to sustainable buildings, but multiple paths. And those paths have been and will continue to constantly evolve. The LEED rating systems provide one choice for buildings and the NGBS provides another. On objective review of both programs demonstrates then to be equally stringent and equally credible. If an agency's objective is to facilitate green, high performance buildings, acceptance of the NGBS as a choice for residentially occupied projects is an effective means to that end.

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