

NGBS vs. IECC PERFORMANCE COMPARISON – COMMERCIAL



The International Energy Conservation Code (IECC) provides an alternative compliance option for energy efficiency programs deemed to be equivalent. Alternative code compliance options are beneficial to local jurisdictions and multifamily developers alike, as they provide compliance flexibility without compromising energy efficiency performance.

C102.1.1 Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program as exceeding the energy efficiency required by this code. Buildings approved in writing by such an energy efficiency program shall be considered to be in compliance with this code. The requirements identified in Table C407.2 shall be met.

OVERVIEW

The ICC-700 *National Green Building Standard*® (NGBS) is an ANSI-approved green building standard within the International Code Council's (ICC) suite of building codes. Like most ICC codes, the NGBS is updated on a three-year cycle, and each NGBS version sets a performance baseline based on a specific version of the International Residential Code (IRC), International Building Code (IBC), and IECC. The NGBS mandatory practices largely derive from these baseline I-codes.

There are two significant benefits resulting from NGBS alignment with the ICC suite of I-codes. First, buildings seeking NGBS Green certification have a minimum baseline performance that can be tied to specific ICC code versions. Second, because NGBS practices are written in ICC code language, code officials, builders, architects, and contractors find the NGBS requirements familiar and easily understand how a building is compliant with any given NGBS practice.

Once the NGBS's mandatory requirements are met, a building can attain a rating of Bronze, Silver, Gold, or Emerald, depending on the number of green features included in the building's design and construction.

The NGBS is comprehensive and has six categories of green practices:

- Lot & Site Development
- Resource Efficiency
- Energy Efficiency
- Water Efficiency
- Indoor Environmental Quality
- Homeowner Education

The NGBS requires a building to obtain a minimum number of points **for each category**, and, to go up in certification level, the building must earn more points in every category. That means that a building certified at the Silver level will have more green practices and be expected to perform at a higher level in every category than a Bronze certified building.

Many NGBS practices address the same building performance concepts as the building code. Across nearly all code requirements, the NGBS requires an equivalent or higher level of performance than that NGBS version's baseline of the building code.

ABOUT HOME INNOVATION & NGBS GREEN

[Home Innovation Research Labs](#) serves as [Certification Agency](#) and provides certification services to the NGBS. Home Innovation Labs is a 57-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. 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.

NGBS Green, Home Innovation's certification program to confirm a buildings conformance with the NGBS is presently the leading green building certification for residentially-used buildings in the United States and Caribbean. NGBS Green is recognized by federal agencies such as the [U.S. Department of Housing and Urban Development \(HUD\)](#), [the U.S. Army](#), [the Veterans Administration](#), and [the U.S. Department of Agriculture for their Rural Housing programs](#). NGBS Green is also recognized by [Fannie Mae](#), [Freddie Mac](#), [the Federal Housing Finance Agency \(FHFA\)](#), and nearly [thirty State Housing Finance Agencies](#) for preferred financing or tax incentives. Numerous local jurisdictions also either require or recognize NGBS Green certification for code compliance, including the City of Baltimore, Montgomery County, the City of Rockville, and the City of Annapolis.

NGBS GREEN CERTIFICATION OF CONFORMANCE

NGBS Green certification requires that a qualified, independent third-party Verifier inspect the building and confirm all NGBS design or construction practices are incorporated correctly. Most projects require at least two inspections. The Verifier must inspect the building before drywall is installed to observe completed wall cavities and must also inspect the building when construction is complete. Multifamily properties typically require multiple inspections at the rough stage. The required on-site verification imbues an elevated level of rigor and quality assurance to certified buildings. Construction issues identified during the inspection get remedied before it is too late. For example, Verifiers often find the insulation installation to fall short of Grade I, but at the rough inspection the Verifier will ensure that the insulation contractor fixes any installation issues so that it meets Grade I before the drywall is hung.

Verifiers record the results of their rough and final inspections on a verification report. Home Innovation reviews every rough and final inspection to ensure consistency and accuracy. Verifications are subject to both desktop and virtual audits for quality control (QC). All QC activities are completed **before** the building can earn certification. After the verification reports are, Home Innovation issues an NGBS Green certificate of conformance to the project.

Home Innovation Research Labs qualifies, trains, tests, and accredits NGBS Green Verifiers and maintains a current list on the [Find A Verifier directory](#). Verifiers must possess experience in residential construction and green building. Many verifiers are Home Energy Rating System (HERS) raters and/or

have earned ICC certification as code inspectors. Home Innovation trains Verifier candidates on how to verify every NGBS practice. This ensures nationwide consistency in verification determinations. After completing the training, verifiers must pass an 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. Further, Home Innovation audits the verifiers and their verifications as part of our internal quality assurance program.

At any time during the certification process, Verifiers, builders, architects, and contractors can avail themselves of Home Innovation's deep building science expertise and NGBS knowledge. Technical assistance and interpretations are free, and we respond within one-business day to ensure there is not a delay.

BENEFITS OF THIRD-PARTY CODE COMPLIANCE

Code compliance determinations are expensive for local jurisdictions to undertake, and as the building code gets increasingly complex and focused on building attributes that extend beyond the traditional life and safety issues, compliance determinations can be more difficult for local code officials. Further, many energy efficiency practices are difficult for code officials to verify without additional training. Time spent on energy efficiency compliance also reduces the amount of time that code officials have available to spend on critical life, safety, and health compliance.

Acceptance of independent, third-party NGBS Green certification could significantly reduce a local jurisdiction's administrative cost of implementing the IECC. Cities and counties can feel confident in outsourcing code compliance, given Home Innovation's residential construction and green building knowledge and expertise as a third-party certification agency. Further, while most code officials inspect buildings using a pass/fail system, Verifiers inspect buildings with a goal of remedying compliance issues. For example, if a Verifier sees a wall section with less than Grade I insulation installation (a situation that is unfortunately all too common), the Verifier will ensure the insulation contractor *fixes the issue before the drywall is installed*. NGBS Green's on-site verification imbues an important quality assurance aspect that provides value to the local jurisdiction, the builder, and the buildings future residents.

An additional benefit of recognizing NGBS Green certification as an equivalent code compliant path is that the State and local jurisdictions benefit from the NGBS's comprehensive scope that extends beyond energy efficiency. IECC compliant buildings are energy efficient. NGBS Green certified buildings:

- Are energy efficient;
- Use less water;
- Provide improved indoor air quality;
- Have fewer environmental impacts because of site and land development considerations;
- Use fewer resources; and
- Have a training, operation, and maintenance plan to help ensure lasting building performance.

While all the above NGBS Green certification attributes are important, the last one is especially critical. Unlike commercially used buildings, homes and multifamily buildings are turned over to residents to operate these buildings, typically without benefit of building science expertise and knowledge. It is one thing to design and construct a high-performance building, it is another thing to operate and maintain one. Our experience shows us that residents that have been provided with detailed operation and maintenance manuals and training are far more likely to help those homes and buildings meet or exceed their performance expectations in the future.

Recognizing NGBS Green as an above code program allows builders and developers to access a host of benefits that come with certification, such as preferred financing, recognition on the local multiple listing service, interest from investors looking for sustainable projects, FTC compliant green marketing, access to free technical and building science assistance, and higher appraisal valuations. This can be the “secret sauce” for a jurisdiction that wants higher performing buildings: adopt the 2021 IECC as code (the stick) but allow NGBS Green compliance as an equivalent (the carrot).

NGBS ENERGY EFFICIENCY COMPLIANCE

The 2020 NGBS Energy Efficiency Chapter uses the 2018 IECC as the energy efficiency baseline. For a building to attain 2020 NGBS Green certification at the Bronze level (the baseline level), the building must be at least 2018 IECC-compliant from an energy efficiency perspective. As the NGBS Green certification level increases, the home’s energy performance increases as well. In addition to meeting the 2018 IECC energy efficiency performance baseline, the NGBS requires a home to meet two additional energy efficiency practices before it can be certified. The additional practices are available in NGBS Section 705 and 706 and they offer an additional 1% – 2.5% energy savings above baseline, which means that any NGBS Green certified building will be more efficient than the 2018 IECC compliance level.

The NGBS provides three basic compliance paths for energy efficiency.

1. **Prescriptive Path.** This is a checklist approach. To earn Bronze, the building must meet the NGBS mandatory requirements (efficiency equivalent to the 2018 IECC) and then incorporate two additional efficiency practices (which yields an additional 1-2% higher efficiency over the baseline). For Silver and above, the building must incorporate successively more energy efficiency practices to meet the NGBS point requirements.¹
2. **Performance Path.** This approach requires an energy model to demonstrate the building will meet an energy use target. Once the mandatory practices are met the model can allow the builder to make trade-offs to attain the energy target. For Silver and above, the building must demonstrate a higher percentage above the 2018 baseline.
3. **Alternative Compliance Options.** These allows a building to be deemed compliant from an energy efficiency perspective if the building meets an energy compliance program like ENERGY STAR Single-Family New Homes or ENERGY STAR Multifamily New Construction.

¹ DOE and Home Innovation collaborated to determine that each NGBS certification point in Chapter 7: Energy Efficiency is roughly equivalent to 0.5% reduction in energy use. Therefore 10 NGBS Chapter 7 certification points is roughly equal to a 5% improvement in energy efficiency.

PERFORMANCE ANALYSIS

The 2021 IECC has three compliance paths for buildings categorized as commercial.²

1. The requirements of ANSI/ASHRAE/IESNA 90.1-2019.
2. The requirements of Sections C402 through C405 and C408. In addition, commercial buildings shall comply with Section C406, and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Sections C402.5, C403.2, C403.3 through C403.3.2, C403.4 through C403.4.2.3, C403.5.5, C403.7, C403.8.1 through C403.8.4, C403.10.1 through C403.10.3, C403.11, C403.12, C404, C405, C407 and C408. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

With each code revision, the U.S. Department of Energy (DOE) issues a formal analysis of the expected energy performance of that new code. Home Innovation relies on the official DOE performance determination of energy efficiency baseline to prepare our comparison with the NGBS.

To date, DOE has not completed an analysis of the 2021 IECC energy cost savings baseline for the Performance or Prescriptive Paths. However, they have published their determination for ASHRAE 90.1-2019, which is used below for the analysis. As a result, this analysis compares the energy performance baseline of ASHRAE 90.1-2019 and the NGBS. Based on the first IECC compliance path, if a building meets the ASHRAE 90.1-2019 energy efficiency baseline, the building complies with the 2021 IECC energy efficiency requirements.

The DOE [Preliminary Analysis Regarding Energy Efficiency Improvements in the 2019 ASHRAE 90.1](#) found that the 2019 ASHRAE 90.1 requires higher energy efficiency in multifamily mid- and high-rise apartments as compared to the previous 2016 ASHRAE 90.1 edition. The increased performance level offers an expected annual energy cost savings of 2.6 percent average nationwide.

The table below compares 2020 NGBS and 2015 NGBS energy efficiency with the 2019 ASHRAE 90.1 baseline energy performance. A negative number indicates a level that is **less energy efficient** than ASHRAE 90.1 while a positive number indicates a level that is **more energy efficient** than ASHRAE 90.1.

2020 NGBS	2019 ASHRAE 90.1	2015 NGBS	2019 ASHRAE 90.1
BRONZE	-5.6	BRONZE	-8.6
SILVER	1.9	SILVER	-1.1
GOLD	8.9	GOLD	6.4
EMERALD	15.9	EMERALD	11.4

The IECC equivalency test has two parts.

First, the above code energy program must exceed the energy efficiency required by the 2021 IECC. The table above demonstrates that the 2020 NGBS offers higher levels of energy performance than ASHRAE 90.1 at the Silver, Gold, and Emerald Levels. ASHARE90.1-2019 is one means of demonstrating compliance for energy performance in the 2021 IECC. Where the NGBS energy efficiency rating levels

² The IECC defines residential buildings 4 or more stories as commercial.

are above the 90.1 energy baseline, they should also be accepted as an above code program for the 2021 IECC.

Second, buildings must also meet the requirements identified in 2021 IECC Table C407.2. See Table below. Many NGBS mandatory practices would meet the practices in 2021 IECC Table C407.2. For practices not deemed equivalent, a local jurisdiction has two options to declare the NGBS as equivalent: 1) Home Innovation can include verification of compliance 2021 IECC Table C407.2 practices that are not in the NGBS and include a separate certification of compliance, or 2) the local jurisdiction can continue to have code officials verify compliance for these practices.

Importantly, an equivalency determination does not mandate that an energy program be **the same**. Equivalency requires that the IECC and energy program be comparable in the efficiency baseline. If the program had to be the same, there would be no reason to allow an equivalency decision.

The NGBS also requires mandatory practices above and beyond 2021 IECC Table C407.2:

1. **NGBS 701.4.1.2 Radiant and hydronic space heating.** Where installed as a primary heat source in the building, radiant or hydronic space heating system is designed, installed, and documented, using industry-approved guidelines and standards (e.g., ACCA Manual J, AHRI I=B=R, ACCA 5 QI, or an accredited design professional's and manufacturer's recommendation).
2. **NGBS 701.4.3.2.1 Grade I insulation installation.** Field-installed insulation products to ceilings, walls, floors, band joists, rim joists, conditioned attics, basements, and crawlspaces, except as specifically noted, are verified by a third-party as Grade I.
3. **NGBS 701.4.3.4 Fenestration air leakage.** Windows, skylights and sliding glass doors have an air infiltration rate of no more than 0.3 cfm per sq. ft. (1.5 L/s/m^2), and swinging doors no more than 0.5 cfm per sq. ft. (2.6 L/s/m^2), when tested in accordance with NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled. For site-built fenestration, a test report by an accredited, independent laboratory verifying compliance with the applicable infiltration rate shall be submitted to demonstrate compliance with this practice. This practice does not apply to field-fabricated fenestration products.
4. **701.4.3.5 Lighting in building thermal envelope.** Luminaires installed in the building thermal envelope which penetrate the air barrier are sealed to limit air leakage between conditioned and unconditioned spaces. All luminaires installed in the building thermal envelope which penetrate the air barrier are IC-rated and labeled as meeting ASTM E283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All luminaires installed in the building thermal envelope which penetrate the air barrier are sealed with a gasket or caulk between the housing and the interior of the wall or ceiling covering.

The Table below demonstrates how the 2020 NGBS practices align with the 2021 IECC mandatory practices.

2021 IECC Table C407.2 Requirements Compared to the 2020 NGBS

2021 IECC	2020 NGBS	Equivalency Notes
Additional Energy Efficiency. 85% of the energy usage of the reference design	Met with NGBS Silver, Gold and Emerald compliance.	Exceeds. 2020 NGBS requirements exceed this requirement.
C402.5 Air leakage—thermal envelope. The building thermal envelope shall comply with Sections C402.5.1 through Section C402.5.11.1	Met with NGBS 701.4.3 Insulation and Air Sealing.	Equivalent.
C403.1.1 Calculation of heating and cooling loads. Design loads associated with heating, ventilating and air conditioning of the building shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183 or by an approved equivalent computational procedure using the design parameters specified in Chapter 3	Met with NGBS 701.4.1.1 HVAC System Sizing.	Equivalent.
C403.1.2 Data centers. Data center systems shall comply with Sections 6 and 8 of ASHRAE 90.4 with the following changes	N/A	Does not apply for multifamily.
C403.2 System design. Mechanical systems shall be designed to comply with Sections C403.2.1 through C403.2.3. Where elements of a building’s mechanical systems are addressed in Sections C403.3 through C403.14, such elements shall comply with the applicable provisions of those sections.	NGBS 901.1.2, 901.1.3, 901.1.4, 901.1.5, 901.3. Whole-building ventilation is a mandatory practice if air infiltration is less than 5 ACH50.	Equivalent.
C403.3 Heating and cooling equipment efficiencies. Heating and cooling equipment installed in mechanical systems shall be sized in accordance with Section C403.3.1 and shall be not less efficient in the use of energy than as specified in Section C403.3.2.	NGBS does not require minimum equipment efficiency. For NGBS Green projects, typical efficiency values are at or above these efficiency values.	None.
C403.4 Heating and cooling system controls. Each heating and cooling system shall be provided with controls in accordance with Sections C403.4.1 through C403.4.5.	The NGBS does not require programmable thermostats; however, voluntary points are available under practice 706.1.	Equivalent Voluntary Practice
C403.5.5 Economizer fault detection and diagnostics. Air-cooled unitary direct-expansion units listed in the tables in Section C403.3.2 and variable refrigerant flow (VRF) units that are equipped with an economizer in	NGBS does not have an equivalent practice, because this typically does not apply to multifamily construction.	Does not apply for multifamily.

2021 IECC Table C407.2 Requirements Compared to the 2020 NGBS

2021 IECC	2020 NGBS	Equivalency Notes
<p>accordance with Sections C403.5 through C403.5.4 shall include a fault detection and diagnostics system complying with the following:</p>		
<p>C403.7 Ventilation and exhaust systems. In addition to other requirements of Section C403 applicable to the provision of ventilation air or the exhaust of air, ventilation and exhaust systems shall be in accordance with Sections C403.7.1 through C403.7.7</p>	<p>NGBS 902.1.1 Spot Ventilation is mandatory. NGBS 901.3 Garages and NGBS 902.2.1 Whole Building Ventilation are voluntary for points.</p>	<p>Equivalent Voluntary Practice.</p>
<p>C403.8 Fans and fan controls. Fans in HVAC systems shall comply with Sections C403.8.1 through C403.8.6.1.</p>	<p>NGBS does not have an equivalent practice, because these equipment systems are not generally installed in multifamily buildings.</p>	<p>Does not apply for multifamily.</p>
<p>C403.9 Large-diameter ceiling fans. Where provided, large-diameter ceiling fans shall be tested and labeled in accordance with AMCA 230.</p>	<p>NGBS does not have an equivalent practice, because these equipment systems are not generally installed in multifamily buildings.</p>	<p>Does not apply for multifamily.</p>
<p>C403.11 Refrigeration equipment performance. Refrigeration equipment performance shall be determined in accordance with Sections C403.11.1 and C403.11.2 for commercial refrigerators, freezers, refrigerator-freezers, walk-in coolers, walk-in freezers and refrigeration equipment. The energy use shall be verified through certification under an approved certification program or, where a certification program does not exist, the energy use shall be supported by data furnished by the equipment manufacturer.</p>	<p>NGBS does not have an equivalent practice, because this practice is not typically relevant to multifamily buildings.</p>	<p>Does not apply for multifamily.</p>
<p>C403.12 Construction of HVAC system elements. Ducts, plenums, piping and other elements that are part of an HVAC system shall be constructed and insulated in accordance with Sections C403.12.1 through C403.12.3.1.</p>	<p>701.4.2.1, 701.4.2.2 & 701.4.2.3 Duct air sealing, and system sizing</p>	<p>Equivalent.</p>
<p>C403.13 Mechanical systems located outside of the building thermal envelope. Mechanical systems providing heat outside of the thermal envelope of a building shall comply with Sections C403.13.1 through C403.13.3</p>	<p>NGBS does not have an equivalent practice, because this design is uncommon to residential construction.</p>	<p>Does not apply for multifamily.</p>

2021 IECC Table C407.2 Requirements Compared to the 2020 NGBS

2021 IECC	2020 NGBS	Equivalency Notes
C404.1 General. This section covers the minimum efficiency of, and controls for, service water-heating equipment and insulation of service hot water piping.	NGBS does not require minimum equipment efficiency. For NGBS Green projects, typical efficiency values are at or above these efficiency values.	None.
C405.1 General. Lighting system controls, the maximum lighting power for interior and exterior applications, and electrical energy consumption shall comply with this section. Sleeping units shall comply with Section C405.2.4 and with either Section C405.1.1 or C405.3. General lighting shall consist of all lighting included when calculating the total connected interior lighting power in accordance with Section C405.3.1 and which does not require specific application controls in accordance with Section C405.2.4.	NGBS 701.4.4 requires a minimum of 75% high efficacy lighting, and NGBS Performance Path requires home to meet energy baseline when compared to the IECC Reference home. NGBS 705.2.1 is a voluntary practice for occupancy controls.	Equivalent Voluntary Practice.
C404.8 Energy consumption of pools and permanent spas. The energy consumption of pools and permanent spas shall be controlled by the requirements in Sections C404.8.1 through C404.8.3.	NGBS does not have an equivalent practice.	None.

CONCLUSION

Recognizing 2020 NGBS Green certification at the Silver level for energy efficiency exceeds the 2021 IECC energy performance baseline. NGBS certification also ensures the building is high performing in many other ways such as water efficiency, resource efficiency and indoor air quality. Further the NGBS will provide tangible benefits to state and local jurisdictions. At the same time, the increased compliance flexibility can help reduce a multifamily developer’s compliance costs and allow them to leverage private and federal incentives for building high performance buildings.

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