

COMPARISON:

NGBS Green vs. ZERH v2 (Single Family)

Abstract

The 2020 National Green Building Standard (NGBS) has many similar practices compared to the Department of Energy's Zero Energy Ready Home (ZERH) certification, but there are some marked differences between the requirements for each certification. This report compares the programs and examines the advantages of NGBS Green certification.

Summary

Builders can take advantage of incentives such as tax credits, rebates, permit fees waivers or preferred financing when their buildings earn a green certification. In addition, many builders seek a green building certification for marketing purposes and/or to satisfy investor demands for more sustainable, high performing homes.

Congress approved the Inflation Reduction Act of 2022 (IRA) to provide [additional tax incentives](#) for new homes that earn EPA's ENERGY STAR or DOE's Zero Energy Ready Home certifications.

Builders who are familiar with NGBS Green certification may wish to add ENERGY STAR or ZERH certification for their homes to be eligible for the IRA incentives. While the three programs are similar and have significant overlap in their compliance requirements, there are notable differences. The analysis below documents the additional practices, equipment, and system changes a home would need **above NGBS Green certification** to earn ENERGY STAR, Indoor airPLUS (which is a prerequisite for the

ZERH certification), and ZERH certification. Builders can then use the information to prepare a project specific cost analysis to determine which certification(s) best suits their project(s).

Overview of Certifications

NGBS Green is a comprehensive, above code green building certification program based on **ICC 700 National Green Building Standard 2020 (NGBS)**. To comply, new homes must incorporate practices in six categories: (1) lot development, (2) resource efficiency, (3) energy efficiency, (4) water efficiency; (5) indoor environmental quality, (6) and home operation and maintenance. NGBS Green is a flexible, point-based rating system. After meeting NGBS mandatory practices, buildings earn points toward certification by incorporating various green building practices, system, and technologies; and, depending on how many points are earned, buildings can earn one of four certification levels: Bronze; Silver; Gold; or Emerald. Builders and developers can select the products, practices, and technologies to

incorporate for their building's climate zone, location, and budget. This highly customizable approach allows projects to select the features that are most practical and cost-effective for the project's goals, while not compromising on performance. NGBS Green is recognized by federal, state, and local agencies, investors, and lenders for financing and incentives.

The U.S. Department of Energy (DOE) Zero Energy Ready Homes (ZERH) is an energy efficiency certification for homes. ZERH's are designed to be so energy efficient that a renewable energy system could offset most or all the home's annual energy use. Recently, DOE updated the [ZERH National Program Requirements for Single Family Homes to Version 2 \(v2\)](#).

For a home to qualify for ZERH certification, it must earn certifications from ENERGY STAR and Indoor airPLUS. These certifications are designed to be above-code and require the home to incorporate energy efficiency features (ENERGY STAR) and indoor air quality practices (Indoor airPLUS).

ENERGY STAR, Indoor airPLUS, and ZERH are not point-based certifications like NGBS Green, but instead are binary certifications where 100% of the practices are mandatory, there are no choices, and all practices must be implemented for the building to be certified. This inflexibility can make compliance less cost effective, and even sizable incentives may be insufficient to offset additional construction costs. Higher construction costs have a direct impact on housing affordability, particularly for home buyers. While a multifamily developer may be able to amortize higher construction costs over many years, a home builder needs to be able to sell the home immediately after construction is completed. Utility savings from increased water and energy efficiency can help

homeowners save on operational costs, but mortgage qualification criteria does not factor in operational savings and the buyer must be able to qualify for the higher priced house based on their current income limitations. This is a delicate balance – ***to deliver efficient, high-performance homes that are affordable at purchase.***

This report compares the program requirements of ENERGY STAR, Indoor airPLUS, and ZERH and how they compare to NGBS Green certification.

Comparison of ZERH v2 and 2020 NGBS Mandatory Practices

The practices specified in ZERH v2 are categorized under Exhibit 1 and Exhibit 2. Exhibit 1 includes the mandatory practices including ENERGY STAR certification requirements, building envelope requirements, duct systems, water heating efficiency, lighting and appliances, indoor air quality and renewable energy.

1. ENERGY STAR Single Family Home Baseline

ENERGY STAR Single-Family New Homes certification is a prerequisite for the ZERH program and a compliance option for NGBS compliance.

ZERH v2 requires a home to be ENERGY STAR Certified for New Homes v3.2.

For NGBS Green certification, ENERGY STAR v3.0 or v3.1 certification is sufficient for certification at the Bronze or Silver performance levels, respectively.

2. Envelope

ZERH certification requires the building's ceiling, wall, floor, & slab insulation to meet or exceed 2021 IECC R, U, or UA levels. The 2020 NGBS requires the building to meet the 2018 IECC R, U or UA levels.

A comparison of the 2021 vs. 2018 IECC R, U and UA levels are shown in the tables below:

2018 and 2021 IECC R-Value Comparison						
	Ceiling		Wood-Framed Walls		Floor	
Climate Zone	2018 IECC	2021 IECC	2018 IECC	2021 IECC	2018 IECC	2021 IECC
1	30	30	13	13 or 0+10	13	13
2	38	49	13	13 or 0+10	13	13
3	38	49	20 or 13+5	20 or 13+5ci or 0+15	19	19
4 except marine	49	60	20 or 13+5	20+5 or 13+10ci or 0+15	19	19
4 marine & 5	49	60	20 or 13+5	20+5 or 13+10ci or 0+15	30	30
6	49	60	20+5 or 13+10	20+5ci or 13+10ci or 0+20	30	30
7 & 8	49	60	20+5 or 13+10	20+5ci or 13+10ci or 0+20	38	38

The above table shows that the 2018 IECC R-value requirements for various building components is less than or equal to that from the 2021 IECC. Hence, meeting the ZERH v2 requirements for the R-values is sufficient to meet the 2020 NGBS requirements. The 2021 IECC has much higher R-value requirement for floor in Climate Zones 2-8 and for walls in Climate Zones 4-8 than the 2018 IECC.

2018 and 2021 IECC U-Factor Comparison						
	Ceiling		Wood-Framed Walls		Floor	
Climate Zone	2018 IECC	2021 IECC	2018 IECC	2021 IECC	2018 IECC	2021 IECC
1	0.035	0.035	0.084	0.084	0.064	0.064
2	0.03	0.026	0.084	0.084	0.064	0.064
3	0.03	0.026	0.06	0.06	0.047	0.047
4 except marine	0.026	0.024	0.06	0.045	0.047	0.047
4 marine & 5	0.026	0.024	0.06	0.045	0.033	0.033
6	0.026	0.024	0.045	0.045	0.033	0.033
7 & 8	0.026	0.024	0.045	0.045	0.028	0.028

The above table shows that the 2018 IECC's U-factor requirement for various building components is less than or equal to that from the 2021 IECC. Hence, meeting the ZERH v2 requirements for these U-factor values also meets the 2020 NGBS requirements. The 2021 IECC has much higher U-factor requirement for Climate Zone 4 than the 2018 IECC.

ZERH v2 requires above grade walls in Climate Zones 4-8 to provide thermal breaks and for the windows to meet high performance requirements based on climate zone. The 2018 IECC or 2020 NGBS do not require provision of thermal breaks in mixed and cold climate zones.

ZERH v2 requires windows to comply with U-factor and SHGC listed for various climate zones. A comparison of the 2018 IECC and ZERH requirements of U-factor and SHGC for windows (shown in the table below) indicates that the ZERH requirements is either equal to or higher than the 2018 IECC requirements, hence it meets the 2020 NGBS requirements for windows.

2018 IECC and DOE ZERH v2 Window U-Factor and SHGC Comparison				
Climate Zone	Window U-Factor		Window SHGC	
	2018 IECC	ZERH v2	2018 IECC	ZERH v2
1	NR	0.4	0.25	0.25
2	0.4	0.4	0.25	0.25
3	0.32	0.3	0.25	0.25
4 except marine	0.32	0.3	0.4	0.4
4 marine & 5	0.3	($\leq 0.27, 0.28, 0.29, 0.3$)	NR	Any, $\geq 0.32, \geq 0.37, \geq 0.42$
6	0.3	≤ 0.25	NR	Any
7 & 8	0.3	≤ 0.25	NR	Any

3. Duct System

ZERH requires ducts and heating and cooling air-handling equipment to be located within the thermal and air barrier boundary.

The NGBS does not require homes to have ducts and air handling equipment within the thermal envelope. However, homes can earn 4-10 points toward NGBS Green certification, depending on climate zone, when (1) building cavities are not used as return ductwork; (2) heating and cooling ducts and mechanical equipment are installed within conditioned building space; and (3) ductwork is not located within exterior walls, and this is a commonly claimed practice in the NGBS Green certification program.

ZERH requirements for Duct System would contribute 4-10 points towards NGBS certification.

4. Water Heating Efficiency

ZERH requires either the hot water delivery system to meet efficient design requirements or water heater and fixtures to meet efficiency criteria.

ZERH efficient design requirements are met when the hot water delivery system/distribution systems store no more than 0.5 gallons (1.9 liters) of water in any piping/manifold between the hot water source and any hot water fixture. Homes can earn 12 points toward NGBS Green certification when the maximum volume from the water heater to the termination of the fixture supply at the furthest fixture is 0.5 gallons.

To meet the efficient design requirements for hot water distribution system, the recirculation systems are required to include an occupant-

controlled switch or an occupancy sensor, installed in each bathroom that is located beyond a 0.5 gallon stored-volume range from the water heater. Recirculation systems that operate based on “adaptive” scheduling, which learn the hot water demand profile in the home and adapt their operation to anticipate this profile, are permitted and do not require the use of occupant-controlled switches or occupancy sensors. Twenty-four points are available in the Water Efficiency chapter of the 2020 NGBS for a demand controlled hot water priming pump installed on the main supply pipe of the circulation loop, but it also requires the maximum volume from this supply pipe to the furthest fixture to be 0.19 gallons.

ZERH requirements for Water Heating Efficiency would contribute 12-36 points towards NGBS certification.

5. Lighting and Appliances

ZERH requires installed refrigerators, dishwashers, clothes washers, clothes dryers, bathroom ventilation, ceiling fans, and 95% of builder-installed lamps and sockets to be ENERGY STAR qualified.

Homes can earn 42 points across both the Energy Efficiency and Water Efficiency categories toward NGBS Green certification by meeting the ZERH requirements for Lighting and Appliances.

6. Indoor Air Quality

ZERH certification requires a home to be Indoor airPLUS certified. DOE may consider an updated version of the Indoor airPLUS for homes that are permitted after 12/31/2023. Indoor airPLUS v2 includes [requirements](#) for moisture control, radon, pests, HVAC systems, combustion pollutants and materials which are comparable to the 2020 NGBS requirements. Homes earning the Indoor airPLUS certification can earn substantial points towards NGBS Green certification.

Practices including sloping of finished grade, foundation drainage, capillary breaks, flashing, water resistive barriers, etc., required by the Indoor airPLUS are also listed in chapter 6 of the NGBS. Similarly practices like HVAC system requirements, radon control, pest control and combustion pollutants required by the EPA Indoor airPLUS are included in chapters 7 (Energy Efficiency) and 9 (Indoor Environmental Quality) of the NGBS.

ZERH also requires a minimum of MERV 13 filter for all ducted heating and cooling systems. 5 Points can be earned toward NGBS Green certification for filters above MERV 8.

ZERH v2 requires energy efficient balanced ventilation (HRV or ERV) for Climate Zones 6-8. This is not required by the NGBS, but 8-10 points are available towards certification for implementing HRV or ERV.

ZERH requirements for Indoor airPLUS label contribute up to 73-84 points toward NGBS certification.

7. Renewable Energy

ZERH certification requires the home to meet the provisions of the [ZERH PV-Ready Checklist](#), including designation of proposed array location and square footage on the architectural diagram, identification of the orientation and inclination of proposed array location, provision of code-compliant documentation of maximum allowable dead load and live load ratings of existing roof to the owner, etc.

A few points are available in the 2020 NGBS if the buyer selects a renewable energy service plan provided by the utility prior to the occupancy of the building with a minimum two-year commitment and a fraction of the dwelling’s projected electricity and gas use is provided by renewable energy.

ZERH requirement for Renewable Energy contribute 2 points per kilowatt towards NGBS Green certification.

Conclusion

A comparison of the ZERH program and the 2020 NGBS Green certification shows that most of the ZERH practices satisfy the 2020 NGBS requirements. A home that has earned the ZERH certification along with the EPA Indoor airPLUS label is very likely to earn the Bronze or higher levels of NGBS certification. Some of the mandatory practices required by ZERH are comparable to the 2020 NGBS practices and can earn more than 190 points in the NGBS. As a point of reference, 231 points are required for Bronze certification.

ENERGY STAR, IAP, and ZERH achievement also positions a home to easily achieve the [NGBS Green+ NET ZERO ENERGY certification](#), which recognizes homes and buildings that are constructed or renovated to be net zero energy. This achievement would further enhance the home's marketability.

About Home Innovation Research Labs & NGBS

Home Innovation Research Labs is a full-service research, testing, and consulting firm focused on removing barriers to innovation in the building industry. We help our clients to improve the quality, durability, affordability, and performance of building products as well as single and multifamily homes. Home Innovation provides an integrated, multidisciplinary team – including professionals in market research, building science analysis, laboratory testing, and standards development – to solve our clients' most difficult product and technology issues. All of these skills manifest in our NGBS Green program - the largest residential green certification program in the nation. From product development and launch through improvement and certification, we help to find a home for innovation in the construction industry.

The ICC 700 National Green Building Standard® (NGBS) was developed based on decades of research and experience in residential building. It was the first point-based rating system focused on green residential construction, remodeling, and land development to be approved by the American National Standards Institute (ANSI). As an ANSI-approved standard, the NGBS was developed by a consensus committee and is subject to periodic review and public comment. Home Innovation serves as the administrator of this process and as the training and certification organization for the NGBS.

Learn more about Home Innovation and the NGBS at www.HomeInnovation.com