

A Comparative Overview of
the ICC/ASHRAE 700-2015
National Green Building
Standard & Green Globes for
New Construction

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A Comparative Overview of the ICC/ASHRAE 700-2015 National Green Building Standard and Green Globes for New Construction

This document reviews the features, elements and key factors of two nationally-recognized sustainability and green building systems: ICC/ASHRAE 700-2015 National Green Building Standard (NGBS) and Green Globes for New Construction (Green Globes). It reviews the similarities and differences of the two systems and provides information for parties interested in integrating above-code, voluntary sustainable design and construction practices and programs into single-family and multifamily buildings.

Rating Systems Overview

ICC/ASHRAE 700-2015 National Green Building Standard

The NGBS or simply “the standard,” serves as a uniform national platform for the recognition and advancement of green residential construction and development. The 2015 edition is the third iteration of the standard, building upon the previous 2012 and 2008 editions. All editions were developed by consensus committees of industry and nonprofit individuals, and in partnership with the International Code Council (ICC) and the National Association of Home Builders (NAHB). The latest edition of the standard introduced a new partner in the development process: ASHRAE. Staff of these three organizations did not serve as committee members but instead helped facilitate meetings.

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

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

The standard is a point-based system, wherein single-family or multifamily building(s) can attain certification by accumulating points for the sustainable and green practices included in design and construction, and planned for its operation and maintenance.

Projects can qualify for four certification levels (Bronze, Silver, Gold or Emerald) by earning the required number of points for each level as well as all mandatory practices. NGBS conformance is verified through construction documents, plans, specifications, in-field inspection reports and other data that demonstrate compliance with the points being pursued. Furthermore, Green Verifiers, who serve as independent, in-field representatives of the NGBS Green certification system, perform rough and final construction inspections to ensure compliance. All relevant information is provided to an adopting entity, such as the Home Innovation Research Labs, for technical review, verification and finally, certification.

As of May 2017, there are over 100,000 homes certified under the NGBS. This includes over 11,000 single-family homes and units in more than 2,000 multifamily buildings.

Green Globes for New Construction

Green Globes is a green building guidance and assessment program designed specifically for new construction as well as major renovations and additions. The Green Globes criterion was developed by the Green Building Initiative (GBI), 501(c)(3) nonprofit organization dedicated to accelerating the adoption of building practices that result in energy-efficient, healthier and environmentally sustainable buildings. The Green Globes certification program was launched in the United States in 2005, originating from the Building Research Establishment Environmental Assessment Method started in 1990 in the United Kingdom. The most recent version of Green Globes is Version 1.4, released in 2016.

Green Globes is a point-based system, wherein a building can attain certification depending on the green practices included in its design and construction. Projects can qualify for four certification levels (one to four “Green Globes”) by earning the required number of points for each level. There are no mandatory practices required to earn Green Globes certification.

The GBI serves as verifier for each Green Globes certification, in conjunction with a third-party assessment conducted by a GBI-trained assessor. Certification is a two-stage submission and review process. Stage I consists of project teams submitting an initial survey and applicable documentation to the GBI for review. In Stage II, project teams submit an updated survey and an assessor performs an onsite review and final report.

The Green Globes for New Construction rating system is suitable for a wide range of buildings, including large and small offices, retail stores, multifamily, and institutional buildings such as healthcare facilities, government buildings, schools, colleges and universities.

As of May 2017, the GBI website reports that over 480 buildings have been certified using Green Globe for New Construction.

NGBS and Green Globes Scopes

Building Types

The NGBS was designed specifically for residential construction, development and renovation. It is not used for commercial or industrial projects. Green Globes was originally developed for private commercial buildings. However, it has evolved to include numerous other building types.

Project Types Eligible for NGBS Certification

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

Project Types Eligible for Green Globes Certification

- Low-rise multifamily
- High-rise multifamily
- Commercial, industrial, and retail buildings
- Institutional buildings, including healthcare, government, and schools
- Renovations of existing buildings (*not covered in report*)

Categories of Green Practices

NGBS and Green Globes have practices in five similar topic areas:

- Water efficiency
- Energy efficiency
- Location and site development
- Material and resource efficiency
- Indoor environmental quality

Green Globes has an additional category for “Emissions,” which contains practices related to reducing environmental exposure to chemicals which have ozone depletion potential and global warming potential. Green Globes also has a category for “Project Management” which contains practices encouraging an integrated design process, as well as operation and maintenance-related practices. The NGBS has similar practices located in the “Operations, Maintenance, and Building Owner Education” chapter.

Table 1: Green Practice Categories in the NGBS and Green Globes

NGBS	Green Globes
<p>The NGBS has six practice categories:</p> <ul style="list-style-type: none">• Lot Design, Preparation, and Development• Resource Efficiency• Energy Efficiency• Water Efficiency• Indoor Environmental Quality• Operation, Maintenance, and Building Owner Education	<p>Green Globes has eight practice categories:</p> <ul style="list-style-type: none">• Project Management• Site• Water• Energy• Materials and Resources• Indoor Environment• Emissions

Certification Levels

ICC/ASHRAE 700-2015 NGBS Certification Levels

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

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

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

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

Table: 2 NGBS Threshold Point Ratings for Certification

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

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

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

Green Globes Certification

To become Green Globes-certified, each project must achieve a minimum of 35% of the total applicable points. There are 1,000 available points. Therefore, projects must earn 350 of them to certify as "One Green Globe." Projects are eligible to certify at higher tiers by earning more points, as seen in Table 3 below.

Green Globes does not require any mandatory practices to achieve certification. All practices are optional and certification is achieved if a project meets the minimum total number of points necessary for each tier. Also, Green Globes does not require a minimum number of points to come from any specific category.

Table 3: Green Globes Threshold Point Ratings for Certification

Green Practice Categories		Number of Mandatory Practices	Minimum Points Required Per Rating Level			
			ONE GLOBE	TWO GLOBES	THREE GLOBES	FOUR GLOBES
1.	Project Management	0	-	-	-	-
2.	Site	0	-	-	-	-
3.	Energy	0	-	-	-	-
4.	Water	0	-	-	-	-
5.	Materials and Resources	0	-	-	-	-
6.	Emissions	0	-	-	-	-
7.	Indoor Environment	0	-	-	-	-
Total Points Needed		-	350	550	700	850
Percentage of Total Available Points		-	35%	55%	70%	85%

The Certification Process

ICC/ASHRAE 700-2015 NGBS

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

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

Home Innovation Research Labs

Home Innovation Research Labs is a 53-year old, internationally recognized and accredited product testing and certification laboratory. Its work is solely focused on the residential construction industry and its mission is to improve the affordability, quality, performance and durability of housing by helping overcome barriers to innovation. Its core competency is as an independent, third-party product testing and certification lab, as well as administering the NGBS Green certification system for residential buildings.

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

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

Green Globes

Conformance with Green Globes is verified through construction documents, plans, specifications and other data that demonstrates compliance with the practices being pursued. Green Globes certification is a two-stage process, including onsite verification.

Stage I consists of project teams completing an online survey to identify the green building practices planned to be utilized in the project. This is typically completed during the project design phase. The GBI reviews this survey for initial compliance. Once construction has been substantially completed, the project team updates the same survey and resubmits to GBI. At this point, GBI will organize a third-party assessment conducted by a GBI-trained assessor. Assessors interface with project teams and building owners during the assessment process by reviewing and evaluating documentation, conducting site visits, and creating comprehensive assessment reports. These reports are submitted to the GBI, which reviews all final documentation for compliance and certification.

To be eligible for certification, buildings must be designed for occupancy, have conditioned space, have been occupied no longer than 18 months at the time assessment is ordered, and be at least 400 gross square feet in size.

Green Building Initiative

Green Building Initiative is a non-profit organization dedicated to accelerating the adoption of building practices that result in energy-efficient, healthier and environmentally sustainable buildings. The GBI is governed by a multi-stakeholder board of directors featuring representatives from the building industry, NGOs, construction companies, architectural firms and academic institutions. It was established in 2004 and is headquartered in Portland, Oregon.

The GBI acquired the rights to the Canadian Green Globes building assessment and certification program in 2004 and adapted it for the U.S. market, launching Green Globes here in 2005. The GBI is also accredited as a standards developer through the American National Standards Institute, however Green Globes itself is not ANSI-approved.

Registration and Certification Fees

The registration and certification fees for the NGBS are depicted in the table below. At the time this report was written, the GBI did not have rates publicly available for Green Globes certification. Project teams can request a quote by contacting the GBI.

These fees do not include any additional fees charged by third-party consultants useful or necessary for project certification, such as Green Verifiers or Energy Raters. These individuals and organizations set their own rates.

Table 7: Registration and Certification Fees

NGBS 2015		Green Globes	
Single-Family	<u>Registration</u> \$0	Commercial	<u>Registration</u> Unknown
	<u>Certification</u> \$200/Home		<u>Certification</u> Unknown
Multifamily	<u>Registration</u> \$0	Multifamily	<u>Registration</u> Unknown
	<u>Certification</u> <ul style="list-style-type: none"> ● 1-3 Stories: \$200 base + \$30/unit ● ≥4 Stories: \$600 base + \$30/unit 		<u>Certification</u> Unknown
Additional Fees	<u>Appeals</u> \$0	Additional Fees	<u>Appeals</u> Unknown
	<u>Inquiries</u> \$0		<u>Inquiries</u> Unknown

Green Practice Categories

This section includes an overview of the green practice categories featured in Green Globes and the NGBS, including mandatory practices, minimum point requirements, and green practices featured within the category. It also details the similarities and differences between the programs.

Location and Site Development

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

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

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

Mandatory Practices:

NGBS does not have any mandatory practices in this category.

Minimum Point Requirements:

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

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

Green Globes - Site

The “Site” category focuses on minimizing the environmental impact of the development of the lot and includes environmental practices such as stormwater management, heat island reduction and soil erosion prevention. It also focuses on the locations itself, such as encouraging development on a brownfield and away from natural bodies of water.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

As seen in Figure 5, a number of green practices within the “Lot Design, Preparation, and Development” category of the NGBS have a corresponding similar practice in the “Site” category of Green Globes. These include encouraging development on brownfields, limiting soil erosion, reducing heat island effect and managing stormwater.

All practices are optional for both rating systems in this category. Green Globes does not have any mandatory practices throughout the entire program, while NGBS does not have any mandatory practices in this specific category. It does, however, have mandatory requirements in several other categories, such as Energy Efficiency.

While not having any mandatory practices in this category, in order to earn NGBS certification, a minimum number of site-related practices must be successfully implemented within the category, allowing builders and designers to select from a wide variety of green practices that best apply to their specific project, location, and climate, while still requiring a minimum level of site- and location-related sustainability at each certification level. Projects pursuing Green Globes are not required to select any site-related practices in order to earn certification.

Some practices in the NGBS, such as those involving bicycle lanes, bicycle racks, and mass transit, have similar practices within the Energy category of Green Globes. This type of cross-category relationship is common among various green building rating systems, where similar practices have been organized in different categories.

Both systems have practices that do not have a relative match in scope within the other system. This includes bird collision prevention practices in Green Globes and building density practices in the NGBS. Overall, the NGBS contains a larger number of individual practices in this category than Green Globes.

Figure 5: Site Development Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes	Points Possible		
Lot Design, Preparation and Development	501.1(2a)	Infill The lot selected is an infill lot with adjacent existing development and infrastructure.	10	Site	3.2.1.1 Urban Infill and Urban Sprawl Locate the project with the following characteristics: <ul style="list-style-type: none"> • Within 1/2-mile of a commercial zone (5pts) • On a previously developed site served by existing utilities for at least a full year before construction (5 pts) 	10
	501.1(2b)	Greyfield The lot selected is a greyfield (previously developed).	10			
	501.1(2c)	Brownfield The lot selected is an EPA-recognized brownfield.	15		3.2.1.2 Greenfields, Brownfields, and Floodplains Locate the project with the following characteristics: <ul style="list-style-type: none"> • On a remediated brownfield or remediated EPA Superfund site (10 pts) • Avoid sensitive sites (i.e. land that was farmland, a public park, a wooded area, prairie, wetland, wildlife corridor, or recreational area) for at least three years prior to time of purchase or from the beginning of project (6 pts) • All habitable space is located higher than the 100-year flood plain (4 pts) 	20
	503.7	Avoid Environmentally Sensitive Areas <ul style="list-style-type: none"> • The lot does not contain any environmentally sensitive area disturbed during construction (4 pts) • Mitigation and/or restoration is conducted to preserve ecosystem functions lost through development/construction (4 pts) 	8			
	503.3	Limiting Soil Disturbance Soil disturbance and erosion is minimized by using one or more of the following: <ul style="list-style-type: none"> • Disturbed soil stabilized within 14 days (5 pts) • 75% or more of utility installation is tunneled, in shared trenches, under pavement, or use equipment uses geomats (5 pts) • Limits of clearing and grading demarcated in plans (5 pts) 	15		3.2.2.1 Site Disturbance and Erosion <i>Path A: Erosion and Sedimentation Control Plan</i> Create an Erosion and Sedimentation Control Plan, signed and stamped by a Professional Engineer (5 pts) -OR- <i>Path B: Erosion and Sedimentation Control Plan</i> In the absence of an Erosion and Sedimentation Control Plan by a Professional Engineer, complete one or more of the following: <ul style="list-style-type: none"> • Silt fences will be installed or fiber socks filled with compost/wood chips around the construction site and maintained throughout construction (1 pt) • Gravel pads will be placed at all site entries and cleaned throughout construction (1 pt) • Riprap will be placed around all storm sewer outlets and silt and debris removed after each 24-hour rainfall of 0.2 inches or more (1 pt) • Disturbed soil will be corrected using erosion control mats or mulched and seeded within 90 days of being disturbed (1 pt) • Dust will be controlled by wetting the soil each day for 15 to 30 minutes before construction activities begin and again after construction activities are done for the day (1 pt) -AND/OR- There is a requirement that construction activities will be located in such a way to limit disturbance to the site (3 pts)	8
	504.3 (1)-(6), (8)-(9)	Soil Erosion and Soil Implementation Soil disturbance and erosion is minimized by using one or more of the following practices in accordance with the SWPPP: <ul style="list-style-type: none"> • Sediment/erosion controls installed per SWPPP (5 pts) • Limits of clearing/grading staked out (5 pts) • "No disturbance" zones created to protect veg. and sensitive areas (5 pts) • Topsoil stockpiled and stabilized for later use (5 pts) • Distribute weight of equipment to reduce soil compaction (4 pts) • Disturbed areas to be left unworked for 21 days are stabilized with 14 days (3 pts) • Utilities are installed by alternative means, such as tunneling (5 pts) • Inspection reports of best practices are available (3 pts) 	35			
	504.2	Tree and Vegetation Preservation Trees and vegetation are preserved by one ore more of the following: <ul style="list-style-type: none"> • Fencing is installed to protect trees and other vegetation (3 pts) • Trenching, significant changes of grade, and soil compaction in "tree save" areas are avoided (5 pts) • Damage to existing trees and vegetation is mitigated during construction (4 pts) 	12		3.2.2.3 Tree Preservation <i>Path A: Tree Preservation Plan</i> There is a Tree Preservation Plan by a certified Arborist (4 pts) -OR- <i>Path B: Tree Protection Specifications</i> In the absence of Tree Preservation Plan by a certified Arborist, the specifications require that the General Contractor will implement one or more of the following: <ul style="list-style-type: none"> • Tree protection barriers will enclose a minimum Tree Protection Zone (TPZ) around the trees and shrubs that are to be retained on the site (2 pts) • Root protection will be installed to protect tree roots from compaction during construction (1 pt) • Sediment control barriers will be provided where some fill or excavate will be temporarily located near a TPZ (1 pt) 	4
	505.2	Heat Island Mitigation <ul style="list-style-type: none"> • 50% or more of the hardscape area is either shaded with vegetation, paving with high SRI (SRI 29 or greater), or permeable. (5 pts) • 75% or more of the roof area is vegetated with noninvasive plants (5 pts) 	10		3.2.2.4 Heat Island Effect <ul style="list-style-type: none"> • A percentage by area of the roof is vegetated, and/or has a high Solar Reflectance Index (SRI): >70% (6 pts), 56 - 70% (4 pts), 40 - 55% (2 pts), <40% (0 pts) • A percentage by area of paved surfaces is high SRI: =50% + (2 pts), 25 - 49% (1 pt), <25% (0 pts) • A percentage by area of paved surfaces outside of the building footprint will be shaded by trees within 15 years: =50%+ (3 pts), 25 - 49% (2 pts), <25% (0 pts) • At least 75% of opaque wall surfaces (by area) on the east and west have an SRI of 29 or greater (2 pts) 	13

Figure 5: Site Development Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible		
Lot Design, Preparation and Development	503.4	Stormwater Management Complete one or more of the following: ● Implement a plan to maintain the natural site hydrology by preserving important permeable soils, natural drainage ways, and other water features (7 pts) ● Design stormwater management system so that post-construction runoff rate, volume, and duration do not exceed pre-development (natural, stable) conditions (10 pts) ● Use LID and Green Infrastructure to manage the 80th percentile (5 pts), 90th percentile, (8 pts), or 95th percentile (10 pts) storm event ● Permeable materials are used for less than 25% (5 pts), 25-50% (8 pts), or greater than 50% (10 pts) of surfaces	37	Site	3.2.3.1	Stormwater Management Report A Stormwater Management Report by a Civil Engineer that shows that: ● The project meets municipal and/or local watershed flood and erosion control targets (5 pts) ● The project meets municipal and/or local watershed water quality control targets (5 pts) ● The site will retain at least 50% of the total average annual rainfall volume as per a Site Water Balance Assessment, to be included in the Stormwater Management Report (5 pts)	15
	801.6	Irrigation Systems Irrigation plans must be executed by a qualified professional certified by WaterSense labeled program.	Mandatory		3.2.4.1	Landscape and Irrigation Plan A Landscape and Irrigation Plan is developed by a Landscape Architect, certified horticulturalist, or certified irrigation professional (6 pts)	6
	503.5 (2), (4), (5)	Landscape Plan A landscaping plan is developed with one ore more of the following: ● Only non-invasive native or regionally appropriate plants selected to promote biodiversity (7 pts) ● EPA WaterSense Water Budget Tool used to implement max % of turf area (2 pts) ● Max % of vegetated areas that are turf is 0% (5 pts), less than 20% (4 pts), less than 40% (3 pts), less than 60% (2 pts)	14		3.2.4.3	Plant Palette ● Minimum of 50% (2 pts) or 75% (3 pts) of the vegetated area is covered with plants that are drought-tolerant ● Minimum of 50% of vegetated area is covered with plants (new or salvaged plantings) that are native and non-invasive ● Turf grass is limited to within 20 feet of buildings and 5 feet of hardscape (3 pts)	10
	504.3 (7)	Soil Erosion and Soil Implementation (cont'd) ● Soil is improved with organic amendments and mulch (3 pts)	3		3.2.4.4	Landscape Design ● At least 6 inches of soil was aerated, tilled and/or broken up (1 pt) ● Organic mulch as per best practices was used (1 pt)	3
	503.5 (6)	Landscape Plan (cont'd) ● Plants with similar watering needs are grouped (5 pts)	5		3.2.4.5	Landscaped Areas ● Plants with similar water requirements are grouped (2 pts) ● Plants are spaced to allow for maturation at a 5-year growth rate (1 pt)	2
	505.1	Driveways and Parking Reduction Water permeable surfacing is used to reduce impervious driving and parking surfaces by 10% (1 pt), 25% (2 pts), and greater than 75% (3 pts)	3		3.2.4.6	Pervious Materials At least 15% of planned impervious walkways, patios, and driveways are installed with pervious materials	4
	501.2 (1)	Mass Transit The project is located within 1/2-mile of pedestrian access to a mass transit system	6		3.3.10.1	Public Transportation The site located within 0.25 miles of a public transportation facility such as a public bus stop or train-stop	10
	505.6	Electric Vehicle Charging Stations Plug-in electric vehicle charging capability (Level 2) is provided for 1% or more of parking stalls. Stalls are equipped with either Level 2 charging AC grounded outlets or Level 2 charging stations.	4		3.3.10.3	Alternative Fuel Stations There are alternative fuel re-fueling facilities or electric charging stations on site or in the general vicinity	5
	501.2 (5)	Dedicated Bicycle Lanes The project is located within an community that has right-of-way, dedicated bicycle paths or lanes, or on an infill lot located within 1/2 -mile of a bicycle lane designated by the jurisdiction.	5		3.3.10.4	Bicycle Paths The site is located within 0.25 miles of a public bicycle path, multi-user path, or on a road with an existing dedicated bicycle lane	3
	501.2 (6)	Bicycle Parking Dedicated bicycle parking and racks are provided for mixed-use and multifamily buildings: <i>Path 1:</i> Minimum of 1 bike space per 3 residential units (2 pts) <i>Path 2:</i> Minimum of 1 bike space per 2 residential units (4 pts) <i>Path 3:</i> Minimum of 1 bike space per 1 residential units (6 pts)	6		3.3.10.5	Bicycle Parking There is sheltered bicycle parking for at least 5% of the maximum number of office building occupants, or at least 50% of units in a multi-family residential building	3
	501.2 (3)	Walkability and Pedestrian Access Design walkways, street crossings, and entrances to promote pedestrian activity and are connect to existing sidewalks or areas of development.	5		3.3.10.6	Walkability The building's walkability index is greater than 75%, per the Walk Score website	1

Figure 5: Site Development Practices

Other NGBS Location/Site Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	
Lot Design, Preparation and Development	501.1 (1)	<p>NGBS Certified Neighborhood The project is located in a NGBS Certified Site or equivalent</p>	15
	501.2 (2)	<p>Mass Transit with Parking The project is located within 5 miles of a mass transit system with available parking</p>	3
	501.2 (4)	<p>Community Resources Located the project within a 1/2-mile walking distance of six or more community resources, such as a supermarket, a place of worship, a bank, a school, a medical/dental office, a recreational facility, a park, etc.</p>	4
	502.1	<p>Project Team, Mission Statement, and Goals A team is established with roles identified specifically for green lot design, preparation, and development. A mission statement is developed with green goal's and objective.</p>	4
	503.1	<p>Natural Resources Natural resources are conserved by one or more of the following: <ul style="list-style-type: none"> • A natural resource inventory is completed under the direction of a qualified professional (5 pts) • A plan is implemented to conserve the elements identified by the natural resource inventory (6 pts) • Listed items are protected under direction of qualified professional (4 pts) • Basic training on resource protection provided to on-site supervisor (4 pts) • Tree pruning conducted by certified arborist (3 pts) • Vegetation maintenance in accordance with TCIA A300 (4 pts) • Protection plan of adjacent common areas implemented (5 pts) </p>	31
	503.2	<p>Slope Disturbance Use practices to minimize slope disturbance, including but not limited to terrain adaptive architecture, soil stability studies, aligning pavements with natural topography, and others listed in the NGBS.</p>	27
	503.5	<p>Landscape Plan (cont'd) A landscaping plan is developed with one ore more of the following: <ul style="list-style-type: none"> • A plan is implemented that protects, restores, or enhances natural vegetation on the lot for 12% (1 pt), 25% (2 pts), 50% (3 pts), or 100% (4 pts) of vegetation. • To improve pollinator habitat, 10% or more of planted area are non-invasive flowering and nectar producing plants (3 pts) • 30% or more of building walls shaded in summer by plants (5 pts) • Vegetative wind breaks/channels designed to protect lot (5 pts) • On-site or community tree trimmings of native trees used as mulch (3 pts) • Developer creates a plan to remove or contain invasive plants from disturbed areas of the site (3 pts) • Developer creates a plan to remove or contain invasive plants from undisturbed areas of the site (6 pts) • Integrated pest management plan is developed to minimize chemical use in pesticides and fertilizers (4 pts) </p>	23

Other Green Globes Site Practices

Green Globes		Points Possible	
Site	3.2.2.2	<p>Tree Integration One or more of the following are integrated into the landscape plan: <ul style="list-style-type: none"> • Large trees, 12" or more diameter (2 pts) • Clusters of trees (2 pts) • Undergrowth (1 pt) </p>	5
	3.2.2.5	<p>Bird Collisions The following measures required to help ensure that birds perceive windows as being a solid object are implemented: <ul style="list-style-type: none"> • Visual markers (1 pt) • Avoidance of reflections (1 pt) </p>	2
	3.2.3.2	<p>Natural Body of Water The site boundary farther than 100 feet from a natural body of water</p>	3
	3.2.4.2	<p>Landscape and Irrigation Plan (Part 2) The Landscape and Irrigation Plan includes the following: <ul style="list-style-type: none"> • Soil type, drainage, and light conditions (2 pts) • Structural limitations (e.g. shading, utilities, overhangs, lights) that would impact the location and growth of plants (1 pt) </p>	3
	3.2.5.1	<p>Exterior Lighting Design Performance A lighting design is completed by an Engineer or Lighting Professional that meets all the performance requirements of the IDA - IES Model Lighting Ordinance <i>Note:</i> Projects achieving points in this section cannot earn points in 3.2.5.2 - Prescriptive Lighting Requirements.</p>	7
3.2.5.2	<p>Prescriptive Exterior Lighting Requirements Meet one or more of the following: <ul style="list-style-type: none"> • Exterior lighting does not exceed prescribed values per Tables A and B of the IDA - IES Model Lighting Ordinance (1.5 pts) • Exterior lighting trespass will not exceed prescribed BUG ratings as per IDA - IES Model Lighting Ordinance (MLO), Table C for backlight trespass (1.5 pts), upright trespass (1.5 pts), and glare (1.5 pts) • Parking lot lighting does not have light emitted above 90 degrees (1 pt) <i>Note:</i> Projects achieving points in this section cannot earn points in 3.2.5.2 - Prescriptive Lighting Requirements.</p>	7	

Figure 5: Site Development Practices

Other NGBS Location/Site Practices (Cont'd)

		ICC/ASHRAE 700-2015 NGBS	Points Possible
Lot Design, Preparation and Development	503.6	<p>Wildlife Habitat At least two of the following practices must be selected to earn this credit:</p> <ul style="list-style-type: none"> ● Plants and garden are selected that encourage wildlife, such as bird and butterfly gardens (3 pts) ● Include a certified "backyard wildlife" program (3 pts) ● The lot is designed in regard to wildlife corridors, fish and game parks, and preserved areas (3 pts) ● Outdoor lighting techniques are utilized with regard to wildlife (3 pts) 	12
	503.8	<p>Demolition of Existing Building A demolition waste management plan is implemented to recycle and/or salvage a minimum of 50% of nonhazardous demolition waste. One additional point awarded for every 10% above 50%.</p>	5-10
	504.1	<p>On-site Supervision of Green Practices On-site supervision is provided during clearing, grading, trenching, paving, an utility installation to ensure green practices are implemented</p>	4
	505.1	<p>Driveways and Parking Reduction (cont'd) Impervious areas are minimized by one or more of the following:</p> <ul style="list-style-type: none"> ● Off-street parking and driveways are shared (5 pts) ● For multifamily, parking does not exceed local minimums (5 pts) ● Structured parking is use or reduce footprint by 25% (4 pts), 50% (5 pts), or greater than 75% (6 pts) 	18
	505.3	<p>Density Construct or renovate a building that meets the following density :</p> <ul style="list-style-type: none"> ● 7-14 units/acre (4 pts) ● 14-20 units/acre (5 pts) ● 21-34 units/acre (6 pts) ● 35-69 units/acre (7 pts) ● 70 or more units/acre (8 pts) 	8
	505.4	<p>Mixed-Use Development The lot contains a mixed-use building</p>	8
	505.5	<p>Community Gardens A portion of the site is established as a community garden, available to all occupants, to provide for local food production</p>	3
	505.6	<p>Electric Vehicle Charging Stations Plug-in electric vehicle charging capability (Level 2) is provided for 1% or more of parking stalls. Stalls are equipped with either Level 2 charging AC grounded outlets or Level 2 charging stations.</p>	4

Materials & Resource Efficiency

ICC/ASHRAE 700-2015 NGBS - Resource Efficiency

The “Resource Efficiency” category is focused on minimizing the environmental impact of buildings by incorporating environmentally efficient building systems and materials, and reducing waste generated during construction and after the home is occupied. Practices include using products and systems with enhanced durability and reduced maintenance, as well as reused, recycled, regional or salvaged materials. It encourages projects with smaller dwelling units, recognizing the inherent impact on the environment of larger homes.

Mandatory Practices:

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

Minimum Point Requirements:

Table 9: Resource Efficiency Minimum Point Requirements

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

Green Globes – Materials and Resources

The “Materials and Resources” category of Green Globes focuses on the environmental impacts of products and materials within the home, as well as helping ensure long-term sustainability through increased performance and fewer potential repairs. This includes encouraging the installation of flashing and vapor retarders, the completing of life-cycle assessments, and the selection of products with Environmental Product Declarations.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

As seen in Figure 6 below, the NGBS and Green Globes include several similar practices in their Materials and Resources categories. Both systems award projects that perform a life cycle analysis or select products that have Environmental Product Declarations. They also both promote certified wood products, diverting waste from landfills through reuse or recycling, and providing recycling stations within the building.

The NGBS focuses on construction practices that affect the long-term durability of the home in this category, mandating several practices that aide in reducing potential damage to increase lifetime resiliency of the home. This includes installing flashing, water barriers, foundation drainage, capillary breaks, and tile backing materials, among others. Green Globes also includes several of these practices; however, all practices in Green Globes are optional.

Both systems have practices that do not have a relative match in scope within the other system. This includes creating a “Building Service Life Plan” in Green Globes and utilizing termite-prevention measures in the NGBS. Overall, the NGBS contains a larger number of individual practices in this category than Green Globes.

Figure 6: Materials and Resources Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible
Resource Efficiency	610.1.1 Whole Building Life Cycle Assessment (LCA) • Execute LCA at the whole building level through a comparative analysis between the final and reference building designs as set forth under Standard Practice, ASTM E2921. (8 pts) The assessment criteria includes the following environmental impact categories: - Primary energy use - Global warming potential - Acidification potential - Eutrophication potential - Ozone depletion potential - Smog potential • Execute LCA on regulated loads throughout the building operations life cycle stage. (5 pts) • Execute full LCA, including use-phase, through calculation of operating energy impacts using local or regional emissions factors from energy supplier, utility, or EPA. (7 pts)	15	Materials and Resources	3.5.1.1 Performance Path for Building Core and Shell The Athena Impact Estimator for Buildings (Version 4.2 or later) was used during design to evaluate a minimum of two different core and shell designs, based on life cycle assessment (LCA) in compliance with the assessment guidance and resulting in selection of the building core and shell with the least anticipated environmental impact -OR- Another LCA tool was used during design to evaluate a minimum of two different core and shell designs, based on life cycle assessment (LCA) in compliance with the assessment guidance and resulting in selection of the building core and shell with the least anticipated environmental impact <i>Note:</i> Projects achieving points in this section cannot earn points in 3.5.1.2 - Prescriptive Path for Building Core and Shell	33
	610.1.2 Product and/or Building Assembly Life Cycle Assessment (LCA) Select products and/or building assemblies that have completed a LCA using the following environmental impact measures: - Primary energy use - Global warming potential - Acidification potential - Eutrophication potential - Ozone depletion potential - Smog potential	10		3.5.1.2 Prescriptive Path for Building Core and Shell A percentage [≥40% (20 pts), 25-39% (15 pts), 10-24% (10 pts)] of the products selected for the building core and shell (based upon cost) have the following: <i>Environmental Product Declarations (EPDs)</i> that utilize recognized Product Category Rules, conform to ISO standards, and minimally includes cradle-to-gate scope: • Industry Wide (Generic) EPD: Products specified for the interior fit-out shall include Type III Environmental Product Declaration (EPD) -and/or- • Brand Specific EPD: Products specified for the building core and shell shall include Type III Environmental Product Declaration (EPD), where the EPDs are specific to particular products from identified manufacturers -AND/OR- <i>Third-party certifications</i> that are based upon a multiple attribute standard(s) developed by a consensus based process from an approved standard development organization (Ex: NSF sustainability assessment standards, UL Environment sustainability standards, etc.) and other consensus based assessment standards that are multiple attribute-based. -AND/OR- <i>Third-party verified product life cycle assessment</i> based upon ISO 14040:2006 and ISO 14044:2006, and minimally covers cradle-to-gate scope -AND/OR- <i>Third-party sustainable forestry certifications</i> such as American Tree Farm System (ATFS), Forest Stewardship Council Standard (FSC), and the Sustainable Forestry Initiative Standard (SFIS), amongst others. <i>Note:</i> Projects achieving points in this section cannot earn points in 3.5.1.2 - Prescriptive Path for Building Core and Shell	20
	611.2 Sustainable Products One or more of the following products are used for at least 30% of the floor or wall area of the entire dwelling unit (9 pts max): • 50% or more of carpet installed is certified to NSF 140. (3 pts) • 50% or more of resilient flooring installed is certified to NSF 332. (3 pts) • 50% or more of the insulation installed is certified to EcoLogo CCD-016. (3 pts) • 50% or more of interior wall coverings installed is certified to NSF 342. (3 pts) • 50% or more of the gypsum board installed is certified to UL 100. (3 pts) • 50% or more of the door leafs installed is certified to UL 102. (3 pts) • 50% or more of the tile installed is certified to TCNA A138.1 (3 pts)	9		3.5.2.1 Performance Path for Interior Fit-outs A life cycle assessment and relative comparison of a minimum of two alternative interior fit-outs (including finishes and furnishings) was performed during design, which resulted in the selection of an interior fit-out that has the least anticipated environmental impact based upon comparable applications. <i>Note:</i> Projects achieving points in this section cannot earn points in 3.5.2.2 - Prescriptive Path for Interior Fit-outs	16
	611.4 Product Declarations A minimum of 10 different installed products have either industry-wide or product specific Environmental Product Declarations (EPDs). Product-specific EPD's are weighted 2x higher than industry-wide EPDs.	5		3.5.2.2 Prescriptive Path for Interior Fit-outs A percentage [≥39% (10 pts), 25-39% (7 pts), 10-24% (5 pts)] of the products selected for the building core and shell (based upon cost) have the following: <i>Environmental Product Declarations (EPDs)</i> that utilize recognized Product Category Rules, conform to ISO standards, and minimally includes cradle-to-gate scope: • Industry Wide (Generic) EPD: Products specified for the interior fit-out shall include Type III Environmental Product Declaration (EPD) -and/or- • Brand Specific EPD: Products specified for the building core and shell shall include Type III Environmental Product Declaration (EPD), where the EPDs are specific to particular products from identified manufacturers -AND/OR- <i>Third-party certifications</i> that are based upon a multiple attribute standard(s) developed by a consensus based process from an approved standard development organization (Ex: NSF sustainability assessment standards, UL Environment sustainability standards, etc.) and other consensus based assessment standards that are multiple attribute-based. -AND/OR- <i>Third-party verified product life cycle assessment</i> based upon ISO 14040:2006 and ISO 14044:2006, and minimally covers cradle-to-gate scope? -AND/OR- <i>Third-party sustainable forestry certifications</i> such as American Tree Farm System (ATFS), Forest Stewardship Council Standard (FSC), and the Sustainable Forestry Initiative Standard (SFIS), amongst others. <i>Note:</i> Projects achieving points in this section cannot earn points in 3.5.2.1 - Performance Path for	10
	606.2 Wood-based Products At least two major and/or minor components are made of certified wood or wood-based products, including Forest Stewardship Council (FSC) or Sustainable Forestry Initiative® Program (SFI), among others.	7			
	610.1.2 Product and/or Building Assembly Life Cycle Assessment (LCA) See Above	See above			
	611.2 Sustainable Products See Above	See above			
	611.4 Product Declarations See Above	See above			
606.2 Wood-based Products See Above	See above				

Figure 6: Materials and Resources Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible	
Resource Efficiency	603.1	<p>Reuse of Existing Building</p> <p>Major elements or components of existing buildings and structures are reused, modified, or deconstructed for later use (1 Point awarded for ever 200 sqft of floor area)</p>	12	3.5.3.1	<p>Existing Façades</p> <p>A percentage of the façade from an existing building on the site is retained and incorporated in the new design:</p> <ul style="list-style-type: none"> • >60% (6 pts) • 51-60% (5 pts) • 41-50% (4 pts) • 31-40% (3 pts) • 21-30% (2 pts) • 10-20% (1 pt) 	6
	603.2	<p>Salvaged Materials</p> <p>Reclaimed and/or salvaged materials and component are used. One point is awarded for every 1% of salvaged materials based on total construction cost</p>	9	3.5.3.2	<p>Existing Structural Systems</p> <p>A percentage of structural systems (e.g. interior walls) from an existing building on the site was retained and incorporated in the new design:</p> <ul style="list-style-type: none"> • >95% (6 pts) • 81-95% (5 pts) • 66-80% (4 pts) • 41-65% (3 pts) • 26-40% (2 pts) • 10-25% (1 pt) 	6
	603.3	<p>Scrap Materials</p> <p>Sorting and reuse of scrap building material is facilitated.</p>	4	3.5.3.3.1	<p>Existing Non-structural Elements</p> <p>A percentage of the existing interior ceilings, interior partitions, and/or demountable walls was reused within the renovation project:</p> <ul style="list-style-type: none"> • >95% (6 pts) • 81-95% (5 pts) • 66-80% (4 pts) • 41-65% (3 pts) • 26-40% (2 pts) • 10-25% (1 pt) 	6
	605.2	<p>On-Site Recycling</p> <p>On-site recycling measures following are implemented, such as the following:</p> <ul style="list-style-type: none"> • Materials are ground or otherwise safely applied on-site as soil amendment or fill. At least of 50% (by weight) of construction and land-clearing waste is diverted from landfill. • Compatible untreated biomass material are set aside for combustion if a solid fuel-burning appliance will be available for on-site renewable energv. 	7	3.5.3.3.3	<p>Reused and Off-site Salvaged Materials</p> <p>There was a requirement that the project incorporate reused and off-site salvaged materials</p>	4
	605.1	<p>Construction Waste Management</p> <p>Develop & implement a Construction Waste Management Plan that results in 50% of construction and demolition waste and 95% of e-waste from demolition being diverted from landfills.</p>	6	3.5.4.1	<p>Construction Waste</p> <ul style="list-style-type: none"> • A percentage of the construction waste, including building demolition waste, was diverted from the landfill: >74% (6 pts), 50-74% (4 pts), 25-49% (2 pts) • There is a requirement to reuse existing on-site materials for site development or landscaping (e.g., crushing concrete for aggregate base or drain rock, shredding vegetative materials for mulch, etc.) (1 pt) 	7
	605.3	<p>Recycled Construction Materials</p> <p>Construction materials are recycled offsite. A minimum of two types of materials are recycled (3 pts), and one additional point is earned for each additional recycled material type.</p>	6	3.5.4.2	<p>Operational Waste</p> <p>The building design address operations-related recycling programs through one or more of the following:</p> <ul style="list-style-type: none"> • Operational flow for waste handling and storage facilities for recycling (0.5 pts) • Storage areas for recyclable waste at points of service (0.5 pts) • Storage areas for recyclable waste at pick-up areas (0.5 pts) • Operational flow for handling and storage facilities for composting (0.5 pts) 	2
	607.1	<p>Recycling and Composting</p> <ul style="list-style-type: none"> • A built-in collection space in each kitchen and a aggregation/pickup space in a covered area for recycling containers is provided (3 pts) • A compost facility is provided on-site (3 pts) • A minimum of one food waste disposer is installed at the primary kitchen sink. (1 pt) 	7	3.5.6.1	<p>Minimized Use of Raw Materials</p> <p>The design specified the use of prefabricated, preassembled, and/or modular products (2 pts) and/or the use of materials efficiently, minimizing the use of raw materials as compared with typical construction practices (1 pt)</p>	3
	601.2	<p>Material Usage</p> <p>Structural systems are designed or construction techniques are implemented that reduce and optimize material usage. (i.e. choosing minimum structural member sizes in accordance with advanced framing techniques, selecting higher-grade or higher-strength materials and reducing sizes accordingly, etc.)</p>	9			
	601.3	<p>Building Dimensions and Layouts</p> <p>Building dimensions and layouts are designed to reduce material cuts and waste. This practice is used for a minimum of 80 percent of the following areas:</p> <ul style="list-style-type: none"> • floor area (3 pts) • wall area (3 pts) • roof area (3 pts) • cladding or siding area (3 pts) • penetrations or trim area (1 pt) 	13			
	601.5	<p>Prefabricated Components</p> <p>Precut or preassembled components, or panelized or precast assemblies are utilized for a minimum of 90 percent for the following system or building:</p> <ul style="list-style-type: none"> • floor system (4 pts) • wall system (4 pts) • roof system (4 pts) • modular construction for the entire building located above grade (13 pts) • manufactured home construction for the entire building located above grade (13 pts) 	13			
608.1	<p>Resource-Efficient Materials</p> <p>Products containing fewer materials are used to achieve the same end-use requirements as conventional products. (3 pts per material)</p>	9				

Figure 6: Materials and Resources Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Enterprise Green Communities		Points Possible		
Resource Efficiency	602.1.9	<p>Flashing</p> <ul style="list-style-type: none"> • Mandatory: Flashing is installed at all of the following locations, as applicable: <ul style="list-style-type: none"> (a) around exterior fenestrations, skylights, and doors (b) at roof valleys (c) at all building-to-deck, -balcony, -porch, and -stair intersections (d) at roof-to-wall intersections, at roof-to-chimney intersections, at wall-to-chimney intersections, and at parapets (e) at ends of and under masonry, wood, or metal copings and sills (f) above projecting wood trim (g) at built-in roof gutters, and (h) drip edge is installed at eave and rake edges. • All window and door head and jamb flashing is either self-adhered flashing complying with AAMA 711-13 or liquid applied flashing complying with AAMA 714-15 and installed in accordance with fenestration or flashing manufacturer's installation instructions. (2 pts) • Pan flashing is installed at sills of all exterior windows and doors. (3 pts) • Seamless, preformed kickout flashing or prefabricated metal with soldered seams is provided at all roof-to-wall intersections. (3 pts) • Through-wall flashing is installed at transitions between wall cladding materials or wall construction types. (2 pts) 	Mandatory + 12 Points	Materials and Resources	3.5.7.2	<p>Flashings</p> <p>There was a requirement that building envelope flashings and sheet metal assemblies were installed as per prescribed industry best practice (1.5 pts) AND/OR Inspected as per prescribed industry protocol (1.5 pts)</p>	3
	701.4.3.1	<p>Building Thermal Envelope Air Sealing</p> <p>Building thermal envelope is durably sealed to limit infiltration. All openings, penetrations, joints, seams, connections, common walls, and other sources of infiltration are caulked, gasketed, weather-stripped, or otherwise sealed with an air barrier material, suitable film, or solid material.</p>	Mandatory		3.5.7.3	<p>Roof and Wall Openings</p> <p>There was a requirement that all products for roof and wall openings (doors, windows, skylights etc.) were comprised of a moisture management design that meets industry prescribed performance requirements (1 pt); AND/OR Installed as per prescribed industry best practice (1 pt); AND/OR inspected as per the prescribed industry protocol, including field testing with respect to water penetration (2 pts)</p>	4
	601.8	<p>Foundations</p> <p>The foundation system minimizes soil disturbance, excavation quantities, and material usage.</p>	3		3.5.8.1.1	<p>Foundation Systems</p> <p>Newly installed foundation systems for conditioned spaces are:</p> <ul style="list-style-type: none"> • Constructed with slab-on-ground vapor retarders conforming to prescribed industry best practices (0.5 pts) • Constructed such that all slabs on grade will be positioned directly over vapor retarders and capillary-break base courses (0.5 pts) • Undergo field-inspection of all vapor retarder and waterproofing assemblies as per prescribed industry protocol (1 pt) 	2
	602.1.1	<p>Capillary Breaks</p> <ul style="list-style-type: none"> • Mandatory: A capillary break and vapor retarder are installed at concrete slabs in accordance with ICC IRC Sections R506.2.2 and R506.2.3 or ICC IBC Sections 1907 and 1805.4.1. • A capillary break between the footing and the foundation wall is provided to prevent moisture migration into foundation wall. (3 pts) 	Mandatory + 3 Points				
	602.1.2	<p>Foundation Waterproofing</p> <p>Enhanced foundation waterproofing is installed using one or both of the following:</p> <ul style="list-style-type: none"> • rubberized coating • drainage mat 	4		3.5.8.1.2	<p>Foundation Moisture Control</p> <p>The following damp-proofing measures are applied to all newly installed foundation walls in contact with grade:</p> <ul style="list-style-type: none"> • 5% slope grade away indicated from the building for at least 10 feet (0.5 pts) • Roof drainage to be directed at least 3 feet beyond the building overhang (0.5 pts) • A foundation drainage system (1 pt) 	2
	602.1.3	<p>Foundation Drainage</p> <ul style="list-style-type: none"> • Mandatory: Where required by the ICC IRC or IBC for habitable and usable spaces below grade, exterior drain tile is installed. • Interior and exterior foundation perimeter drains are installed and sloped to discharge to daylight, dry well, or sump pit. (4 pts) 	Mandatory + 4 Points				
	602.3	<p>Roof Water Discharge</p> <p>A gutter and downspout system or splash blocks and effective grading are provided to carry water a minimum of 5 feet away from perimeter foundation walls.</p>	4		602.4	<p>Finished Grade</p> <ul style="list-style-type: none"> • Mandatory: Finished grade at all sides of a building is sloped to provide a minimum of 6 inches of fall within 10 feet of the edge of the building. Where there is not 10 feet available, the final grade is sloped away from the edge of the building at 2% or greater. • Final grade is sloped away from the edge of the building at a minimum slope of 5%. (1 pt) • Water is directed to drains or swales to ensure drainage away from the structure. (1 pt) 	Mandatory + 2 Points
	701.4.3.1	<p>Building Thermal Envelope Air Sealing</p> <p>Building thermal envelope is durably sealed to limit infiltration. All openings, penetrations, joints, seams, connections, common walls, and other sources of infiltration are caulked, gasketed, weather-stripped, or otherwise sealed with an air barrier material, suitable film, or solid material.</p>	Mandatory				
	602.1.9	<p>Flashing (cont'd)</p> <ul style="list-style-type: none"> • A rainscreen wall design is used for exterior wall assemblies. (4 pts) 	4		9.5.9.2	<p>Rainscreen Wall Cladding</p> <ul style="list-style-type: none"> • Construction documents indicate that exterior rainscreen wall cladding systems are specified over framed walls, installed with the following: primary and secondary line of defense (0.5 pts), an air barrier (0.5 pts), a means for incidental bulk water intrusion to escape the cladding system assembly (0.5 pts) • Rainscreen cladding assemblies were required to pass requirements of AAMA 508-07 laboratory-testing (0.5 pts) 	2

Figure 6: Materials and Resources Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible		
Resource Efficiency	701.4.3.1	<p>Building Thermal Envelope Air Sealing Building thermal envelope is durably sealed to limit infiltration. All openings, penetrations, joints, seams, connections, common walls, and other sources of infiltration are caulked, gasketed, weather-stripped, or otherwise sealed with an air barrier material, suitable film, or solid material.</p>	Mandatory	Materials and Resources	3.5.10.1	<p>Air Barriers A continuous air barrier will be installed according to the following practices:</p> <ul style="list-style-type: none"> • The air barrier material of each assembly detail shows an airtight and flexible joint between the air barrier material and adjacent assemblies (0.5 pts) • The air barrier is designed to withstand positive and negative combined design wind, fan and stack pressures on the air barrier without damage or displacement (0.5 pts) • The air barrier is designed to withstand movement in the structure and not displace materials under full load (0.5 pts) • Air barrier connection details are shown between: foundation and walls; walls and windows or doors; different wall systems; wall and roof; wall and roof over conditioned space or wall and ceiling under unconditioned space; walls, floors, and roof across construction, control, and expansion joints; walls, floors, and roof to utility, pipe, and duct penetrations (0.5 pts) • Compliance of the continuous air barrier for the opaque building envelope was demonstrated using one of the following strategies: Materials tested in accordance with ASTM E2178-11 Standard Test Method for Air Permeance of Building Materials (2 pts), Assemblies tested in accordance with ASTM E2357-11 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies, or ASTM E1677-11 Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls (2 pts), or building tested with ASTM E779-03 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization (2 pts) 	4
	602.1.4	<p>Crawlspaces <i>For unconditioned and vented crawlspace:</i></p> <ul style="list-style-type: none"> • Mandatory: Dampproof walls are provided below finished grade. • Minimum 6-mil vapor retarder installed on the crawlspace floor and extended at least 6 inches up the wall and is attached and sealed to the wall. (6 pts) <p><i>For conditioned crawlspace:</i></p> <ul style="list-style-type: none"> • Mandatory: 6-mil polyethylene sheeting, or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the IRC. • A concrete slab over 6-mil polyethylene sheeting, or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the IRC. (8 pts) 	8		3.5.10.2	<p>Vapor Retarders</p> <ul style="list-style-type: none"> • The interior side of framed walls in Climate Zones 5, 6, 7, 8 and Marine 4 were installed with a Class I or II vapor retarder that is in accordance with the International Energy Conservation Code (IECC) 2012, International Energy Conservation Code (IECC) 2007 Supplement, or International Building Code® (IBC) 2009 Section 1405.3 (1 pt) • The walls of unvented crawl spaces had insulation that is permanently fastened to the wall, extends downward from the floor to the finished grade level, and then vertically and/or horizontally for at least an additional 24 inches (1 pt) • Exposed earth in unvented crawl space foundations were covered with a continuous Class I vapor retarder, and installed with all joints of the vapor retarder overlapped by 6 inches and are sealed or taped, and the edges of the vapor retarder extend at least 6 inches up the stem wall and are attached to the stem wall (1 pt) 	3

Figure 6: Materials and Resources Practices

Other NGBS Resource Efficiency Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible
Resource Efficiency	<p>601.1 <u>Conditioned Floor Area</u> Total finished floor area of a dwelling unit is limited to the following areas: <ul style="list-style-type: none"> • ≤ 700 sqft: 14 points • ≤ 1,000 sqft: 12 points • ≤ 1,500 sqft: 9 points • ≤ 2,000 sqft: 6 points • ≤ 2,500 sqft: 3 points • ≤ 4,000 sqft: Mandatory: No point awarded and for every 100 sqft over 4,000 sqft, one additional point is required to be earned elsewhere in the home for every level of certification. Multifamily: A weighted average of the individual unit sizes is used for this practice.</p>	14 (Mandatory if over 4,000 sqft)
	<p>601.4 <u>Framing and Structural Plans</u> Detailed framing or structural plans, material quantity lists and on-site cut lists for framing, structural materials, and sheathing materials are provided.</p>	4
	<p>601.6 <u>Stacked Stories</u> Stories above grade are stacked, with support floors at least 1/2 the size of ground floor and 7-foot ceiling. First stacked floor is worth 4 points, with 2 points for each additional floor, 8 points max.</p>	8
	<p>601.7 <u>Prefinished Materials</u> Prefinished building materials or assemblies, such as trim, walls, floors, ceilings, and fenestrations, have no additional site-applied finishing material are installed.</p>	12
	<p>601.9 <u>Above-Grade Wall Systems</u> Above-grade wall systems provide the structural and thermal characteristics of mass walls and are used for at least 75% of the gross exterior wall area of the building.</p>	4
	<p>602.1.5 <u>Termite Barrier</u> <i>For areas of moderate to heavy termite infestation potential:</i> Install no or low-toxicity treatment measures (4 pts) <i>For areas of very heavy termite infestation potential:</i> Install above measures, as well as implement low toxicity bait and kill treatment plan. (4 pts)</p>	4
	<p>602.1.6 <u>Termite-resistant materials</u> <i>Slight to moderate termite infestation probability:</i> Install termite resistive materials for foundation, structural walls, floors, exterior decks, and exterior claddings 2 feet above top of foundation. (2 pts) <i>Moderate to heavy termite infestation probability:</i> Install termite resistive materials in all above areas as well as exterior claddings 4 feet above top of foundation. (4 pts) <i>Very heavy termite infestation probability:</i> Install termite resistive materials in all above areas as well as all exterior claddings. (6 pts)</p>	6
	<p>602.1.7 <u>Moisture Control Measures</u> <ul style="list-style-type: none"> • Mandatory: Insulation in cavities is dry in accordance with manufacturer's instructions when enclosed (2 pts) • Mandatory: Moisture content of subfloor, substrate, or concrete slabs is in accordance with the appropriate industry standard for the finish flooring to be applied. • Building materials with visible mold are not installed or are cleaned or encapsulated prior to concealment and closing. (2 pts) • The moisture content of lumber is sampled to ensure it does not exceed 19 percent prior to the surface and/or cavity enclosure. (4 pts) • Building envelope assemblies are designed for moisture control based on documented hygrothermal simulation or field study analysis. (4 pts) </p>	Mandatory + 14 Points
	<p>602.1.8 <u>Water-Resistive Barrier</u> Where required by the ICC, IRC, or IBC, a water-resistive barrier and/or drainage plane system is installed behind exterior veneer and/or siding.</p>	Mandatory
	<p>602.1.10 <u>Exterior Doors</u> Entries at exterior door assemblies, inclusive of side lights, are covered by installing a porch roof or awning, extending the roof overhang, recessing the exterior door, or installing a storm door. (2 pts per door, 6 pts max)</p>	6

Other Green Globes Materials and Resources Practices

Green Globes		Points Possible
Materials and Resources	<p>3.5.3.3.2 <u>Existing Furnishings</u> A percentage of the existing furnishings (including systems furniture) will be re-used and/or refurbished for reuse within the renovation project: <ul style="list-style-type: none"> • >65% (4 pts) • 41-65% (3 pts) • 26-40% (2 pts) • 10-25% (1 pt) </p>	4
	<p>3.5.5.1 <u>Building Service Life Plan</u> There is a preliminary Building Service Life Plan that includes the expected service life estimates for the following: <ul style="list-style-type: none"> • The building (2 pts) • The structural systems, building envelope, and hardscape materials that will need to be replaced during the life of the building (2 pts) • The mechanical, electrical, plumbing, and energy generation systems that will require inspection and/or replacement during the service life of the building (2 pts) </p>	6
	<p>3.5.5.2 <u>Maintenance and Repair</u> There is a schedule for maintenance, repair, and replacement for each building element, including the building fit-out (as applicable) for the duration of the building design life</p>	1
	<p>3.5.6.2 <u>Multi-Functional Assemblies</u> The design incorporated assemblies that perform multiple functions (1 pt)</p>	1
	<p>3.5.6.3 <u>Deconstruction and Disassembly</u> The building design facilitated future deconstruction, demounting and disassembly; and re-configuration</p>	2
	<p>3.5.7.1 <u>Roofing Membrane Assemblies and Systems</u> There was a requirement that roofing membrane assemblies and systems were installed as per manufacturers' instructions and recommendations (1.5 pts) AND/OR Field-inspected by a roofing system manufacturer's technical personnel or RCI-certified third-party roofing inspector as per the prescribed industry protocol (1.5 pts)</p>	3
	<p>3.5.8.2 <u>Below Grade Wall Slabs and Above Grade Horizontal Assemblies</u> Waterproofing membrane assemblies are: <ul style="list-style-type: none"> • Provided at all below grade slabs and foundation/basement walls that are subject to hydrostatic pressures (1 pt) • Installed as per the manufacturer's requirements, and field-inspected as per prescribed industry protocol (1 pt) </p>	2
	<p>3.5.9.1.1 <u>Exterior Wall Cladding Systems Installation</u> Cladding systems were installed per industry best practices for one of the following: <ul style="list-style-type: none"> • Exterior Insulation Finishing Systems (1 pt), or; • Aluminum framed glazing systems (1 pt), or; • Masonry veneer cladding (1 pt), or; • Architectural precast concrete cladding systems (1 pt) </p>	1
	<p>3.5.9.1.2 <u>Exterior Wall Cladding Systems Inspection</u> Cladding installation was inspected per the appropriate prescribed industry protocols for one of the following: <ul style="list-style-type: none"> • Exterior Insulation Finishing Systems (1 pt), or; • Aluminum framed glazing systems (1 pt), or; • Masonry veneer cladding (1 pt) </p>	1

Figure 6: Materials and Resources Practices

Other NGBS Resource Efficiency Practices (cont'd)

ICC/ASHRAE 700-2015 NGBS		Points Possible
Resource Efficiency	602.1.11 Tile Backing Materials Tile backing materials installed under tiled surfaces in wet areas are in accordance with ASTM C1178, C1278, C1288, or C1325.	Mandatory
	602.1.12 Roof Overhangs Roof overhangs are provided over at least 90% of exterior walls to protect the envelope.	4
	602.1.13 Ice Barrier In applicable climates, an ice barrier is installed in accordance with the ICC IRC or IBC at roof eaves of pitched roofs and extends at least 24 inches inside the exterior wall line.	Mandatory
	602.1.14 Architectural Features <ul style="list-style-type: none"> • Mandatory: All horizontal ledgers are sloped away to provide gravity drainage. (1 pt) • No roof configurations create horizontal valleys in roof design. (2 pts) • No recessed windows and architectural features trap water on horizontal surfaces. (2 pts) 	Mandatory + 5 Points
	602.2 Roof Surfaces At least 90% of roof surfaces are comprised of one or more of the following: <ul style="list-style-type: none"> • ENERGY STAR® cool roof certification or equivalent materials • A vegetated roof system • Materials with a minimum initial SRI of 78 for low-sloped roof (a slope less than 2:12) and a minimum initial SRI of 29 for a steep-sloped roof (a slope equal to or greater than 2:12). <i>Note:</i> Do not include roof area that is used for roof penetrations and associated equipment, on-site renewable energy systems such as photovoltaics or solar thermal energy collectors, or rooftop decks, amenities and walkways.	3
	604.1 Recycled Content Building materials with recycled content are used for two minor and/or two major components of the building. Point are based on the percentage of recycled content, with a minimum of 25%.	9
	606.1 Biobased Products Use two types of biobased materials for at least 0.5% of the total construction cost, including but not limited to bamboo, cotton, cork, and straw.	8
	606.3 Manufacturing Energy Materials manufactured using a minimum of 33% of manufacturing process energy from renewable or combustible waste sources, or renewable energy credits. Two points are awarded per material.	6
	609.1 Regional Materials Regional materials (within 500 miles of site) are used for major and/or minor components of the building. For a component to comply with this practice, a minimum of 75% of all products in that component category must be sourced regionally. Two points per each major component and 1 point per each minor component.	10
	611.1 Manufacturer's Environmental Management System Concepts Product manufacturer's operations and business practices include environmental management system concepts, and the production facility is registered to ISO 14001. One point is awarded for every 1% of materials from ISO 14001 facilities based on total construction cost.	10
	611.3 Universal Design Elements Dwelling incorporates one or more of the following universal design elements. (12 pts max): <ul style="list-style-type: none"> • Any no-step entrance into the dwelling which is accessible from a substantially level parking or drop-off area (no more than 2%) via an accessible path which has no individual change in elevation or other obstruction of more than 1-1/2 inches in height with the pitch not exceeding 1 in 12, and provides a minimum 32-inch wide clearance into the dwelling. (3 pts) • Minimum 36-inch wide accessible route from the no-step entrance into at least one visiting room in the dwelling and into at least one full or half bathroom which has a minimum 32-inch clear door width and a 30-inch by 48-inch clear area inside the bathroom outside the door swing. (3 pts) • Minimum 36-inch wide accessible route from the no-step entrance into at least one bedroom which has a minimum 32-inch clear door width. (3 pts) • Blocking or equivalent installed in the accessible bathroom walls for future installation of grab bars at water closet and bathing fixture, if applicable. (1 pt) • All interior and exterior door handles are levers rather than knobs. (1 pt) • All sink faucet controls are single-handle controls of both volume and temperature. (1 pt) • Interior convenience Power receptacles, communication connections and switches are placed between 15" and 48" above the finished floor. Additional switches to control devices and systems (such as alarms, home theaters and other equipment) not required by the local building code may be installed as desired. (1 pt) • All light switches are rocker-type switches or other similar switches that can be operated by pressing them (with assistive devices). Toggle-type switches may not be used. (1 pt) • Any of the following can be controlled with a (wireless) mobile device such as a smartphone, tablet or laptop computer: HVAC, lighting, alarm system or door locks. (1 pt) 	12

Energy Efficiency

ICC/ASHRAE 700-2015 NGBS – Energy Efficiency

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

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

Table 10: NGBS Energy Efficiency Compliance Paths

Energy Performance Compliance Path	Summary	Rating Levels Achievable
Performance Path	Meet or surpass ICC IECC 2015 baseline performance, and include at least two additional energy efficiency practices, such as occupancy sensors & lighting controls. Two points are earned for every percentage point above IECC 2015	<ul style="list-style-type: none"> • Bronze • Silver • Gold • Emerald
Prescriptive Path	Obtain at least 30 points through prescriptive practices detailed in the ICC/ASHRAE-700 2015, and include at least two additional energy efficiency practices, such as occupancy sensors & lighting controls.	<ul style="list-style-type: none"> • Bronze • Silver • Gold
HERS Index Target	Complete EPA HERS Index Target Procedure with final value equal to or less than EPA HERS Index Target, and include at least two additional energy efficiency practices, such as occupancy sensors & lighting controls.	<ul style="list-style-type: none"> • Bronze • Silver • Gold
ENERGY STAR Version 3.0	Qualify as an ENERGY STAR Version 3.0 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03	<ul style="list-style-type: none"> • Bronze Only
ENERGY STAR Version 3.1	Qualify as an ENERGY STAR Version 3.1 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03 (with a baseline at ASHRAE 90.1-2010)	<ul style="list-style-type: none"> • Silver Only

Mandatory Practices:

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

Minimum Point Requirements:

Table 11: Energy Efficiency Minimum Point Requirements

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

Green Globes – Energy

The “Energy” category of Green Globes is focused on practices that help increase the energy efficiency of a project. There are four optional pathways for demonstrating this. There are also a number of specific practices targeting lower energy consumption, such as using efficient heating and cooling equipment, efficient cooling towers, and condensate recovery.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

The NGBS provides multiple pathways for demonstrating the baseline compliance with this category, as seen in Table 10 above. This includes energy modeling, utilizing the ENERGY STAR Home Energy Rating System (HERS) Index Target, and/or certifying the project through ENERGY STAR. It also includes a number of additional mandatory practices, such as HVAC and duct-sizing requirements, to ensure a baseline of energy efficiency. Notably, the NGBS requires all insulation to be installed to Grade 1 standards, which is verified pre-drywall to ensure no visual defects. This ensures that no matter what path is selected, a minimum baseline of efficiency practices is completed.

Green Globes also provides multiple pathways for demonstrating energy efficiency, however the project team is not required to select any of them. The optional choices are using ASHRAE 90.1-2010 for energy modeling, Energy Star Target Finder, GBI 01-2010 Energy Performance Building Carbon Dioxide Equivalent Emissions, or ASHRAE Building Energy Quotient.

Green Globes also contains a plethora of optional practices a project team can select to help reduce the potential energy consumption of the building. In total, Green Globes contains a larger number of practices within this category, including steam traps, efficient cooling towers and metering practices.

As seen in Figure 7, some practices in the NGBS, such as those involving bicycle lanes, bicycle racks and mass transit, are organized in the Location and Site Category while similar practices in Green Globes resides within the Energy category.

ICC IECC 2015 and ASHRAE 90.1-2010

The energy performance compliance paths differ between the rating systems because they use two different baselines. Green Globes uses ANSI/ASHRAE/IESNA Standard 90.1–2010 as the baseline performance for energy modeling of a building, while the NGBS uses the ICC IECC 2015.

Both baselines are common across the country. According to the report *Energy and Energy Cost Savings Analysis of the 2015 IECC for Commercial Buildings*, produced by the Pacific Northwest National Laboratory for the Department of Energy, “while Standard 90.1 is the national model energy standard for commercial buildings, many states have historically adopted the International Energy Conservation Code (IECC) for both residential and commercial buildings.” This deems it more appropriate for NGBS, which is focused on residential projects and not applicable to commercial buildings.

Per Figure 7a below from the Pacific Northwest National Laboratory report *National Average Energy Cost Index for Standard 90.1 and IECC Prototypes*, the 2015 IECC is nearly on par with the ASHRAE 90.1-2013. On a national average basis for all prototypes combined, the 2015 IECC and Standard 90.1-2013 are within 1% for both energy use and energy costs. For mid- and high-rise multifamily residences, the variation is between 1%-2%.

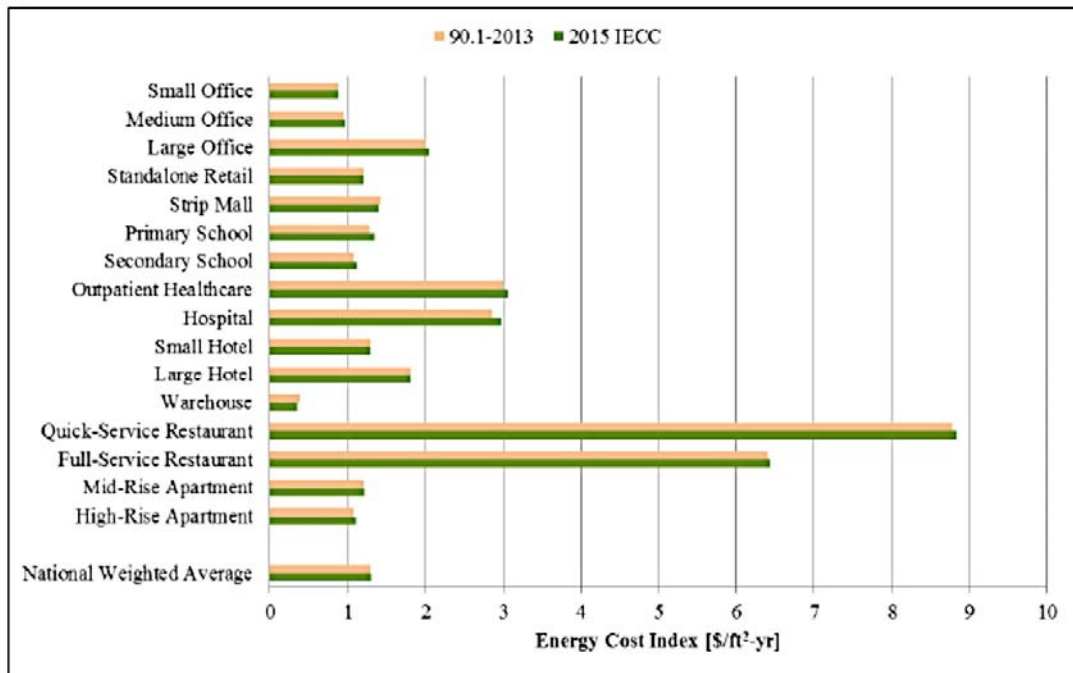


Figure B.2. National Average Energy Cost Index for Standard 90.1 and IECC Prototypes

Figure 7a: Figure B.2 from "Energy and Energy Cost Savings Analysis of the 2015 IECC for Commercial Buildings"

Green Globes uses ANSI/ASHRAE/IESNA Standard 90.1–2010, not the 2013 version. As of the date of this report, no direct comparison of ASHRAE 90.1-2010 to IECC 2015 produced by a national laboratory or equivalent body was found. However, Pacific Northwest National Laboratory also produced a report for the Department of Energy titled, *National Cost-effectiveness of ANSI/ASHRAE/IES Standard 90.1-2013*, which compared the 2013 version to the previous 2010. As seen in Figure 7b below, on average, buildings constructed to ASHRAE 90.1-2013 saw increased energy savings across all climate zones, with the exception of gas usage, compared to the 2010 version. For mid- and high-rise multifamily residences, the total increase in energy savings from 2010 to 2013 by climate zone ranged from 4% to over 7%.

C.1 Energy Cost and Savings Summary with Plug and Process Loads, 90.1-2010 and 90.1-2013

Energy Cost Saving Results for ASHRAE Standard 90.1, \$ per Square Foot per Year

Climate Zone:	2A				3A				3B			
	90.1-2010	90.1-2013	Savings		90.1-2010	90.1-2013	Savings		90.1-2010	90.1-2013	Savings	
Small Office												
Electricity	\$1.053	\$0.903	\$0.150	14.2%	\$1.001	\$0.887	\$0.114	11.4%	\$0.954	\$0.885	\$0.069	7.2%
Gas	\$0.000	\$0.000	\$0.000	-	\$0.002	\$0.002	\$0.000	0.0%	\$0.000	\$0.001	\$0.000	-
Totals	\$1.053	\$0.903	\$0.150	14.2%	\$1.003	\$0.889	\$0.114	11.4%	\$0.954	\$0.885	\$0.069	7.2%
Large Office												
Electricity	\$2.158	\$2.055	\$0.102	4.7%	\$2.062	\$1.989	\$0.073	3.5%	\$2.107	\$2.036	\$0.071	3.4%
Gas	\$0.018	\$0.020	-\$0.002	-11.1%	\$0.033	\$0.051	-\$0.019	-57.6%	\$0.016	\$0.017	-\$0.001	-6.3%
Totals	\$2.176	\$2.076	\$0.100	4.6%	\$2.094	\$2.040	\$0.054	2.6%	\$2.123	\$2.053	\$0.070	3.3%
Stand-Alone Retail												
Electricity	\$1.408	\$1.246	\$0.162	11.5%	\$1.324	\$1.168	\$0.156	11.8%	\$1.321	\$1.209	\$0.112	8.5%
Gas	\$0.055	\$0.045	\$0.010	18.2%	\$0.077	\$0.063	\$0.014	18.2%	\$0.067	\$0.061	\$0.006	9.0%
Totals	\$1.462	\$1.290	\$0.172	11.8%	\$1.401	\$1.231	\$0.169	12.1%	\$1.388	\$1.270	\$0.118	8.5%
Primary School												
Electricity	\$1.481	\$1.266	\$0.216	14.6%	\$1.366	\$1.193	\$0.172	12.6%	\$1.314	\$1.080	\$0.234	17.8%
Gas	\$0.118	\$0.117	\$0.002	1.7%	\$0.152	\$0.155	-\$0.002	-1.3%	\$0.106	\$0.112	-\$0.006	-5.7%
Totals	\$1.600	\$1.382	\$0.217	13.6%	\$1.518	\$1.348	\$0.170	11.2%	\$1.420	\$1.193	\$0.228	16.1%
Small Hotel												
Electricity	\$1.259	\$1.133	\$0.126	10.0%	\$1.215	\$1.106	\$0.108	8.9%	\$1.168	\$1.057	\$0.111	9.5%
Gas	\$0.203	\$0.203	\$0.000	0.0%	\$0.218	\$0.218	-\$0.001	-0.5%	\$0.209	\$0.209	\$0.000	0.0%
Totals	\$1.462	\$1.336	\$0.126	8.6%	\$1.432	\$1.325	\$0.108	7.5%	\$1.377	\$1.267	\$0.111	8.1%
Mid-rise Apartment												
Electricity	\$1.284	\$1.193	\$0.091	7.1%	\$1.236	\$1.170	\$0.065	5.3%	\$1.243	\$1.179	\$0.064	5.1%
Gas	\$0.012	\$0.011	\$0.001	8.3%	\$0.039	\$0.043	-\$0.004	-10.3%	\$0.010	\$0.011	-\$0.002	-20.0%
Totals	\$1.296	\$1.203	\$0.092	7.1%	\$1.275	\$1.214	\$0.061	4.8%	\$1.253	\$1.190	\$0.063	5.0%

Energy Cost Saving Results for ASHRAE Standard 90.1, \$ per Square Foot per Year

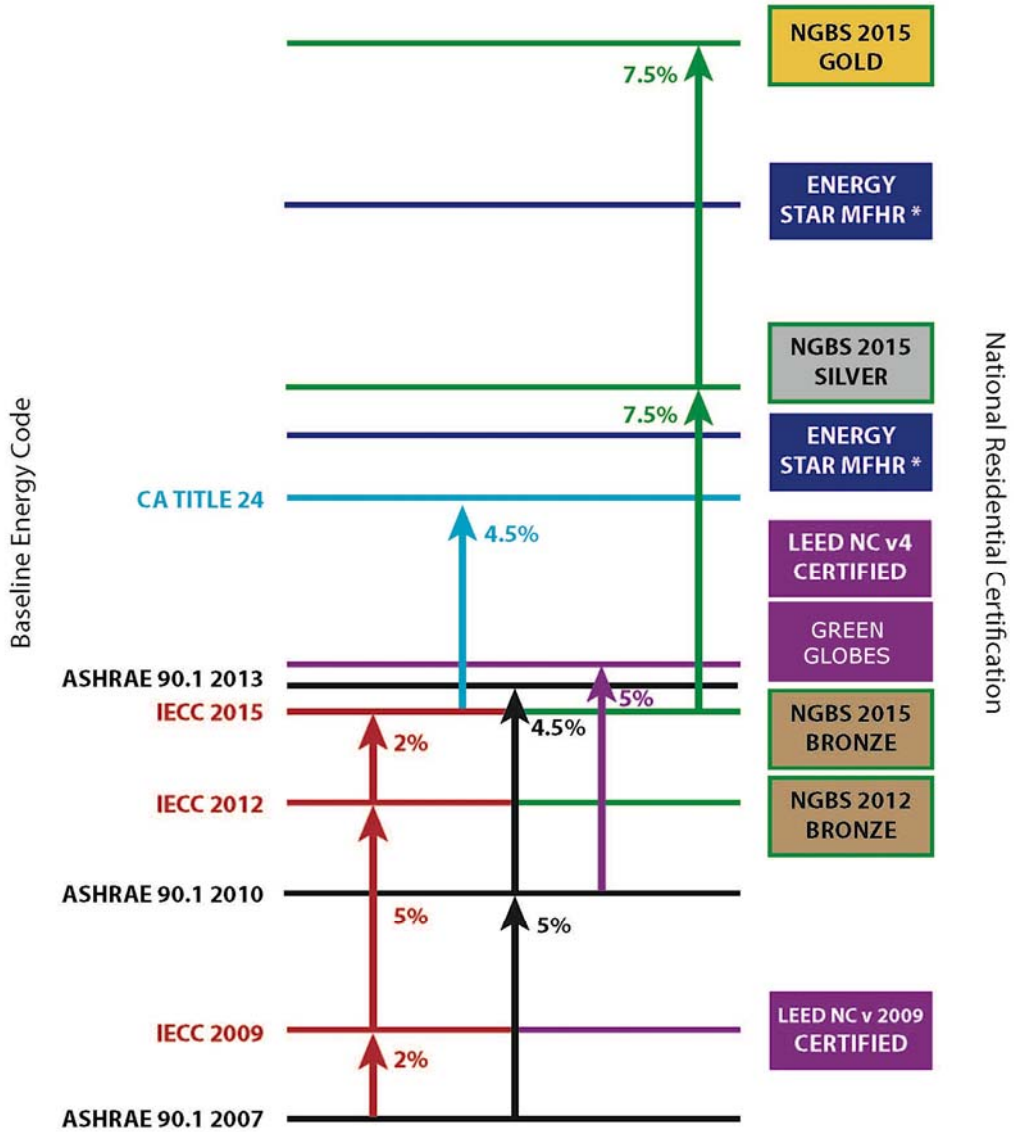
Climate Zone:	4A				5A			
Code:	90.1-2010	90.1-2013	Savings		90.1-2010	90.1-2013	Savings	
Small Office								
Electricity	\$0.957	\$0.855	\$0.102	10.7%	\$0.956	\$0.862	\$0.094	9.8%
Gas	\$0.004	\$0.003	\$0.001	25.0%	\$0.013	\$0.010	\$0.003	23.1%
Totals	\$0.961	\$0.858	\$0.103	10.7%	\$0.969	\$0.872	\$0.097	10.0%
Large Office								
Electricity	\$1.991	\$1.944	\$0.048	2.4%	\$1.976	\$1.935	\$0.041	2.1%
Gas	\$0.054	\$0.067	-\$0.013	-24.1%	\$0.098	\$0.111	-\$0.013	-13.3%
Totals	\$2.046	\$2.011	\$0.035	1.7%	\$2.074	\$2.046	\$0.028	1.4%
Standalone Retail								
Electricity	\$1.265	\$1.107	\$0.158	12.5%	\$1.247	\$1.077	\$0.169	13.6%
Gas	\$0.102	\$0.075	\$0.027	26.5%	\$0.144	\$0.106	\$0.038	26.4%
Totals	\$1.367	\$1.182	\$0.184	13.5%	\$1.390	\$1.183	\$0.207	14.9%
Primary School								
Electricity	\$1.297	\$1.134	\$0.163	12.6%	\$1.261	\$1.106	\$0.155	12.3%
Gas	\$0.173	\$0.178	-\$0.005	-2.9%	\$0.207	\$0.206	\$0.001	0.5%
Totals	\$1.470	\$1.312	\$0.158	10.7%	\$1.468	\$1.312	\$0.156	10.6%
Small Hotel								
Electricity	\$1.190	\$1.083	\$0.107	9.0%	\$1.240	\$1.133	\$0.107	8.6%
Gas	\$0.236	\$0.237	-\$0.001	-0.4%	\$0.255	\$0.255	\$0.000	0.0%
Totals	\$1.426	\$1.320	\$0.106	7.4%	\$1.495	\$1.389	\$0.106	7.1%
Mid-rise Apartment								
Electricity	\$1.227	\$1.178	\$0.049	4.0%	\$1.224	\$1.176	\$0.048	3.9%
Gas	\$0.063	\$0.057	\$0.006	9.5%	\$0.121	\$0.108	\$0.014	11.6%
Totals	\$1.290	\$1.235	\$0.055	4.3%	\$1.345	\$1.284	\$0.062	4.6%

Figure 7b: Tables C.1 and C.2 from "National Cost-effectiveness of ANSI/ASHRAE/IES Standard 90.1-2013"

Based on the data provided by these research papers, the following graphic demonstrates the relative comparison of the various editions of the IECC and ASHRAE 90.1.

ENERGY EFFICIENCY COMPARISON

FOR MID- TO HIGH-RISE RESIDENTIAL BUILDINGS



* ESTAR MFHR 15% above state adopted code.

Figure 7c: Relative Comparison of Energy Efficiency for ASHRAE 90.1 and IECC Standards

References for Figure 7c

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Figure 7: Energy Efficiency Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible		
Energy Efficiency	701.1.1 & 702	Path 1: Minimum Performance Path Requirements (ICC IECC 2015) Demonstrate through energy modeling that the proposed building performance is equal to or better than the baseline building performance. Calculate the baseline building performance according to ICC IECC 2015. Every percentage improvement above baseline earns 2 points.	Mandatory (Option 1) 30+	Energy Efficiency	3.3.1.1.1	Path A: ENERGY STAR® Target Finder Points are based on the energy performance per the ENERGY STAR® percentile score derived from the Target Finder program. (75 = 44 pts; 76-78 = 52 pts; 79-81 = 60 pts; 82-84 = 68 pts; 85-87 = 76 pts; 88-90 = 84 pts; 91-93 = 92 pts; 94-100 = 100 pts)	100
	701.1.2 & 703	Path 2: Minimum Prescriptive Path Requirements (ICC/ASHRAE 700-2015 & ICC IECC 2015) Comply with all mandatory requirements, as well as obtain a minimum of 30 points, within Section 703 of the ICC/ASHRAE 700-2015. <i>Note:</i> All projects must also include two additional energy conservation practices listed in Section 705 of the ICC/ASHRAE 700-2015, such as occupancy sensors & lighting controls.	Mandatory (Option 2) 30+		3.3.1.1.2	Path B: ANSI/ASHRAE/IES Standard 90.1-2010, Appendix G Points are based on the energy performance per the percentage value compared to the reference base building, per ANSI/ASHRAE/IES Standard 90.1-2010, Appendix G. 2010. Points are awarded based on 5% - 50% (or higher) energy performance values over the base building.	100
	701.1.3	Path 3: EPA HERS Index Target Path The building must complete the EPA HERS Index Target Procedure with the final value equal to or less than EPA HERS Index Target. Points are awarded per percent less than EnergyStar HERS Index Target. <i>Note:</i> All projects must also include two additional energy conservation practices listed in Section 705 of the ICC/ASHRAE 700-2015, such as occupancy sensors & lighting controls.	Mandatory (Option 3) 30+		3.3.1.1.3	Path C: ANSI/GBI 01-2010 Energy Performance Building Carbon Dioxide Equivalent Emissions Points are based on the energy performance per the reduction of Carbon Dioxide Equivalent (CO2e) Emissions based on the ANSI/GBI 01-2010 Energy Performance Building Carbon Dioxide Equivalent (CO2e) Emissions protocol. 100 points are awarded if 50% reduction achieved, and 1 bonus point is awarded for every 1% achieved over 50% reduction. A reduction of 0-49% does not achieve any points.	150
	701.1.4	Path 4: ENERGY STAR Version 3.0 Certified Home A project that qualifies as an ENERGY STAR Version 3.0 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03 can satisfy the Energy Efficiency category, but can only achieve Bronze Certification. A project that qualifies as an ENERGY STAR Version 3.1 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev 03 (with the baseline as AHSRAE 90.1-2010) can satisfy the Energy Efficiency category, but can only achieve Silver Certification.	Mandatory (Option 4)		3.3.1.1.4	Path D: ASHRAE Building Energy Quotient (BEQ) Points are based on the energy performance per the ASHRAE Building Energy Quotient (BEQ) rating program for an 'As Designed' assessment. 100 points maximum are available with 25 possible bonus points. ● Zero Net Energy: A+ (100 pts + 25 bonus pts) ● High Performance: A (100 pts) ● Very Good: A- (60 pts) ● Efficient: B (30 pts)	125
	703.2.2	Mass Walls More than 75% of the above-grade exterior opaque wall area of the building is mass walls. Points are based on climate zone and mass thickness.	3		3.3.2.1	Passive Demand Reduction ● A minimum of 20% of the building envelope gross wall area have either a minimum heat capacity of 7 Btu/sqft °F, or a minimum heat capacity of 5 Btu/sqft °F, provided the walls have a material unit weight equal to or less than 120 lb/ft3 (3 pts) ● Mass walls that are used as interior partitions, and constituting 20% of the building envelope gross area, have either a minimum heat capacity of 7 Btu/sqft °F, or a minimum heat capacity of 5 Btu/sqft °F, provided the walls have a material unit weight not greater than 120 lb/cuft with the portion of the wall with the greatest heat capacity exposed to conditioned air (3 pts) ● 50% of return air plenums are located directly in contact with a floor or wall having either a heat capacity of at least 7 Btu/sqft °F, or a heat capacity of 5 at least Btu/sqft °F, provided the wall or floor has a material unit weight equal to or less than 120 lb/cuft (3 pts) ● There is a thermal energy storage system that is capable of offsetting the peak cooling demand by more than 31-40% (4 pts), 41-50% (7 pts), >50% (10 pts)	12
	706.7	Grid-Interactive Thermal Storage System A grid-interactive electric thermal storage system is installed for water and/or space heating and cooling.	2		3.3.2.2	Power Demand Reduction ● The modeled building's monthly power demand factor (lowest monthly kW demand ÷ peak monthly kW demand) is >85% (8 pts), 80-85% (6 pts), 75-79% (4 pts) ● There is an Energy Management System designed to reduce power demand >30% (8 pts), 25-30% (7 pts), 20- 24% (6 pts), or 15-19% (4 pts) below non-reduced peak, -OR- power demand is controlled by the electric utility as per a load shedding agreement between the building owner and the utility (8 pts)	16
	706.1	Energy Consumption Control A whole-building or whole-dwelling unit device or system is installed that controls or monitors energy consumption. ● Programmable communicating thermostat with the capability to be controlled remotely (1 pt) ● Energy-monitoring device or system (1 pt) ● Energy management control system (3 pts) ● Programmable thermostat with control capability based on occupant presence or usage pattern (1 pt) ● Lighting control system (1 pt)	4		3.3.4.1	Thermal Resistance and Transmittance The thermal resistance (R/RSI) or the thermal transmittance (U- /C- /F-factor) values for all the opaque elements of the building envelope meet or exceed the requirements per Green Globes New Construction Technical Manual	10
	706.9	Automatic Demand Response An automatic demand response system is installed that curtails energy usage upon a signal from the utility or energy service provider.	1		3.3.4.2	Orientation The building is oriented such that the ratio of the north/south fenestration area to the east/west fenestration area is 2.00 (5 pts), 1.85-1.99 (4 pts), 1.70-1.84 (3 pts), 1.55-1.69 (2 pts), 1.40-1.54 (1 pt), 1.25-1.39 (0.5 pts)	4
	703.1.1.1	Maximum UA The total building UA is less than or equal to the total maximum UA as computed by 2015 IECC. The total UA proposed and baseline calculations are documented. REScheck or COMcheck is deemed to provide UA calculation documentation. Points are available enhanced improved thermal envelope based on UA and climate zone.	Mandatory				
	703.1.1.2	Prescriptive R-values The building thermal envelope is in accordance with the insulation requirements of 2015 IECC.	Mandatory				
703.7.1	Passive Solar Design The building is designed for passive solar, including but not limited to, the long side of the building facing within 20 degrees of true south, overhangs or adjustable canopies or awnings or trellises provide shading on south-facing glass for the appropriate climate zone, and the south face windows have a SHGC of 0.40 or higher.	13					

Figure 7: Energy Efficiency Practices

ICC/ASHRAE 700-2015 NGBS			Points Possible	Green Globes			Points Possible
Energy Efficiency	703.1.1.2	Fenestration Requirements The building is in accordance fenestration requirements of 2015 IECC. The Solar Heat Gain Coefficient (SHGC) is in accordance with 2015 IECC requirements. Points are available enhanced fenestrations based on U-Factor, SHGC, and climate zone.	Mandatory 6 points available	Energy	3.3.4.3	Fenestration Systems <ul style="list-style-type: none"> The thermal transmittance (U-factor) of the building's fenestration system is less than or equal to the values set in the Green Globes New Construction Technical Manual (8 pts) The Solar Heat Gain Coefficient (SHGC) of the building's fenestration system is less than or equal to the values set in the Green Globes New Construction Technical Manual (8 pts) 	16
	703.2.5.1	Efficient Fenestration NFRC-certified U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices (TDDs) do not exceed the values in NGBS Table 703.2.5.1.	Mandatory (Prescriptive Path)				
	703.2.5.2	Enhanced Fenestration NFRC-certified (or equivalent) U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices (TDDs) meet the values in NGBS Table 703.2.5.2.	6				
	701.4.4	High-Efficacy Lighting Dwelling unit(s) must either have a minimum of 75% of total hard-wired lighting fixtures or bulbs qualify as high efficacy, or the lighting power density be 1.1 watts/square foot or less.	Mandatory		3.3.5.1	Total Lighting Power Density The total lighting power density (LPD) of the building is at or below the allowed lighting power density given in Green Globes New Construction Technical Manual	10
	703.6.1	Hard-wired Lighting <ul style="list-style-type: none"> 95% percent of the total hard-wired interior luminaires or lamps qualify as ENERGY STAR or equivalent. (2-3 pts based on climate zone) In multifamily buildings, common area lighting power density (LPD) is less than 0.51 Watts per square foot. (7 pts) 	10				
	705.2.1	Interior Lighting Controls Points can be earned for providing dimming controls and/or occupancy sensors for interior lighting fixtures of dwelling units. Multifamily projects can earn points for having dimmers or occupancy sensors in common areas.	4		3.3.5.2	Interior Automatic Light Shutoff Controls Light fixtures have time-scheduling devices and/or individual occupant-sensing devices: <ul style="list-style-type: none"> More than 50% (3 pts) 30% - 50% (2 pts) 10% - 29% (1 pt) 	3
	705.2.1	Lighting Reduction Controls Multifamily projects can earn points for having occupancy sensors in corridors, garages, parking structures and exit stairwells. A reduction of 50% earns 4 points and a reduction of 75% or more earns 6 points.	6		3.3.5.3	Light Reduction Controls Light fixtures have lighting controls that can reduce the lighting load by at least 50% from full lighting using any of the following technologies: <ul style="list-style-type: none"> More than 50% (4 pts) 30% - 50% (3 pts) 10% - 29% (2 pts) 	4
	705.2.2	TDD's and Skylights A tubular daylight device or skylight is installed in rooms without windows.	2		3.3.5.4	Daylighting <ul style="list-style-type: none"> Regularly occupied side-lit daylighted areas (vertical fenestration) and the top-lit daylighted areas (skylights) are equal to at least 10% of the net building area (3 pts) The effective aperture for vertical fenestration (EAVF) is equal to or greater than 0.10 EAVF for climate zones (CZ) 1, 2, 3A, or 3B or 0.15 EAVF for climate zones 3C, 4, 5, 6, 7, or 8 (3 pts) A percentage of the roof consists of skylights: ≥5% (2 pts); 4-<5% (1.5 pts); 3-<4% (1pt); 2-<3% (0.5 pts) 	8

Figure 7: Energy Efficiency Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible	
Energy Efficiency	703.6.1 (2)	Exterior Lighting Wattage A minimum of 80% of the exterior lighting wattage has a minimum efficacy of 40 lumens per watt, or is solar-powered.	1	3.3.5.6	Exterior Luminaires and Controls <ul style="list-style-type: none"> Exterior luminaires have lamps with an initial system efficacy of at least 60 lumens per watt (1 pt) LED lamp sources are used for all exterior lighting (1 pt) Lamps specified have low or no mercury content (1 pt) All one of the following controls be installed for exterior lighting: <ul style="list-style-type: none"> Lighting designated for dusk-to-dawn are controlled by a photo sensor or astronomical time switch with 10-hour backup (2 pts), OR lighting not designated for dusk-to-dawn controlled by a time switch with 10-hour backup (1 pt) 	5
	705.2.1.2	Exterior Lighting Controls Photo or motion sensors are installed on 75 percent of outdoor lighting fixtures to control lighting.	1			
	701.4.1.1	HVAC System Sizing Equipment is sized according to loads calculated using ACCA Manual J (or equal).	Mandatory	3.3.6.2	Cooling Equipment <ul style="list-style-type: none"> The cooling equipment base efficiency meets ANSI/ASHRAE/IES Standard 90.1-2010 efficiency requirements with respect to COP, EER and SEER. (1-5 pt) The cooling equipment base efficiency exceeds ANSI/ASHRAE/IES Standard 90.1-2010 or ANSI/ASHRAE/IESNA Standard 90.1-2007 with respect to Seasonal energy efficiency ratio (SEER) or Integrated part-load value (IPLV), AND the Coefficient of Performance (COP) or Energy Efficiency Ratio (EER) (1-8 pts) 	13
	705.5	HVAC Design and Installation 705.5.1: HVAC Contractor and service technician are certified by nationally/regionally recognized program (e.g., Building Performance Institute). (1 Pt) 705.5.2: Performance of system is verified by HVAC contractor, including start-up procedure refrigerant charge, air handler speed, and total airflow, among others. (3 Pts)	4			
	703.3	HVAC Equipment Efficiency Design and install HVAC equipment that meets efficiency standards stated in NGBS Section 703.3 Tables. Points are dependent on equipment type and Climate Zone.	1-52			
	701.4.1.1	HVAC System Sizing See above	Mandatory			
	705.5	HVAC Design and Installation See above	See above	3.3.6.5	Heating Equipment The heating equipment exceed ANSI/ASHRAE/IESNA Standard 90.1-2010, ANSI/ASHRAE/IESNA Standard 90.1-2007, or International Energy Conservation Code (IECC) 2009 for either Annual fuel utilization efficiency (AFUE), Thermal efficiency (ET), or Combustion Efficiency (EC) <ul style="list-style-type: none"> ≥15% (8 pts) 13-14% (7 pts) 11-12% (6 pts) 9-10% (5 pts) 7-8% (4 pts) 5-6% (3 pts) 3-4% (2 pts) 1-2% (1 pt) 	8
	703.3	HVAC Equipment Efficiency See above	See above			
	703.5	Water Heating System Water heating system meets the necessary Energy Factor or Solar Energy Factor required to earn points. Points are dependent on water heater type (gas, heat pump, desuperheater, solar, etc.) and climate zone.	25	3.3.6.8	Domestic Hot Water Heaters <ul style="list-style-type: none"> All domestic hot water heaters meet the efficiency requirements of ANSI/ASHRAE/IESNA STANDARD 90.1-2010 or 90.1-2007, or IECC 2009 (2 pts) All domestic hot water heaters are equipped with intermittent electrical igniters and low NOx burners (1 pt) 	3
706.4	Pumps <ul style="list-style-type: none"> Electronically controlled variable-speed pumps are installed. Sump pumps with electrically commutated motors or permanent split capacitor motors are installed. 	5	3.3.6.9	Variable Speed Control of Pumps The connected hydronic pumping power is provisioned with variable speed control <ul style="list-style-type: none"> >75% (6 pts) 74-75% (5 pts) 55-73% (4 pts) 35-54% (3 pts) 15-34% (2 pts) 	6	
			Energy			

Figure 7: Energy Efficiency Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes	Points Possible	
Energy Efficiency	701.4.2.1	Duct Air Sealing All duct sealing is in conformance with UL 181A or UL 181B	3.3.7.3	7	
	701.4.2.2	Ducts and Plenums Building cavities are not used as ducts or plenums.			
	701.4.2.3	Duct System Sizing Duct systems are sized and designed in accordance with ACCA Manual D (or equal).			
	703.1.3	Duct Testing The duct system is in accordance with 2015 IECC R403.3.2 through R403.3.5 as applicable.			
	703.4	Duct Systems Install ductless heating and/or cooling systems, install all ducts in the conditioned space, and/or have the entire HVAC duct system tested by a third party for total leakage at a pressure differential of 25 Pa and max air leakage is no more than 6% of design flow rate, or 4.0 cfm at 25 Pascals per 100 square feet. Points are dependent on climate zone.			
	706.5	On-Site Renewable Energy System An on-site renewable energy production system is installed. Two points are awarded based on kW produced, divided by the number of dwelling units.	2 or more (kW per DU)	3.3.9.1	20
	706.2	Renewable Energy Service Plan A renewable energy service plan is provided: - Builder's local administrative office has renewable energy service and also selects renewable energy service plan for interim electric service for project until occupant occupied (1 Point) - The homeowner selects a renewable energy service provider with minimum two-year commitment for 1-49% (1 Point) or 50%+ (2 Points) of projected energy use.	3	3.3.9.2	18
	501.2 (1)	Mass Transit The project is located within 1/2-mile of pedestrian access to a mass transit system	6	3.3.10.1	10
	706.8	Electrical Vehicle Charging Station A Level 2 or 3 electric vehicle charging station is installed on the building site.	2	3.3.10.3	5
	501.2 (5)	Dedicated Bicycle Lanes The project is located within an community that has right-of-way, dedicated bicycle paths or lanes, or on an infill lot located within 1/2 -mile of a bicycle lane designated by the jurisdiction.	5	3.3.10.4	3
	501.2 (6)	Bicycle Parking Dedicated bicycle parking and racks are provided for mixed-use and multifamily buildings: <i>Path 1:</i> Minimum of 1 bike space per 3 residential units (2 pts) <i>Path 2:</i> Minimum of 1 bike space per 2 residential units (4 pts) <i>Path 3:</i> Minimum of 1 bike space per 1 residential units (6 pts)	6	3.3.10.5	3
	501.2 (3)	Walkability and Pedestrian Access Design walkways, street crossings, and entrances to promote pedestrian activity and are connect to existing sidewalks or areas of development.	5	3.3.10.6	1
	701.4.3.1	Building Thermal Envelope Air Sealing Building thermal envelope is durably sealed to limit infiltration. All openings, penetrations, joints, seams, connections, common walls, and other sources of infiltration are caulked, gasketed, weather-stripped, or otherwise sealed with an air barrier material, suitable film, or solid material.	Mandatory	3.5.10.1	4
			Fans and Ductwork <ul style="list-style-type: none"> The duct distribution system comprises of the following: Diffusers and registers sized with a full flow pressure drop no greater than 0.01 inches of water column (0.5 pts); Noise criteria of 35 or less (0.5 pts); Supply and return ductwork with a pressure drop no greater than 0.1 inch of water column per 100 lineal feet (0.5 pts) There are the following requirements for flexible duct work: No longer than 5 feet when fully stretched (0.5 pts); The use of flexible ductwork is limited to only connections between duct branches and diffusers, and connections between duct branches and variable air volume terminal units (0.5 pts); Durable elbow support is provided when flexible ductwork is used as an elbow (0.5 pts) The duct joints are sealed and have the seams been leak-tested and found to have an overall leak rate that does not exceed 5% (1 pt) Motors for fans meet NEMA's Premium® "Energy Efficiency Motor Program" (1 pt) Variable speed fans are controlled by a duct pressure set-point or an energy management control system (2 pts) 		
			On-Site Renewable Energy <ul style="list-style-type: none"> A study has been conducted to determine the technical feasibility and life-cycle cost effectiveness of on-site renewable energy (9 pts) The recommendations of the Feasibility Study above are fully implemented (23 pts) or partially implemented (11 pts) 		
			Off-Site Renewable Energy The building owner committed to sign a contract to purchase either certified "green" power or certified renewable energy certificates (RECs) with a minimum three-year commitment for a percentage of total electrical consumption of the building <ul style="list-style-type: none"> ≥40% (18 pts) 20-39% (14 pts) 10-19% (10 pts) 		
			Public Transportation The site located within 0.25 miles of a public transportation facility such as a public bus stop or train-stop		
			Alternative Fuel Stations There are alternative fuel re-fueling facilities or electric charging stations on site or in the general vicinity		
			Bicycle Paths The site is located within 0.25 miles of a public bicycle path, multi-user path, or on a road with an existing dedicated bicycle lane		
			Bicycle Parking There is sheltered bicycle parking for at least 5% of the maximum number of office building occupants, or at least 50% of units in a multi-family residential building		
			Walkability The building's walkability index is greater than 75%, per the Walk Score website		
			Air Barriers A continuous air barrier will be installed according to the following practices: <ul style="list-style-type: none"> The air barrier material of each assembly detail shows an airtight and flexible joint between the air barrier material and adjacent assemblies (0.5 pts) The air barrier is designed to withstand positive and negative combined design wind, fan and stack pressures on the air barrier without damage or displacement (0.5 pts) The air barrier is designed to withstand movement in the structure and not displace materials under full load (0.5 pts) Air barrier connection details are shown between: foundation and walls; walls and windows or doors; different wall systems; wall and roof; wall and roof over conditioned space or wall and ceiling under unconditioned space; walls, floors, and roof across construction, control, and expansion joints; walls, floors, and roof to utility, pipe, and duct penetrations (0.5 pts) Compliance of the continuous air barrier for the opaque building envelope was demonstrated using one of the following strategies: Materials tested in accordance with ASTM E2178-11 Standard Test Method for Air Permeance of Building Materials (2 pts), Assemblies tested in accordance with ASTM E2357-11 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies, or ASTM E1677-11 Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls (2 pts), or building tested with ASTM E779-03 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization (2 pts) 		

Figure 7: Energy Efficiency Practices

Other NGBS Energy Efficiency Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible
701.4.1.2	Radiant and Hydronic Space Heating System is designed, installed, and documented using industry-approved guidelines and standards.	Mandatory
701.4.3.2.1	Grade I Insulation Installation Insulation must be installed to Grade 1 standards and visually inspected by Green Verifier before installation of drywall.	Mandatory
701.4.3.2.2	Air Sealing & Insulation Testing <ul style="list-style-type: none"> Building envelope tightness must be tested with blower door per ASTM E-779. Air barrier and insulation must be field verified by Green Verifier pre-drywall and post-construction. 	Mandatory
701.4.3.4	Fenestration Air Leakage Fenestrations, such as windows, must not have an infiltration rate of 0.3 cfm per square foot, while swinging doors must not exceed 0.5 cfm per square foot.	Mandatory
701.4.3.5	Recessed Lighting Recessed luminaires installed in the thermal envelope must be sealed to limit air leakage, must be IC-rated and labeled as meeting ASTM E283, and sealed with a gasket or caulk.	Mandatory
701.4.5	Boiler Supply Piping Any boiler supply piping in unconditioned space must be insulated	Mandatory
703.1.2	Building Envelope Leakage Building thermal envelope must be in accordance with 2015 IECC R402.4.1.2 or C402.5	Mandatory (Prescriptive Path)
703.5.5	Solar Water Heater Solar domestic water heating system is installed and meets Solar Rating & Certification Corporation OG 300 rating. Points awarded based on Solar Energy Factor and Climate Zone.	1-33
703.6.2	ENERGY STAR Appliances Install ENERGY STAR-qualified appliances for the following: <ul style="list-style-type: none"> Refrigerator (1 pt) Dishwasher (1 pt) Washing Machine (4 pts) 	6
705.2.3	Lighting Outlets Occupancy sensors are installed for 80% or more hard-wired lighting outlets in living spaces.	1
705.2.4	Recessed Luminaires Recessed luminaires penetrating the thermal envelope is less than 1 per 400 square feet.	1
705.3	Induction Cooktop An induction cooktop is installed.	1
705.4	Return Ducts/Transfer Grilles Return ducts or transfer grilles installed in every room with a door (except bathrooms, kitchens, closets, pantries, and laundry rooms).	2
705.6.1	Installation and Performance Verification Third-party onsite inspections are conducted pre-drywall and post-construction to verify proper duct installation and sealing, building envelope sealing, and all fenestration sealing, in addition to Green Verifier inspection.	3
705.6.2.1	Air Leakage Validation of Building or Dwelling Units If not required by IECC 2015, blower door testing (3 Points) or third party verification (5 Point) is completed.	5
705.6.2.2	HVAC Airflow Testing Balanced airflows are demonstrated by a third-party. Test results are in accordance with ACCA 5 QI-2010, Section 5.2.	5
705.6.2.3	HVAC Duct Leakage Testing If not required by IECC 2015, duct leakage is tested in accordance with IECC R403.3.3 and R403.3.4 (3 Points). An additional 2 points can be earned if conducted by independent third party.	5
705.6.3	Insulating Hot Water Pipes Piping involved in hot water is insulated with a minimum thermal resistance of R-3	1
705.6.4	Potable Hot Water Demand Re-circulation System A Potable Hot Water Demand Re-circulation System is installed.	2
705.7	Submetering System In a multifamily building, an advanced submetering system is installed to monitor energy consumption for each unit. Information is available to occupants monthly.	1
706.3	Smart Appliances and Systems Smart appliances and systems are installed for at least three of the following: refrigerator, freezer, dishwasher, clothes dryer, clothes washer, HVAC System, Service Hot Water Heating System	2

Other Green Globes Energy Practices

Green Globes		Points Possible
3.3.1.2	Benchmarking Energy Performance There is a program or policy in place to compare actual performance data from the first year of operation with the energy design target. No points are available for completing this practice.	0
3.3.3.1	Building-Level Metering There is metering (at the building level) for the following: <ul style="list-style-type: none"> Electricity (1 pt) Heating fuels (1 pt) Steam (1 pt) Other (1 pt) Sub-Metering There is sub-metering for the following: <ul style="list-style-type: none"> Lighting and lighting controls by floor or by zones with floor areas no greater than 20,000 sqft (0.5 pt) Plug loads by floor or by zones no greater than 20,000 sqft (0.5 pt) Major electric HVAC equipment 5 HP or greater (0.5 pt) Chilled water generation (0.5 pt) On-site renewable energy power generation (0.5 pt) Heating water or steam generation (0.5 pt) Specialty or process electrical equipment (0.5 pt) Critical HVAC controls (0.5 pt) 	8
3.3.3.2	Measurement and Verification The Energy Metering Reporting Plan includes the following monitoring protocols (e.g. daily, monthly, seasonal, by floor, etc.): <ul style="list-style-type: none"> Lighting and lighting controls: daily demand and consumption by floor or by zones with floor areas no greater than 20,000 sqft (0.5 pt) Plug loads: daily demand and consumption by floor or by zones no greater than 20,000 ft (0.5 pt) Major electric HVAC equipment 5 HP or greater: seasonal peak demand and monthly consumption (0.5 pt) Chilled water generation: seasonal peak output and monthly consumption (0.5 pt) On-site renewable energy power generation: monthly peak output, monthly production, and site specific weather characteristics (0.5 pt) Heating water or steam generation: seasonal peak and monthly consumption (0.5 pt) Specialty or process electrical equipment: daily demand and consumption (0.5 pt) Critical HVAC controls: status monitoring and verification (0.5 pt) 	4
3.3.3.5	Controls for Daylighted Zones <ul style="list-style-type: none"> All small daylight areas (<2,501 sqft) have manual or automatic photocell lighting controls (3 pts) All large daylight areas (>2,500 sqft) have automatic photocell lighting controls (3 pts) Exterior luminaires have lamps with an initial system efficacy of at least 60 lumens per watt (1 pt) 	6
3.3.6.1	Building Automation System (BAS) There is a central Building Automation System (BAS) that encompasses all systems that affect building energy performance, lighting, and thermal comfort	10
3.3.6.3	Cooling Towers <ul style="list-style-type: none"> Any of the following measures are used in cooling towers to reduce fan energy consumption: Two speed fans, Variable speed fans, or other measures (4 pts) There is a waterside economizer system with capacity to use outdoor air for cooling water (4 pts) 	8
3.3.6.4	Cooling Towers The heating efficiency for heat pump applications exceed ANSI/ASHRAE/IESNA STANDARD 90.1-2010, ANSI/ASHRAE/IESNA Standard 90.1-2007, or International Energy Conservation Code (IECC) 2009 requirements for either Heating Seasonal Performance Factor (HSPF) or Coefficient of Performance (COP) <ul style="list-style-type: none"> ≥15% (6 pts) 13-14% (5 pts) 11-12% (4 pts) 9-10% (3 pts) 7-8% (2 pts) 5-6% (1 pt) 	6

Figure 7: Energy Efficiency Practices

Other NGBS Energy Efficiency Practices (cont'd)

ICC/ASHRAE 700-2015 NGBS		Points Possible
Energy Efficiency	706.6 Parking Garage Efficiency Structured Parking Garages are designed to require no mechanical ventilation for fresh air.	2

Other Green Globes Energy Practices (cont'd)

Green Globes		Points Possible
Energy	3.3.6.6 Condensate Recovery Steam heating systems (including district systems) are equipped to recover and return condensate (excluding trap losses) <ul style="list-style-type: none"> • >80% condensate return (3 pts) • 65-79% (2 pts) • 50-64% (1 pt) 	8
	3.3.6.7 Steam Traps <ul style="list-style-type: none"> • All steam trap designs are sealed/stamped by a Professional Engineer (1 pt) • There are isolation valves to allow all steam traps to be isolated for repairs (1 pt) 	2
	3.3.7.1 Minimizing Reheat and Re-cool The HVAC design minimizes (3 pts) or eliminates (6 pts) re-heat and re-cool	6
	3.3.7.2 Air Economizers <ul style="list-style-type: none"> • There are air economizers with a mode that uses outdoor air for cooling in place of mechanical cooling (1 pt) • There are controls to shut outdoor air and exhaust air dampers during periods when the system is not operating (1 pt) • The dampers in the air handline system are "low leakage" (1 pt) 	3
	3.3.7.4 Demand Controlled Ventilation <ul style="list-style-type: none"> • There are occupancy and/or CO2 sensors to control ventilation rates in regularly occupied spaces that may experience frequent variations in the number of occupants (4 pts) • CO2 sensors are capable of maintaining calibration within 2% for a one year period of operation (1 pt) • The ventilation heat recovery systems includes a pressure-drop impact on fan power (1 pt); Bypass for economizer operation, if applicable (2 pts); and/or MERV 13 Filtration (2 pts) 	7
	3.3.7.5 Variable Refrigerant Flow Systems The HVAC design utilizes Variable Refrigerant Flow (VRF) system technology	6
	3.3.8.1 Elevators and Escalators <ul style="list-style-type: none"> • There are regenerative braking elevators (3 pts) • Escalators and moving walkways are equipped with the capability to slow down or stop when detectors indicate no traffic (2 pts) 	5
	3.3.8.2 Other Energy Efficient Equipment The building's energy efficiency is increased through the use of one or more of the following energy efficient equipment: Energy efficient lighting fixtures, lamps, and ballasts (2 pts); Energy efficient motors (2 pts); or others (2 pts)	6
	3.3.10.2 Preferred Parking There is designated preferred parking for car/van pooling, and shelter from weather for persons waiting for a lift	2

Water Efficiency

ICC/ASHRAE 700-2015 NGBS – Water Efficiency

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

Mandatory Practices:

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

Minimum Point Requirements:

Table 12: Water Efficiency Minimum Point Requirements

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

Green Globes – Water

The “Water” category is focused on reducing the use of water in the building through whole-building and fixture-specific conservation measures, as well as encouraging the use of alternative water sources. The program also includes a number of non-residential practices, such as water-efficient commercial food and medical equipment.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

Both the NGBS and Green Globes focus on reducing water use of the building through increased efficiency and conservation, as well as encouraging the use of alternative water sources. Green Globes provides an optional water consumption calculator in order to determine the overall projected water savings for the entire building. A project team can also go fixture by fixture and earn points for having Watersense fixtures installed. The NGBS does not provide a calculator for determining overall building water consumption, and projects must earn points by choosing specific practices that result in savings.

Similar to Green Globes, the NGBS does not mandate fixture flush and flow rates, with the exception of water closets in projects seeking Gold or Emerald certification. The one standalone requirement for water in the NGBS is that if irrigation is installed, it must be designed and executed by a qualified professional certified by a WaterSense-labeled program.

For alternative water sources, the NGBS lists specific options for earning points, such as rainwater collection, engineering biological systems and advanced wastewater treatment systems. Green Globes does not award specific practices. However, it does award points for projects that meet 10% or more of their non-potable water needs using alternative sources.

Green Globes contains multiple practices in this category that do not apply to residential construction, but are available for teams certifying a commercial or institutional facility or spaces. These include practices for reducing water consumption in commercial food service, laboratory and medical equipment, as well as industrial laundry appliances.

Figure 8: Water Efficiency Practices

ICC/ASHRAE 700-2015 NGBS			Points Possible	Green Globes			Points Possible
Water Efficiency	801.3	<p>Showerheads</p> <ul style="list-style-type: none"> Showerheads are less than 2.5 gpm. (4 pts for 1st shower, 1 pt for each added shower, 7 pts max) All showerheads are less than 2.5 gpm (6 added pts), less than 2.0 gpm (10 added pts), or less than 1.6 gpm (14 added pts). Showers can shut off flow without affecting temperature. (1 pt each, 3 pts max) 	24	Water	3.4.1.2	<p>WaterSense Fixtures</p> <p>The following plumbing fixtures and fittings are certified as being compliant with the requirements of the U.S. EPA's WaterSense Program:</p> <ul style="list-style-type: none"> Toilets with max flush volumes of 1.28 gallons (2 pts) Urinals with max flush volumes of 0.5 gallons (2 pts) Showerheads with max flow rate of 2.0 gpm (2 pts) Residential lavatory faucets with max flow rate of 1.5 gpm (2 pts) Residential kitchen faucets with max flow rate of 2.2 gpm (2 pts) Non-residential lavatory faucets with max flow rate of 0.5 gpm (2 pts) 	12
	801.4	<p>Lavatory Faucets</p> <ul style="list-style-type: none"> Bathroom faucets are 1.5 gpm or less. (1 pt each, 3 pts max) All bathroom faucets are 1.5 gpm or less. (6 added pts) Self-closing valve, motion sensor, metered, or petal-activated faucet installed. (1 pt each, 3 pts max) 	12		3.4.1.3	<p>Non-WaterSense Fixtures</p> <p>If any water fixtures not addressed by the WaterSense program requirements were used in the project design, the projected consumption rates for these fixtures was determined and entered into the Green Globes Water Consumption Calculator</p>	2
	801.5	<p>Water Closets and Urinals</p> <ul style="list-style-type: none"> Water closet have a flush volume of 1.28 gal or less. (2 pts per fixture, 6 pts max) All water closets have a flush volume of 1.28 gal or less. (11 pts, and Mandatory for Gold or Emerald Certification) Water closets have flush volume of 1.2 gal or less. (1 added pt per toilet, 3 pts max) One or more urinals have flush volume of 0.5 gal or less. (1 added pt) One or more toilets and/or urinals are composting or waterless. (6 added pts) 	19		3.4.1.4	<p>Energy Star Clothes Washer</p> <p>Residential clothes washers are ENERGY STAR® labeled with a maximum water factor of 6.0 gal/ft3 per full cycle</p>	2
	801.2	<p>Water-Conserving Appliances</p> <p>ENERGY STAR or equivalent water-conserving dishwasher (2 pts) and/or washing machine (13 pts) or washing machine with a water factor of 4.0 or less (24 pts) are installed.</p>	24		3.4.1.5	<p>Energy Star Dishwasher</p> <p>Residential dishwashers are ENERGY STAR® labeled with a maximum water factor of 5.8 gal/ft3 per full cycle</p>	2
	802.1.2	<p>Reclaimed , Gray , or Recycled Water (Irrigation)</p> <p>Irrigation demand is met by reclaimed, gray or recycled water on-site.</p>	10		3.4.6	<p>Alternate Sources of Water</p> <p>A percentage of water for non-potable uses will be harvested on-site or reclaimed:</p> <ul style="list-style-type: none"> >50% (5 pts) 25-50% (3 pts) 10-24% (1 pt) 	5
	801.6	<p>Irrigation Systems</p> <ul style="list-style-type: none"> Sprinkler nozzles have a max precipitation rate of 1.2 in/hr, tested by a third-party laboratory. (6 pts) Drip irrigation is installed in landscapes beds, turf, and zone specs show plant type and water need for each emitter. (13 pts max) Mandatory: Irrigation plans must be executed by a qualified professional certified by WaterSense labeled program. Either no irrigation (& corresponding landscape plan), irrigation. controller with rain sensor/soil moisture sensor installed, or irrigation. controller labeled by WaterSense installed. (15 pts max) Irrigation zones use pressure regulation (3 pts) 	Mandatory + 26 Points		3.4.8	<p>Irrigation</p> <ul style="list-style-type: none"> A percentage of exterior vegetated space does not require irrigation: ≥75% (14 pts), 50-74% (11 pts), 25-49% (8 pts) The irrigation system includes either gutter downspouts directed into landscaping or onsite cisterns and/or rainwater harvesting system, or reclaimed water system (1 pt) The irrigation system includes drip or low-volume irrigation (1 pt) The irrigation system includes EPA WaterSense/Smart Water Application Technology (SWAT), smart controllers (ET, rain sensors, or soil moisture sensors), and automatic rain shut off devices (1 pt) The irrigation system includes the capability to regulate precipitation rates on sprinkler heads for differing hydrozones (0.5 pt) The irrigation system includes swing joints or flex pipes used on all in-ground irrigation heads (0.5 pt) 	18
	801.7.1	<p>Rainwater Collection and Distribution (Irrigation)</p> <ul style="list-style-type: none"> Rainwater is diverted to landscape without storage. (5 pts) Storage of rainwater provided: 50-499 gal (5 pts), 500-2499 gal (10 pts), 2500 gal or larger designed by ARCSA professional. (15 pts) All irrigation met by rainwater capture, designed by ARCSA professional. (25 pts) 	25				

Figure 8: Water Efficiency Practices

Other NGBS Water Efficiency Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	
Water Efficiency	801.1	<p>Indoor Hot Water Usage</p> <ul style="list-style-type: none"> • Demand controlled hot water priming pump installed on main supply pipe, and volume in circulation loop from heater to furthest fixture is 1 gal. (39 pts) • Central hot water recirculation system implemented in multifamily. (9 pts) • Tankless water heater w/ at least 0.5 gal storage or ramp up to 100F in 5 secs installed. (4 added pts) 	43
	801.8	<p>Sediment Filters</p> <p>Water filter installed to reduce sediment and protecting plumbing for entire building or dwelling unit(s).</p>	1
	802.2	<p>Reclaimed Water, Graywater, or Rainwater Pre-Piping</p> <p>These systems are rough-plumbed into building for future use. (3 pts per system, 9 max)</p>	9
	802.3	<p>Automatic Shutoff Water Device</p> <p>One of the following installed: excess water flow automatic shutoff or leak detection system with automatic shutoff.</p>	2
	802.5	<p>Recirculating Humidifier</p> <p>Where humidifier required, a recirculating humidifier is used in lieu of flow through type.</p>	1
	801.1	<p>Indoor Hot Water Usage</p> <p>Max volume from water heater to furthest fixture is 1 gallons [11 pts] , 0.5 gallons [17 pts], or 0.25 gallons [29 pts]</p>	29
	801.7.2	<p>Rainwater Collection and Distribution (Domestic)</p> <ul style="list-style-type: none"> • Rainwater is used to supply indoor appliance(s) or fixture(s). (5 pts each, 25 max) • Rainwater used for total domestic demand. (25 pts) 	25
	802.1.1	<p>Reclaimed , Gray , or Recycled Water (Domestic)</p> <p>Water closet flushed by reclaimed, gray, or recycled water. (5 pts each, 20 max)</p>	20
	802.4	<p>Engineered Biological System or Intensive Bioremediation System</p> <p>One of these systems are installed and treated water is used on-site.</p>	20
	802.6	<p>Advanced Wastewater Treatment System</p> <p>Advanced wastewater (aerobic) treatment system installed and treated water used on-site. (20 pts)</p>	20

Other Green Globes Water Practices

Green Globes		Points Possible	
Water	3.4.1.1	<p>Green Globes Water Consumption Calculator</p> <p>Using the Green Globes Water Consumption Calculator, is the projected water consumption of the building less than the given baseline ≥40% (24 pts), 35-39% (18 pts), 30-34% (12 pts), 25-29% (6 pts)</p>	24
	3.4.2	<p>Cooling Towers</p> <p>Cooling towers meet one or more of the following:</p> <ul style="list-style-type: none"> • A minimum discharge conductivity of 1500 micromhos/cm or maximum of 150 ppm of silica measured as silicon dioxide, OR A minimum of 5 cycles of concentration for makeup water having less than or equal to 200 ppm total hardness as calcium carbonate or 3.5 cycles for makeup water with more than 200 ppm total hardness as calcium carbonate (2 pts) • Exceed the minimum water quality criteria above by 20% or more (1 pt) • Flow meters are on the make-up and blowdown lines, and conductivity controllers (1 pt) • The percentage of cooling consisting of dry cooling is 75 - 100% dry cooling (3 pts), 51-74% dry cooling (2 pts), 21-50% dry cooling (1 pt) • Cooling towers are equipped with drift eliminators that achieved an efficiency of 0.001% or less for counterflow systems (2 pts) 	9
	3.4.3	<p>Boilers and Water Heaters</p> <p>Boilers and/or water heaters have one or more of the following:</p> <ul style="list-style-type: none"> • Boilers and water heating systems of 50 bhp and above have a boiler feed makeup meter (1 pt) • Boiler systems with over 50 bhp have condensate return systems (1 pt) • Boilers have conductivity controllers (1 pt) • Steam boilers have conductivity meters (1 pt) 	4
	3.4.4.1	<p>Commercial Food Service Equipment</p> <p>Food service equipment meets one or more of the following:</p> <ul style="list-style-type: none"> • There is no once-through water-cooled equipment (1 pt) • There is no water-fed garbage disposal (1 pt) • Combination ovens consume 10 gal/hr or less (1 pt) • Pre-rinse spray valves for dish-rinsing consume 1.5 gal/min or less (1 pt) • Boilerless/connectionless food steamers consume 2 gal/hr or less (1 pt) • Dishwashers consume 5.8 gal/cycle or less (1 pt) 	6
	3.4.4.2	<p>Laboratory and Medical Equipment</p> <ul style="list-style-type: none"> • Steam sterilizers are equipped with mechanical vacuum systems (0.5 pt) and/or Water tempering devices that only allow water to flow when the discharge of condensate or hot water from the sterilizer exceeds 140°F (0.5 pt) • Dry vacuum systems are specified for all medical/dental purposes (1 pt) • X-rays, MRIs, CT scans, and other imaging equipment employ digital technologies or large X-ray film systems (capable of processing X-ray films of more than 5.9 inches in length or width) employ recycling technology to reduce water waste (1 pt) • Wet scrubbers are equipped with water recirculation systems (1 pt) 	3
	3.4.4.3	<p>Laundry Equipment</p> <ul style="list-style-type: none"> • Coin or card-operated laundromat machines meet the following: Single-load, soft- or hard-mounted laundromat washing machines with a WF of 8 gal/ft3 or less, and/or Multi-load washing machines with a WF of 9.5 gal/ft3 or less (2 pts) • If an institutional/industrial laundry is installed, it has the following features: Tunnel washing machine that is programmable to use a specific amount of water depending on the soiling of the material to be washed, has a water consumption of less than 1.44 gal/lb, and/or has a water recycling system (2 pts) 	4

Figure 8: Water Efficiency Practices

Other Green Globes Water Practices (Cont'd)

		Green Globes	Points Possible
Water	3.4.4.4	<p>Special Water Features</p> <ul style="list-style-type: none"> • Special water features (e.g. swimming pools, spas, ornamental fountains, water playscapes, etc.) filter and re-circulate water for reuse within the system (2 pts) • Special water features use alternate sources of water for makeup water (1 pt) 	3
	3.4.5	<p>Water Treatment</p> <ul style="list-style-type: none"> • Filtration systems are equipped with pressure drop gauges that allow backwash to be based on pressure drop and not on timers (1 pt) • Reverse osmosis is provided that rejects less than 70% of feedwater volume for a system that produces less than 100 gallon per day or that rejects less than 60% of feedwater for a system that produces more than 100 gallon per day (1 pt) • Water softeners are equipped with recharge controls based on volume of water treated or hardness, and not on timers (1 pt) 	3
	3.4.7	<p>Metering</p> <ul style="list-style-type: none"> • There is sub-metering for all water-intensive indoor applications such as commercial kitchens, commercial laundry, labs, pools, spas, etc (3 pts) • The potable water that is used for irrigation is sub-metered (3 pts) • All water meters and sub-meters are linked to a Meter Data Management System to store and report water consumption data (3 pts) • Chilled or hot water loops are equipped with makeup meters (2 pts) 	11

Indoor Environmental Quality

ICC/ASHRAE 700-2015 NGBS – Indoor Environmental Quality

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

Mandatory Practices:

- Bathrooms are vented to the outdoors.
- Clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors.
- Carbon monoxide alarms are provided in accordance with the IRC Section R315.
- Gas-fired fireplaces and direct heating equipment within dwelling units are installed in accordance with applicable code and vented to the outdoors.
- Solid fuel-burning appliances must be code compliant and in accordance with the requirements listed in Figure 10.
- Doors installed in common walls between garage and conditioned space are sealed and gasketed.
- A continuous air barrier is provided in the wall between the garage and conditioned space.
- Radon control measures are mandatory in Zone 1.
- The living space is sealed in accordance with Section 701.4.3.1 (Building Thermal Envelope Air Sealing) to prevent unwanted contaminants.
- Structural plywood is compliant DOC PS and/or DOC PS 2. OSB meets DOC PS 2.
- Wall-to-wall carpeting is not installed near water closets and bathing fixtures.

Minimum Point Requirements:

Table 13: Indoor Environmental Quality Minimum Point Requirements

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

Green Globes – Indoor Environment

The “Indoor Environment” practice category is focused on providing increased ventilation, reducing the occupants’ exposure to possible indoor pollutants, and bettering the occupants overall experience in the building. This includes installing low-to no-VOC adhesives and paints, providing carbon monoxide monitoring, and designing the interior spaces for acoustic comfort.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

As observed in Figure 9, both systems have multiple optional practices related to whole-building and spot ventilation. When it comes to ventilation, the “Whole Building Ventilation” practice in Green Globes contains multiple compliance pathways.

Both rating systems encourage additional pollution control measures, such as high MERV filters for HVAC equipment and non-smoking policies. Both rating systems also encourage low-emitting products from floor to ceiling by recognizing the value in products that are Zero-VOC or have been tested and found compliant with the California Department of Public Health Standard Method V1.1.

This category contains the highest number of practices in both rating systems that do not relate to each other. As seen in in Figure 9, both systems have several unique practices and both systems offer a wide variety of options for projects to earn points.

Figure 9: Indoor Environmental Quality Green Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes	Points Possible				
Indoor Environmental Quality	902.2.1	<p>Building Ventilation Systems One of the following whole-building ventilation systems is implemented and complies with Appendix D in the NGBS:</p> <ul style="list-style-type: none"> Exhaust air supply fan(s) ready for continuous operation (3 pts) Balanced exhaust and supply fans with supply intakes located in accordance with the manufacturer's guidelines as to not allow polluted air back into the building (6 pts) Heat-recovery ventilator (7 pts) Energy-recovery ventilator (8 pts) 	<p>Mandatory where max air infiltration less than 5.0 ACH50 + 8 Points</p>	3.7.1.1	<p>Building Ventilation Systems The quantity of ventilation air for the building compliant with one of the following:</p> <ul style="list-style-type: none"> ANSI/ASHRAE Standard 62.1-2010 (7 pts), or; ICC 2009 (7 pts), or; IAPMO 2009 (7 pts), or; ANSI/ASHRAE/ASHI 170-2008 (7 pts), or; More stringent local code or standard (7 pts), or; ANSI/ASHRAE Standard 62.1-2007 (5 pts) 	11		
	902.2.2	<p>Ventilation Testing Ventilation airflow is tested to achieve design fan airflow at point of exhaust.</p>	4		<p>The construction documents indicate the ventilation schedule for all occupied spaces (4 pts)</p>			
	902.1.5	<p>Stack-Effect and Cross-Ventilation Fenestration in spaces (except bathrooms, laundry rooms, and kitchens) are designed for stack effect or cross-ventilation in accordance with all of the following:</p> <ul style="list-style-type: none"> Operable windows, skylights, or sliding glass doors with a total area of at least 15% of the conditioned floor area are provided. Insect screens are provided for all operable windows, skylights, and sliding glass doors. A minimum of two operable windows or sliding glass doors are placed in adjacent or opposite walls. If there is only one wall surface in that space exposed to the exterior, the minimum windows or sliding glass doors may be on the same wall. 	3	3.7.1.2	<p>Air Exchange <i>Path A: Mechanical Ventilation Only</i> The zone air distribution effectiveness Ez value is greater than or equal to 0.9 in all regularly occupied spaces, excluding circulation and transitional spaces (8 pts) -OR- <i>Path B: Natural Ventilation Only</i> The following conditions are met as per ANSI/ASHRAE Standard 62.1-2010, Section 5.1:</p> <ul style="list-style-type: none"> All points within habitable spaces considered to be naturally ventilated are within 25 feet of a permanent or operable wall, window or roof opening to the outdoors (2 pts) The unobstructed area of the opening measures at least 4% of the net floor area that is being naturally ventilated (2 pts) Where interior spaces are naturally ventilated through adjoining (perimeter) rooms, the openings between the spaces were designed to have a minimum area of 8% of the net floor area of the interior room and were at least 25 sqft (2 pts) All operable openings are readily accessible to building occupants (2 pts) <p>-OR- <i>Path C: Combination of Mechanical & Natural Ventilation</i> Mechanical Ventilation: Where mechanical ventilation is employed, is the zone air distribution effectiveness Ez value greater than or equal to 0.9 in all regularly occupied spaces, excluding circulation and transitional spaces (4pts) Natural Ventilation: The following conditions are met as per ANSI/ASHRAE Standard 62.1-2010, Section 5.1:</p> <ul style="list-style-type: none"> All points within habitable spaces considered to be naturally ventilated are within 25 feet of a permanent or operable wall, window or roof opening to the outdoors (1 pt) The unobstructed area of the opening measures at least 4% of the net floor area that is being naturally ventilated (1 pt) 	8		
	902.2.3	<p>MERV 8-13 Filters MERV filters 8 to 13 are installed on central forced air systems and are accessible</p>	2		3.7.1.5		<p>Air Handling Equipment Air handling equipment was equipped with MERV 13 filtration, or terminal equipment had the highest filtration level available for the specific equipment under consideration, and main air handlers in terminal systems equipped with MERV 13 filtration</p>	5
	902.2.4	<p>MERV 14 Filters MERV filters 8 to 13 are installed on central forced air systems and are accessible</p>	3					
	901.10	<p>Interior Adhesives and Sealants 85% or more of interior adhesives and sealants meet one of the following:</p> <ul style="list-style-type: none"> Emission are in accordance with California Department of Public Health Standard Method v1.1 (8pts) GreenSeal GS-36 (5 pts) SCAOMD Rule 1168 (5 pts) 	8	3.7.2.1.1	<p>Adhesives and Sealants Adhesives and sealants (not including carpet adhesives) comply with prescribed limits of VOCs and/or are certified</p>	2.5		
	901.7	<p>Floor Materials Materials have emission levels in accordance with California Department of Public Health Standard Method v1.1. The following prefinished hard surfacing comply if no coatings or surface applications are applied: Ceramic tile, mineral-based flooring, clay masonry flooring, concrete masonry flooring, concrete flooring, metal flooring. Carpet and carpet cushion meets California Department of Public Health Standard Method v1.1. (1 pt for every 10% of floor space qualified)</p>	8	3.7.2.1.2	<p>Carpets Carpet, carpet pad, and under-carpet adhesives comply with the Carpet and Rug Institute's (CRI) Green Label Plus program</p>	2		
	901.9	<p>Interior Architectural Coatings 85% or more of architectural coatings meet one of the following:</p> <ul style="list-style-type: none"> Low VOC, no VOC, or GreenSeal GS-11. (6 pts) <p>-OR- Emission levels in accordance with California Department of Public Health Standard Method v1.1 (8pts)</p>	8	3.7.2.1.3	<p>Paints Paints comply with prescribed limits of VOCs and/or are certified</p>	3		
	901.7	<p>Floor Materials See above</p>	See Above	3.7.2.1.4	<p>Flooring Floors, floor coverings, and other interior products comply with prescribed limits of VOCs and/or are certified</p>	2.5		
				Indoor Environment				

Figure 9: Indoor Environmental Quality Green Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible		
Indoor Environmental Quality	903.3	Relative Humidity In climate zones 1A, 2A, 3A, 4A, and 5A defined by the 2015 IECC, install equipment to maintain relative humidity at or below 60% using either additional dehumidification systems or a central HVAC system equipped with controls to operate in dehumidification mode	7	Indoor Environment	3.7.2.2	Moisture and Vapor Control Methods <ul style="list-style-type: none"> HVAC is able to monitor and control dew point (4 pts) Materials and finishes are resistant to mold growth in spaces that generate high humidity (e.g. kitchens, toilet rooms, pools, laundry facilities, shower areas, etc.) (2 pts) There are floor drains located in all areas where equipment failures may cause plumbing leaks or where certain operations may cause spills or overflows (2 pts) 	8
	905.1	Humidity Monitoring System A humidity monitoring system is installed that measures temperature and relative humidity. The system shall have two remote sensor units, minimum, with one inside the conditioned space and the other outside.	2		3.7.2.4	Carbon Monoxide Monitoring Carbon monoxide monitoring devices and alarms in enclosed areas are provided where there are sources of combustion	4
	901.12	Carbon Monoxide (CO) Alarms A CO alarm is provided in accordance with the IRC Section R315	Mandatory		3.7.2.6	Domestic Hot Water Systems Domestic hot water system was designed to maintain hot water storage at or above 131° F (1 pt), or there is a tankless system (2 pts)	2
	801.1	Indoor Hot Water Usage <ul style="list-style-type: none"> Demand controlled hot water priming pump installed on main supply pipe, and volume in circulation loop from heater to furthest fixture is 1 gal. (39 pts) Central hot water recirculation system implemented in multifamily. (9 pts) Tankless water heater w/ at least 0.5 gal storage or ramp up to 100F in 5 secs installed. (4 added pts) 	43		3.7.2.8	Pest and Contamination Control <ul style="list-style-type: none"> Outdoor air inlets have insect screens of 18x14 mesh for plenum systems feeding multiple air handlers (0.5 pts) Structural and mechanical openings are fitted with permanent protection (e.g. screens, sealants, etc.) (0.5 pts) Advertising signs and other assemblies affixed to the building façade are designed and constructed in a way that reduces bird habitation, and penetrations in the façade are sealed to prevent entry (0.5 pts) Mullions and ledges are less than 1 inch deep to discourage bird roosting (0.5 pts) There is a sealed storage area for food/kitchen solid waste and recycling (1 pt) 	3
	902.6	Living Space Contaminants The living space is sealed in accordance with Section 701.4.3.1 (Building Thermal Envelope Air Sealing) to prevent unwanted contaminants.	Mandatory		3.7.2.9.2	No Smoking Signage There is a requirement to post "No Smoking" signage in the building and near all building entrances and air intakes	1
	503.5 (12)	Integrated Pest Management Integrated pest management plan is developed to minimize chemical use in pesticides and fertilizers	4		3.7.2.9.3	Radon A site-specific assessment of radon potential has been conducted and radon mitigation measures were specified	5
	901.14	Non-Smoking Areas Multifamily projects only: <ul style="list-style-type: none"> All interior common areas of a multifamily building are non-smoking, with signage (1 pt) Exterior smoking areas of a multifamily building are located at least 25 feet from 	2		3.7.2.10	Ventilation and Physical Isolation for Specialized Activities <ul style="list-style-type: none"> There is a separate ventilation and/or physical isolation for specialized activities that generate pollutants (1 pt) The separate ventilation systems for specialized activities are capable of maintaining on average, a negative pressure at least 5.0 Pascals on average (1 pt) 	2
	902.3	Radon Control Radon control measures are installed in accordance with ICC IRC Appendix F. <u>Zone 1:</u> <ul style="list-style-type: none"> Radon control is Mandatory. Passive Radon System installed (7 points) Active Radon System installed (10 points) <u>Zones 2 & 3:</u> <ul style="list-style-type: none"> Passive or active radon system installed (7 points) 	Mandatory for Zone 1 + 10 Points		3.7.3.1.3	Exposures There are shading devices on southern, western, and eastern exposures (1 pt), or on some of those exposures (0.5 pts)	1
	902.1.1	Spot Ventilation <ul style="list-style-type: none"> Mandatory: Bathrooms are vented to the outdoors. The minimum ventilation rate is 50 cfm for intermittent operation or 20 cfm for continuous. One point is possible if a window complying with IRC Section R303.3 is provided as well as mech. ventilation.) Mandatory: Clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors. Kitchen exhaust units and/or range hoods are ducted to the outdoors and have a minimum ventilation rate of 100 cfm for intermittent operation or 25 cfm for continuous operation. (8 pts) 	Mandatory + 9 Points		3.7.3.1.4	Shading There are shading devices to eliminate direct sunlight from reaching task areas	1
	703.7.1	Passive Solar Design The building is designed for passive solar, including but not limited to, the long side of the building facing within 20 degrees of true south, overhangs or adjustable canopies or awnings or trellises provide shading on south-facing glass for the appropriate climate zone, and the south face windows have a SHGC of 0.40 or higher.	4				
703.7.2	Window Shading Automated solar protection or dynamic glazing is installed to provide shading for windows	1					

Figure 9: Indoor Environmental Quality Green Practices

Other NGBS Indoor Environmental Quality Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible
901.1.2	No Air Handling in Garage Air handling equipment and return ducts not placed in garage, unless in isolated, air-sealed mechanical rooms with outdoor air source.	5
901.3	Garages <u>Attached garages:</u> <ul style="list-style-type: none"> • Mandatory: Doors installed in common walls with conditioned space are sealed and gasketed (2 pts) • Mandatory: Continuous air barrier is provided in common wall with conditioned space (2 pts) • For 1-2 family dwelling units, ducted exhaust fan installed and vented to outdoors (8 pts) -OR- <u>Detached or no garage:</u> A carport is installed in lieu of garage, garage is detached, or no garage installed (10 pts)	Mandatory + 10 Points
901.1.6	Electric heat pump air handler <u>Path 1:</u> Install the heat pump in an unconditioned space (2 pts) <u>Path 2:</u> Install the heat pump in a conditioned space (5 pts)	5
901.4	Wood Materials 85% or more of material in a wood product group (wood structural panels, composite trim and doors, custom woodwork, etc.) meets the following: <ul style="list-style-type: none"> • Mandatory: Structural plywood (floors, walls, roof sheathing) is compliant DOC PS and/or DOC PS 2. OSB meets DOC PS 2. • Particleboard and MDF is labeled CPA A208.1 and CPA A208.2. (2 pts) • Hardwood plywood meets HPVA HP-1. (2 pts) • Particleboard, MDF, or hardwood plywood meets CPA 4. (3 pts) • Composite wood or agrifiber contains no urea-formaldehyde or meets CARB Composite Wood Air Toxic Contaminant Measure Standard. (4 pts) • No emitting products used. (4 pts) 	Mandatory + 10 Points
901.5	Cabinets 85% or more installed cabinets are: <ul style="list-style-type: none"> • Made of solid wood or non-formaldehyde emitting materials (5 pts) • Composite wood meeting CARB Composite Wood Air Toxic Contaminant Measure Standard (3 pts) 	5
901.6	Bathroom Carpets Wall-to-wall carpeting is not installed near water closets and bathing fixtures	Mandatory
901.8	Wall Coverings 85% of more wall coverings are in accordance with California Department of Public Health Standard Method v1.1.	4
901.11	Insulation 85% or more of wall, ceiling, and floor insulation materials are in accordance with emission levels of California Department of Public Health Standard Method v1.1	4
901.13	Building Entrance Pollutants Control <ul style="list-style-type: none"> • Exterior grilles or mats installed in fixed manner, removable for cleaning (1 pt) • Interior grilles or mats installed in fixed manner, removable for cleaning (1 pt) 	2
902.1.3	Exhaust Verification Kitchen range, bathroom, and laundry exhaust are verified to air flow specification. Ventilation airflow at the point of exhaust is tested to a minimum of 100 cfm intermittent or 25 cfm continuous for kitchens, and 50 cfm intermittent or 20 cfm continuous for bathrooms and/or laundry.	8
902.1.4	ENERGY STAR Exhaust Fans Exhaust fans are ENERGY STAR, as applicable. <ul style="list-style-type: none"> • ENERGY STAR fans, or equivalent (2 pts per fam, 12 pts max) • ENERGY STAR fans operating at or below 1 sone, or equivalent (3 pts per fam, 12 pts max) 	12
902.4	HVAC System Protection Perform one the following: <ul style="list-style-type: none"> • HVAC supply registers, return grilles, and rough-ins are covered during construction. • Prior to occupancy, HVAC supply registers, return grilles, and duct terminations are inspected and vacuumed. Coils are inspected and cleaned. 	3

Other NGBS Indoor Environmental Quality Practices (cont'd)

Other Green Globes Indoor Environment Practices

Green Globes		Points Possible
3.7.1.3	Ventilation Intakes and Exhausts The ventilation systems were equipped with the following features: <ul style="list-style-type: none"> • Exhaust outlets and plumbing vent stacks are located at least 20 feet away from outdoor air intakes (1 pt) • Outdoor air intakes are located at least 30 feet away from sources of pollution (1 pt) • Outdoor air intakes are protected with 0.3 inches or smaller mesh screens (1 pt) • For each air handling system in single or multiple arrangements, filters are compliant with ANSI/ASHRAE Standard 62.1-2010 (2 pts) • Outdoor air inlets and outlets, including louvers and rain hoods, are sized appropriately per ANSI/ASHRAE Standard 62.1-2010 (1 pt) • Except in transfer air ducts, all outdoor air, return air, and supply air ductwork avoids interior liner that could harbor microbial growth and/or erode in the air stream (1 pt) • Roof drainage slopes away from outdoor air intakes (1 pt) 	8
3.7.1.4	CO2 Sensing and Ventilation Control Equipment Rooms that are occupied by several people (e.g. open offices) and those that have variable occupancy (e.g. meeting rooms, assembly areas) have CO2 sensing and ventilation control equipment	5
3.7.2.3	Access for HVAC Maintenance The following measures to facilitate maintenance of HVAC equipment that require routine and periodic maintenance are provided: <ul style="list-style-type: none"> • Access to equipment complies with the 2009 International Code Council International Mechanical Code (ICC IMC 2009), 2009 Uniform Mechanical Code (IAPMO/ANSI UMC 1-2009), and the manufacturer published and/or suggested recommendations (1 pt) • Distribution systems are installed in accordance with ANSI/ASHRAE Standard 62.1-2010, and SMACNA's HVAC Duct Construction Standards: Metal and Flexible 3rd Edition 2005 (1 pt) • Architectural features related to access are specified to be installed in accordance with the International Building Code (1 pt) • Access doors to HVAC are removable or have full degree swing (1 pt) 	4
3.7.2.5	Wet Cooling Towers Wet cooling towers have drift eliminators and inlet air louvers (1 pt), or there are no wet cooling towers (2 pts)	2
3.7.2.7	Humidification and Dehumidification Systems Drain pans for dehumidifying cooling coils are designed to properly capture and drain the condensate in the air handler in terms of the following: <ul style="list-style-type: none"> • Drain pans have a 1/8 inch slope per foot (10 mm slope per meter) in two directions toward the drain outlet • The drain opening is located at the lowest point of the drain pan • The drain pan is sufficiently wide to span the cooling coils and is sized to prevent overflow under peak dew point conditions • A P-trap or other seal prevents ingestion of air while allowing complete drainage 	3
3.7.2.9.1	Tobacco Smoke During Construction There is a construction management policy to prohibit smoking in the building and a provision to require that smoking be a minimum of 25 feet from the building with posted signage	1
3.7.2.9.4	Asbestos Removal There is a requirement that the removal or abatement of asbestos and asbestos-containing materials meet all applicable state and local regulations	1
3.7.3.1.1	Minimum Daylight Factor A percentage of floor area occupied for critical visual tasks achieves a minimum daylight factor (DF) of 2 (excluding all direct sunlight penetration) <ul style="list-style-type: none"> • ≥75% (7 pts) • 50-74% (5 pts) • 25-49% (3 pts) 	7
3.7.3.1.2	Exterior Views A percentage of task areas were designed to have views to the exterior or atria within 25 ft. (7.6 m) from a window <ul style="list-style-type: none"> • ≥30% (5 pts) • 31-59% (3 pts) • 10-30% (1 pt) 	5

Other Green Globes Indoor Environment Practices (cont'd)

Figure 9: Indoor Environmental Quality Green Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible
902.5	Central Vacuum Systems Central vacuum system is installed and vented outside	3
903.1	Plumbing <i>Path 1:</i> Cold water pipes in unconditioned spaces are insulated, R-4 or higher (2 pts) <i>Path 2:</i> Plumbing is not installed in unconditioned spaces. (5 pts)	5
903.2	Duct Installation • All HVAC ducts, plenums, & trunks located in conditioned space (1 pt) • Option 1, as well as all HVAC ducts insulated to R4 or higher (3 pts)	3
904.1	Indoor Air Quality During Construction Wood is kept dry, sources of water infiltration of condensation is eliminated, accessible interior surfaces are dry a free of water damage	2
904.2	Indoor Air Quality Post Completion Verification is performed that no mold, moisture, or dust issues per ASTM D7338 Sections 6.3 and 7.4.3	3
905.2	Kitchen Exhaust The kitchen exhaust unit equals or exceeds 400 cfm, with make-up air provided	2
901.1.1	Natural Draft Heaters Natural draft furnaces, boilers or water heaters are not located in conditioned spaces, unless in mechanical room with outdoor air source which is sealed and insulated from conditioned spaces	5
902.1.2	Bathroom/Laundry Exhaust Fan Controls Bathroom and/or laundry exhaust fan is provided with an automatic timer and/or humidistat. (5 pts for first device, 2 pts for each added device, 11 pts max)	11
901.1.3	Combustion Space/Water Heaters Inside the Conditioned Space • All furnaces or boilers are power-vented (3 pts) or direct-vented (5 pts) • All water heaters are power-vented (3 pts) or direct-vented (5 pts)	5
901.1.4	Gas Fireplaces Gas-fired fireplaces and direct heating equipment within dwelling units are installed in accordance with applicable code and vented to the outdoors.	Mandatory
901.1.5	Natural Gas/Propane Fireplaces Natural gas and propane fireplaces are direct vented, have permanently fixed glass fronts or gasketed doors, and comply with CSA Z21.88/CSA 2.33 or CSA Z21.50b/CSA 2.22b	7
901.2.1	Solid Fuel-Burning Appliances Solid Fuel-burning appliances must be code compliant and are in accordance with the following Mandatory requirements: • Site-built masonry wood-burning fireplaces us outside combustion air and include means of sealing the flue and combustion air outlets. (4 pts) • Factory-built wood burning fireplaces are meet certification requirements of UL 127 and are EPA certified or Phase 2 Qualified. (6 pts) • Wood stove and fireplace inserts meet certification requirements of UL 1482 and meet emission requirements of EPA certification and State of Washington WAC 173-433-100(3). (6 pts) • Biomass stoves and furnaces meet ASTM E1509 or are EPA certified. (6 pts) • Masonry heaters meet definitions in ASTM E1602 and ICC IBC Section 2112.1. (6pts)	Mandatory + 6 points
901.2.2	No Solid-Fuel Indoors Fireplaces, woodstoves, pellet stoves, or masonry heaters are not installed.	6

Green Globes		Points Possible
3.7.3.1.5	Photo-sensors A percentage of daylit areas are there photo-sensors to maintain consistent lighting levels throughout the day using both daylighting and artificial lighting • >75% (3 pts) • 50-75% (2 pts) • 25-49% (1 pt)	3
3.7.3.2	Lighting Design • Primary occupied spaces have the prescribed lighting levels for the types of tasks anticipated in the various building spaces (7 pts) • A lighting designer signed off on calculations that show that luminance ratios do not exceed the following as per IESNA for tasks: 3:1 between the task and adjacent surroundings, 10:1 between the task and remote (non-adjacent) surfaces, 20:1 between the brightest and darkest surface in the field of view, 8:1 between rows of luminaires where there is indirect lighting and where ceiling luminance exceeds 425 cd/m2 (3 pts) • A lighting designer signed off on the design showing that where there is direct lighting the average luminance does not exceed the following values for given luminaire angles: 850 cd/m2 at 65° from the vertical, 350 cd/m2 at 75° from the vertical, 175 cd/m2 at 85° from the vertical (3 pts)	13
3.7.4.1	Thermal Comfort Strategies • Very large functional areas such as big box stores have thermal control zones that are ≥5,000 sqft (2 pts) or ≥2,000 sqft (3 pts) • Large functional areas such as large classrooms and auditoria have thermal control zones that are ≥1,500 sqft (3 pts) • Open circulation areas such as open offices and healthcare general patient areas have thermal control zones that are ≥1,000 sqft (2 pts) or ≥500 sqft (3 pts) • Smaller functional areas such as offices, meeting rooms, and hospital/hotel rooms have thermal control zones that are ≥1,200 sqft (2 pts) or ≥750 sqft (3 pts)	12
3.7.4.2	Thermal Comfort Design An Engineer signed off on the design that shows the building conforms to ANSI/ASHRAE Standard 55-2010 (6 pts) or ANSI/ASHRAE Standard 55-2004 (4 pts)	6
3.7.5.1	Acoustic Comfort Design • Toilets are located remotely from acoustically separated areas (0.5 pts) • Acoustically separated areas are located away from noise producing areas such as dance studios, music rooms, cafeterias, indoor swimming pools, mechanical rooms, and gymnasias (1 pt) • Entry doors to rooms opposite each other on the same corridor are staggered (0.5 pts) • Through-wall penetrations comply with Annex B of ANSI/ASA S12.60-2010/Part 1 (0.5 pts) • Walls separating acoustically separated areas from other areas are constructed full height to underside of the next floor above or the roof deck (1 pt) • Walls separating quiet areas from other areas have all joints and penetrations sealed with acoustical sealant (0.5 pts) • Areas with high floor impact activities (dance studios, shops, gymnasias, etc.) are not located above acoustically separated areas (1 pt) • An Acoustical Consultant or Acoustician signed off on the design that shows that open office areas conform to ASTM E1573-02 with respect to spatial uniformity, temporal uniformity, spectrum shape, and sound level (1 pt) • An Acoustical Consultant or Acoustician signed off on a design that complies with minimum Sound Transmission Class (STC) ratings of floor/ceiling assemblies, walls and doors between acoustically separated areas (e.g. learning spaces), and adjacent spaces (5 pts) • The Impact Insulation Class (IIC) design of all floor-ceiling assemblies have a minimum rating of IIC-50 (2 pts) • An Acoustical Consultant or Acoustician signed off on a design that shows Reverberation Time (RT) in quiet areas and all other areas where speech intelligibility is important does not exceed 0.6 seconds in spaces less than 10,000 cu. ft. in volume, 0.7 seconds in spaces 10,000 - 20,000 cu. ft. in volume, or compliance with Annex C of ANSI/ASA S12.60-2010/Part 1 in spaces larger than 20,000 cu. ft. in volume (5 pts)	18

Figure 9: Indoor Environmental Quality Green Practices

Other Green Globes Indoor Environment Practices (cont'd)

		Green Globes	Points Possible
Indoor Environment		<p><u>Mechanical, Plumbing, and Electrical Acoustic Design</u></p> <p>An Acoustical Consultant or Acoustician signed off on a design that complies with the following:</p> <ul style="list-style-type: none"> ● Airborne sound power levels from HVAC unit do not exceed the Room Criteria detailed in ASHRAE Systems Application Handbook 2007, Chapter 47, Table 42 for listed spaces when HVAC units are in operation (1.5 pts) ● Spaces are designed such that room background noise using the Room Criteria (RC) ratings complies with ASHRAE Systems Application Handbook-2007, Chapter 47, Table 42. (1 pt) ● Duct transitions are spread out and graduated to minimize generation of turbulence and air flow separations (0.5 pts) ● Secondary attenuators are located immediately downstream of duct fittings that would otherwise generate noise (0.5 pts) ● Air flow velocities in low pressure ductwork did not exceed 900 f/m for main duct trunk lines, 700 f/m for branch ducts, 400 f/m for final run outs, 1200 f/m for main vertical ducts in shafts (0.5 pts) 	11
	3.7.5.2	<ul style="list-style-type: none"> ● Where significant cross talk paths exist between two habitable spaces, there are sound attenuators and/or silencers, or ducts are designed in a "Z" configuration (0.5 pts) ● HVAC grilles and diffusers were selected that comply with ANSI/ASA S12.60-2010/Part 1 (0.5 pts) ● Fans and other powered HVAC equipment are acoustically separated from the structure using vibration isolators (1 pt) ● Ducts are supported on resilient mounts to isolate them from the structural system, and ducts are isolated using resilient material where they pass through walls (1 pt) ● Piping was not run above quiet areas and learning spaces with the exception of sprinklers and radiant heating systems (1 pt) ● Waste water piping noise is mitigated using cast iron pipe or with acoustic insulation above quiet areas and learning spaces, and a water hammer arrester was used (1 pt) ● Low-noise ballasts are installed in quiet areas and all other areas where speech intelligibility is important (1 pt) ● Noise from light fixtures and other electrical fixtures does not exceed values indicated in ANSI/ASA S12.60- 	

Operation, Maintenance, Education, and Project Management

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

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

Mandatory Practices:

- Single-family: Provide a home owner’s manual to responsible parties that complies with Figure 11.
- Multifamily: Provide a building construction, operations and maintenance manual to responsible parties that complies with Figure 11.
- Provide onsite training to responsible parties regarding operations and maintenance, control systems, and actions that will improve the environmental performance of the building.

Minimum Point Requirements:

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

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

Green Globes – Project Management

This category within Green Globes focuses on variety of practices, including providing relevant information and training to all applicable parties regarding the green features of the building. In addition to operations and maintenance, this category features available points for using an integrated design process as well as performing commissioning.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

As observed in Figure 10, both systems have practices that encourage the education of building owners and users, and the provision of appropriate operations and maintenance information to responsible parties. The NGBS has separate guidelines for developing operations and maintenance manuals depending on if the project is a single-family or multifamily building. Both systems also promote the importance of indoor air quality during construction by providing available points for completing related practices.

Green Globes also encourages that an integrated design process be employed, with qualitative green design goals and performance objectives established. It also encourages the general contractor to document an environmental management system, including its environmental policy and environmental risk, management strategies, among other required items. These practices are not included in the NGBS.

In addition, Green Globes contains optional practices regarding commissioning, including completion of whole-building commissioning in accordance with AHSRAE guidance and review of the "Owner's Project Requirements."

NGBS awards points for providing public education about the green features of the project, such as construction signs demonstrating how the project is designed and built in accordance with the NGBS. Providing a verification system plan can earn a project additional points. The verification system provides methods for demonstrating continued energy and water savings that are determined from the building's initial year of occupancy of water and energy consumption and comparing it to annualized consumption at least every four years.

Overall, the two programs have few practices and available points within this category. In fact, this category has the lowest number of available points of any category in the NGBS, and is tied with the "Emissions" category in Green Globes as having the lowest number of available points.

Figure 10: Project Management, Operations, and Maintenance

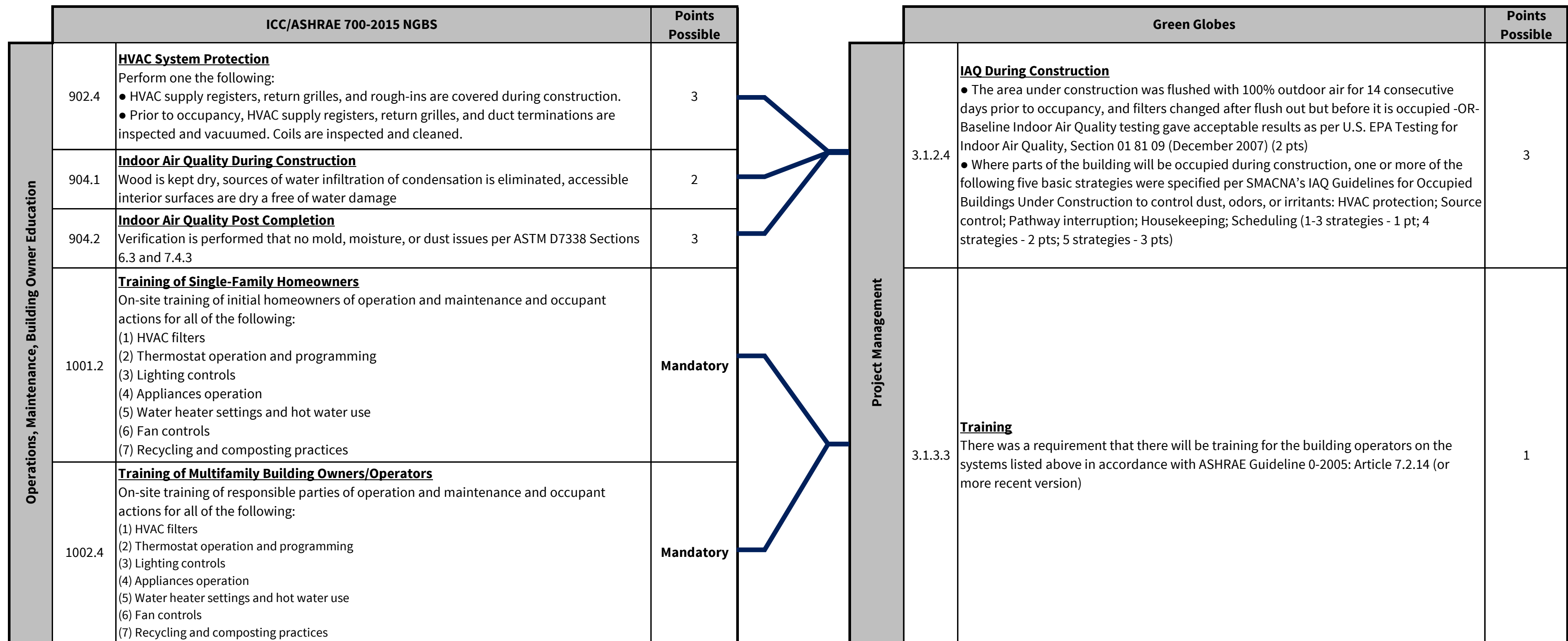


Figure 10: Project Management, Operations, and Maintenance

ICC/ASHRAE 700-2015 NGBS		Points Possible
Operations, Maintenance, Building Owner Education	<p>1001.1</p> <p>Single-Family Homeowner's Manual Provide a homeowner's manual to responsible parties, including the following:</p> <p><u>Mandatory:</u></p> <ul style="list-style-type: none"> • A National Green Building Standard certificate with a web link and completion document. • List of green building features (can include the national green building checklist). • Product manufacturer's manuals or product data sheet for installed major equipment, fixtures, and appliances. If product data sheet is in the building owners' manual, manufacturer's manual may be attached to the appliance in lieu of inclusion in the building owners' manual. <p><u>Optional (One Point awarded per two items):</u></p> <ul style="list-style-type: none"> • Maintenance checklist • Information on local recycling and composting programs. • Information on available local utility programs that purchase a portion of energy from renewable energy providers. • Explanation of the benefits of using energy-efficient lighting systems in high-usage areas. • A list of practices to conserve water and energy. • Information on the importance and operation of the home's fresh air ventilation system. • Local public transportation options. • A diagram showing the location of safety valves and controls for major building systems. • Where frost-protected shallow foundations are used, owner is informed of precautions including: <ul style="list-style-type: none"> - Instructions to not remove or damage insulation when modifying landscaping. - Providing heat to the building as required by the ICC IRC or IBC. - Keeping base materials beneath and around the building free from moisture caused by broken water pipes or other water sources. • A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure. • A photo record of framing with utilities installed. Photos are taken prior to installing insulation, clearly labeled, and included as part of the building owners' manual. • List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials. • Information on organic pest control, fertilizers, deicers, and cleaning products. • Information on native landscape materials and/or those that have low water requirements. • Information on maintaining the building's relative humidity in the range of 30-60%. • Instructions for inspecting the building for termite infestation. • Instructions for maintaining gutters and downspouts and importance of diverting water a minimum of 5 feet away from foundation. • A narrative detailing the importance of maintenance and operation in retaining the attributes of a green-built building. • Where stormwater management measures are installed on the lot, information on the location, purpose, and upkeep of these measures. • Explanation of and benefits from green cleaning in the home. • Retrofit energy calculator that provides baseline for future energy retrofits. 	<p>Mandatory (Earn 1 point for every two optional items)</p>

Green Globes		Points Possible
Project Management	<p>3.1.3.4</p> <p>Operations and Maintenance Manual There was a requirement to develop an Operations and Maintenance (O&M) Manual and/or Computerized Maintenance Management System (CMMS) that meets Green lobes requirements, and is completed as follows:</p> <ul style="list-style-type: none"> • There is/will be a complete, user-friendly O&M manual (6 points) • O&M Manual meets some, but not all requirements (3 points) • There is/will be a complete CMMS (6 points) • CMMS meets some, but not all requirements (3 points) 	<p>6</p>

Figure 10: Project Management, Operations, and Maintenance

ICC/ASHRAE 700-2015 NGBS		Points Possible	Green Globes		Points Possible	
Operations, Maintenance, Building Owner Education	1002.1	<p>Multifamily Building Construction Manual Provide a building construction manual to responsible parties, including 5 or more of the following: <u>Mandatory:</u></p> <ul style="list-style-type: none"> • A narrative detailing the importance of constructing a green building. • A local green building program certificate and the individual measures achieved by the building. • Warranty, operation, and maintenance instructions for all equipment, fixtures, appliances, & finishes. <p><u>Optional (One Point awarded per two items):</u></p> <ul style="list-style-type: none"> • Record drawings of the building. • A record drawing of the site including stormwater management plans, utility lines, landscaping with common name and genus/species of plantings. • A diagram showing the location of safety valves and controls for major building systems. • A list of the type and wattage of light bulbs installed in light fixtures. • A photo record prior to insulation of framing with utilities labeled and installed. 	Mandatory (Earn 1 point for every two optional items)	Project Management	3.1.3.4	See Above
	1002.2	<p>Multifamily Operations Manual Provide an operations manual to responsible parties, including 5 or more of the following: <u>Mandatory:</u></p> <ul style="list-style-type: none"> • Narrative detailing the importance of operating and living in a green building. • A list of practices to conserve water and energy <p><u>Optional (One point awarded per two items):</u></p> <ul style="list-style-type: none"> • Information on methods of maintaining the building's relative humidity in the range of 30 to 60 percent. • Information on opportunities to purchase renewable energy from local utilities or national green power providers and information on utility and tax incentives for the installing onsite renewable energy systems. • Information on local and on-site recycling and hazardous waste disposal programs and waste handling and disposal procedures. • Local public transportation options. • Explanation of the benefits of using compact fluorescent light bulbs, LEDs, or other high efficiency lighting. • Information on native landscape materials and/or low water requirements. • Information on the radon mitigation system, where applicable. • A procedure for educating tenants in rental properties on the proper use, benefits, and maintenance of green building systems including a maintenance staff notification process for improperly functioning equipment. • Information on the importance and operation of the building's fresh air ventilation system. 	Mandatory (Earn 1 point for every two optional items)		Operations and Maintenance Manual See Above	
	1002.3	<p>Multifamily Maintenance Manual Provide an maintenance manual to responsible parties, including 5 or more of the following: <u>Mandatory:</u></p> <ul style="list-style-type: none"> • Narrative detailing the importance of maintaining a green building. <p><u>Optional (One point awarded per two items):</u></p> <ul style="list-style-type: none"> • A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure. • User-friendly maintenance checklist that includes: HVAC filters, thermostat, operation and programming, lighting controls, appliances and settings, water heater settings, fan controls. • List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials. • Information on organic pest control, fertilizers, deicers, and cleaning products. • Instructions for maintaining gutters and downspouts and the importance of diverting water a minimum of 5 feet away from foundation. • Instructions for inspecting the building for termite infestation. • A procedure for rental tenant occupancy turnover that preserves the green features. • An outline of a formal green building training program for maintenance staff. • A green cleaning plan which includes guidance on sustainable cleaning products. 	Mandatory (Earn 1 point for every two optional items)			

Figure 10: Project Management, Operations, and Maintenance

Other NGBS Operations, Maintenance, Building Owner Education Practices

ICC/ASHRAE 700-2015 NGBS		Points Possible
Operations, Maintenance, Building Owner Education	<p>1003.1</p> <p>Public Education One or more of the following is implemented. (2 pts max):</p> <ul style="list-style-type: none"> • Signs showing the project is designed and built in accordance with the National Green Building Standard are posted on the construction site. (1 pt) • National Green Building Standard certification plaques with rating level attained are placed in a conspicuous location near the utility area of the home or, in a conspicuous location near the main entrance of a multifamily building. (1 pt) • A URL for the National Green Building Standard is included on site signage, builder website (or property website for multifamily buildings), and marketing materials for homes certified under the National Green Building Standard. (1 pt) 	2
	<p>1004.1</p> <p>Verification System A verification system plan is provided in the building owner’s manual. The verification system provides methods for demonstrating continued energy and water savings that are determined from the building’s initial year of occupancy of water and energy consumption as compared to annualized consumption at least every four years.</p> <ul style="list-style-type: none"> • Verification plan is developed to monitor post-occupancy energy and water use and is provided in the building owner’s manual. (1 pt) • Verification system is installed in the building to monitor post-occupancy energy and water use. (3 pt) 	4

Other Green Globes Project Management Practices

Green Globes		Points Possible
Project Management	<p>3.1.1.1</p> <p>Pre-Design Meetings</p> <ul style="list-style-type: none"> • An integrated design process (IDP) was employed, which included a minimum of five of the key design disciplines involved in the project, such as the architect, civil engineer, electrical engineer, interior designer, etc. (3 pts) • Qualitative green design goals were established at the pre-design phase for one or more of the following categories: Site design, Envelope, Materials efficiency, Indoor environment (1-2 categories - 0.5 pts; 2-4 categories - 1 pt) • Performance objectives were established at the pre-design phase for one or more of the following categories: Energy efficiency; Renewable energy; Greenhouse gas emissions; Water conservation, efficiency, and reuse, Life cycle impact; Construction waste diversion (1-2 categories - 1 pt; 3-4 categories - 1.5 pts; 5-6 categories - 2 pts) 	3
	<p>3.1.1.2</p> <p>IDP Performance Goals</p> <ul style="list-style-type: none"> • Qualitative green design goals were established at the pre-design phase for one or more of the following categories: Site design, Envelope, Materials efficiency, Indoor environment (1-2 categories - 0.5 pts; 2-4 categories - 1 pt) • Performance objectives were established at the pre-design phase for one or more of the following categories: Energy efficiency; Renewable energy; Greenhouse gas emissions; Water conservation, efficiency, and reuse, Life cycle impact; Construction waste diversion (1-2 categories - 1 pt; 3-4 categories - 1.5 pts; 5-6 categories - 2 pts) 	3
	<p>3.1.1.3</p> <p>IDP Progress Meetings for Design</p> <ul style="list-style-type: none"> • The IDP team held progress meetings prior to the Concept Design Phase (0.5 pts) • The IDP team held progress meetings prior to the Design Development Phase (0.5 pts) • The IDP team held progress meetings prior to the Construction Documents Phase (0.5 pts) • The integrated design and delivery team held progress meetings prior to the completion of one or more of the following project milestones: Pre-Construction, 25% Completion of budget or schedule, 50% Completion of budget or schedule, Substantial Completion (1-2 categories - 1 pt; 3-4 categories - 1.5 pts) 	3
	<p>3.1.1.4</p> <p>Capital Asset Plan & Business Case Summary For Federal building projects, the integrated design process integrated the use of OMB’s A-11, Section 7, Exhibit 300: Capital Asset Plan and Business Case Summary</p> <p><i>Note:</i> This criterion is not necessary for certification by Green Globes.</p>	0
	<p>3.1.2.1</p> <p>Environmental Management System (EMS) The General Contractor was required to document the following elements as part of their Environmental Management System: General Contractor’s Environmental Policy; Regulatory Compliance and Training; Environmental Risk Assessment that shows sensitive environmental areas and ranks potential risks that may arise from the construction; Environmental Risk Management Strategies; Environmental Management Roles, Responsibilities and Reporting Structure for the construction phase; Site and Work Instructions for site personnel outlining environmental procedures during construction; Environmental Inspection Checklists; Records of Compliance (1-2 categories - 1 pt; 3-5 categories - 2 pts; 6-8 categories - 3 pts)</p>	3
	<p>3.1.2.2</p> <p>Clean Diesel Practices The General Contractor was required to supplement mandatory regulatory requirements by implementing one or more of the following “clean diesel” strategies: A vehicle “idling-reduction” directive; Use of clean fuels; Engine upgrades that reduce emissions; Engine maintenance records (1-2 categories - 1 pt; 3-5 categories - 2 pts; 6-8 categories - 3 pts)</p>	3

Figure 10: Project Management, Operations, and Maintenance

		Green Globes	Points Possible
Project Management	3.1.2.3	<p>Building Materials and Building Envelope</p> <p>The following construction best-practices to protect building materials and control mold were required:</p> <ul style="list-style-type: none"> • Building materials made of organic material or those that could absorb moisture were protected in transit and at the construction site from contact with moisture and from collecting organic matter such as leaves, soil or insects (1 pt) • The building envelope is weather-tight and permitted to dry before installation of interior walls, wood floors, ceilings, or HVAC systems (1 pt) 	2
	3.1.3.1	<p>Pre-Commissioning</p> <ul style="list-style-type: none"> • There was a requirement for the Commissioning Agent to document the “Owner’s Project Requirements” for building systems as per ASHRAE Guideline 0-2005: The Commissioning Process, Annexes I and J (or more recent version) (1 pt) • There was a requirement to document the building’s “Basis of Design” for building systems as per ASHRAE Guideline 0-2005 Annex K (or more recent version) (1 pt) • There was a requirement for a Commissioning Authority with technical credentials as per ASHRAE Guideline 0-2005 (or more recent version), to lead the commissioning team, coordinate the commissioning process, and report directly to the owner (1 pt) 	3
	3.1.3.2	<p>Whole Building Commissioning</p> <ul style="list-style-type: none"> • There was a requirement that commissioning will be conducted in accordance with ASHRAE Guideline 0-2005: The Commissioning Process: Articles 5, 6 and 7, (or more recent version) for the following: HVAC&R systems and their controls (4 pts); Building envelope (3 pts); Structural systems (2 pts); Fire protection system (2 pts); Plumbing system (1 pt); Electrical system (1 pt); Lighting system and their controls (1 pt); Building automation systems (1 pt); Elevating and conveying systems (1 pt); Communication systems (1 pt) • There was a requirement to field-test partitions for noise isolation (1 pt) • There was a requirement that the building system commissioning will be conducted in accordance with ASHRAE Guideline 0-2005: The Commissioning Process, Annex L (or more recent version) (1 pt) 	3

Emissions

ICC/ASHRAE 700-2015 NGBS – No Category

The NGBS does not have an emissions category.

Green Globes – Emissions

The “Emissions” category of Green Globes contains practices related to reducing environmental exposure to chemicals that have ozone depletion potential and global warming potential.

Mandatory Practices:

Green Globes does not have any mandatory practices.

Minimum Point Requirements:

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

Analysis

In this category, Green Globes focuses on reducing the potential for projects to impact the ozone layer and contribute to global warming. There are a handful of practices in this category. These include using district heating, or installing boilers and furnaces with low NO_x and CO emissions. Points are also available for installing cooling equipment with low ozone depletion and/or global warming potential, as well as designing janitorial storage areas with full-heights walls and mechanical ventilation.

The NGBS does not have a category pertaining to emissions.

Figure 11: Emissions

Green Globes			
Indoor Environment	3.6.1	<p>Heating</p> <p><u>Path A - District Heating:</u> District heating is being used (18 pts)</p> <p>-OR-</p> <p><u>Path B - Low Emission Boilers and Furnaces:</u></p> <ul style="list-style-type: none"> • There are low (7 pts) or ultra-low (9 pts) NOx emission boilers and furnaces • There are low (7 pts) or ultra-low (9 pts) CO emission boilers and furnaces 	18
	3.6.2	<p>Cooling</p> <p><u>Ozone-Depleting Potential:</u> Cooling equipment (not including portable equipment) used refrigerants that have zero or "near zero" ozone depletion potential (ODP), or there are no refrigerants:</p> <ul style="list-style-type: none"> • No refrigerants (10 points) • ODP less than or equal to 0.005 (10 points) • ODP less than or equal to 0.01 (8 points) • ODP less than or equal to 0.015 (6 points) • ODP less than or equal to 0.02 (4 points) • ODP less than or equal to 0.025 (2 point) • ODP less than or equal to 0.03 (1 point) <p><u>Global Warming Potential:</u> Cooling equipment (not including portable equipment) used refrigerants that have a low global warming potential (GWP100), or there are no refrigerants:</p> <ul style="list-style-type: none"> • No refrigerants (10 points) • GWP100 less than or equal to 100 (10 points) • GWP100 less than or equal to 300 (8 points) • GWP100 less than or equal to 500 (6 points) • GWP100 less than or equal to 700 (5 points) • GWP100 less than or equal to 900 (4 points) • GWP100 less than or equal to 1100 (3 points) • GWP100 less than or equal to 1300 (2 points) • GWP100 less than or equal to 1500 (1 points) <p><u>Leak Detection:</u></p> <ul style="list-style-type: none"> • There was a requirement that equipment installer(s) test remote commercial systems as per GreenChill Best Practices Guideline Ensuring Leak-Tight Installations of Commercial Refrigeration Equipment (3 pts) • There were refrigerant leak detectors capable of detecting leakage rates down to 2.0% per year for each refrigerant (3 pts) • There was an alarm system capable of alerting the building operator to leakage thresholds (3 pts) 	29
	3.6.3	<p>Janitorial Equipment</p> <p>There are designated storage areas for hazardous materials / janitorial supplies with full-height, floor-to-floor walls and mechanical ventilation</p>	3

Conclusion

Green Globes and the NGBS have a wide range of similarities and differences. The NGBS is designed to accommodate all residential buildings, from single-family to multifamily high-rise. Green Globes was originally developed for commercial use; however, a variety of other projects are eligible for certification under the program, including multifamily buildings.

One major difference between the two programs is the inclusion of mandatory practices to be completed for certification to the NGBS. Green Globes does not have any mandatory requirements. Instead, all practices are optional.

Both programs offer a catalog of optional practices for a project to earn points. Within each green practice category, the rating systems contain a number of similar or identical design and construction practices.

Both systems allow a project to earn increasing levels of certification based on the total points earned. The NGBS also requires projects to earn a minimum number of points in each practice category, providing a wide variety of practices a project team can select based on site-specific conditions while helping ensure a balanced approach to sustainable design and construction. Green Globes does not have this requirement. This can potentially allow a project team to earn certification without selecting any practices in a certain category, such as water efficiency.

Both Green Globes and NGBS focus on the six main subject areas of sustainability in the residential industry: water efficiency, energy efficiency, location and site development, material and resource efficiency, indoor environmental quality, as well as operation and maintenance. Green Globes has an additional category for “Emissions,” which contains practices related to reducing environmental exposure to chemicals which have ozone depletion and global warming potential. Green Globes also has a category for “Project Management,” which contains practices encouraging an integrated design process and commissioning.

Both rating systems require a project to have third-party onsite verification of proper installation of green building features. The NGBS requires two onsite visits, one pre-drywall and one post-construction. Green Globes requires one onsite visit towards the end of construction. These visits help ensure items have not been value-engineered out of the project during the construction phase and that green building practices are completed correctly. The pre-drywall inspection of the NGBS is critical to determine if there are deficiencies that should be corrected.

As of the time of this report, there are over 100,000 units certified NGBS Green, and over 480 certified Green Globes for New Construction projects.

