

Comparison of

United States Green Building Council's
LEED for Homes®
First Edition 2008

And

National Association of Home Builders'
National Green Building Standard™
ICC 700-2008

For:
City of Cincinnati
Office of Environmental Quality
Larry Falkin, Director

By:
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Introduction

Currently, the City of Cincinnati offers a property tax abatement for new Leadership in Energy and Environmental Design® (LEED) certified homes and renovations. LEED certified homes are eligible for a 15-year 100% tax abatement at the LEED certified, silver, or gold tiers for up to \$515,000 value of new construction. There is no maximum value limit for new and rehabilitated homes certified at the LEED platinum tier. This incentive has spurred environmentally responsible development across the city. There are currently over 28 LEED certified homes within Cincinnati and many more are in the midst of the design or construction process.

The local chapter of the National Association of Home Builders is requesting that their organization's green building rating system, known as the National Green Building Standard™, be adopted for the same tax incentive.

The City of Cincinnati's Office of Environmental Quality has asked the American Institute of Architects local chapter (AIA Cincinnati) to review both residential green building rating systems to determine if they are equivalent in performance and rigor of proof.

Committee Members

Andy Corn, AIA, LEED-AP; Committee Chair
RWA Architects, Inc.
2771 Observatory Avenue
Cincinnati, OH 45208

Andrew Schaub, AIA, LEED-AP+HOMES
Architects Plus, Inc.
10816 Millington Court
Cincinnati, OH 45243

Mark Streicher, AIA
Abacus Design Group, LLC
11241 Acrewood Dr.
Cincinnati, OH 45249

Cynthia Williams, AIA
Cynthia Williams Architect
5081 Shattuc Avenue
Cincinnati, OH 45208

Study Specific Terms and Definitions

LEED – For this study, the Committee uses the term “LEED” to refer to the United States Green Building Council’s (USGBC) residential green building rating system entitled “Leadership in Energy and Environmental Design” and “LEED for Homes[®]” First Edition 2008. This Study did not review the LEED commercial rating system or the City of Cincinnati’s LEED tax abatement for commercial improvements and new construction.

NGBS - For this study, the Committee uses the term “NGBS” to refer to the National Association of Home Builders’ residential green building rating system entitled “National Green Building Standard[™]” also ANSI registered as ICC 700-2008.

Energy Star - For this study, the Committee uses the term “Energy Star” to refer to the ENERGY STAR for Homes program, a residential joint venture of the U.S. Environmental Protection Agency and the U.S. Department of Energy. Typically an ENERGY STAR certified home is 15%-20% more energy efficient than an average minimum-code home.

HERS score – Home Energy Rating System developed by the Residential Energy Services Network (RESNET). An index is assigned to each modeled home as an indicator of its energy efficiency. A score of 100 is equivalent to minimum IECC recommendations; a score of 0 equals zero net energy use. A score of 85 or lower meets Energy Star requirements.

Rating System – Refers to either LEED or NGBS residential green building rating systems.

Division – For this study, the Committee refers to a grouping of similar credits typically already defined by each Rating System.

Credits – Mandatory or optional green building strategies within either Rating System that collects one, or several, or no points. LEED does not offer points for mandatory credits. NGBS offers points for a few mandatory measures for optional built practices such as fireplaces and garage design strategies. Each credit within each Rating System has a given proprietary division number.

Tier – Each rating system is broken down into their respective levels of graduated performance. LEED graduated from lowest to highest is certified, silver, gold, and platinum. NGBS graduated from lowest to highest is bronze, silver, gold, and emerald.

Green Rater – Third party inspector accredited with USGBC to administrate LEED project team assistance, documentation, inspections, and testing.

Provider – Intermediary between LEED project Green Rater and USGBC to administer documentation and certification.

Verifier – Third party inspector accredited with NAHB to administer National Green Building Standard project team assistance, documentation, inspections, and testing.

Registration – Refers to the process whereby a project begins the documentation to become certified. A project can be in predesign, design, bidding, or construction phase when registered.

Certification – Refers to a project that has received final approval, including tier level, from the respective Rating System.

Cincinnati’s 2009 property tax abatement - Property tax abatement is available for any increased valuation that results from the improvements to the property for both new construction and renovation. New LEED construction of one, two, and three unit residential structures, including condominiums, are eligible for a 15-year 100% tax abatement valued up to \$515,000. For renovated LEED construction of one, two, and three unit residential structures, including condominiums, there is 10-year tax abatement on improvements up to a maximum \$515,000 market value. There is no maximum value limit for new and rehabilitated residential structures certified with the LEED Platinum level. Owners will pay tax on the land. The market value limit will increase by 3% compounded each year.

USGBC LEED for Homes Overview

The United States Green Building Council (USGBC) has developed the Leadership in Energy and Environmental Design (LEED) green building rating system, which is applicable for most construction and major remodeling projects. LEED was developed in a consensus-based process by a diverse group of interested parties. Several LEED rating systems are available for various construction types such as commercial, existing buildings, schools, retail, and healthcare. LEED for Homes was developed to measure and document the green strategies of residential projects. This Study uses the term “LEED” to refer to the LEED for Homes green building rating system.

Applicability for LEED for Homes

LEED for Homes is applicable to single-family homes, low rise multifamily, production homes, affordable housing, modular homes, and existing renovated homes.

Requirements for LEED for Homes

LEED is a voluntary point-based rating system that rates homes in a number of divisions, including location and community, site development, water efficiency, energy efficiency, resource conservation, indoor air quality, education, and innovation. LEED requires verification by third party LEED accredited inspectors called Green Raters.

Projects receive points in each division for reaching certain performance or construction goals. These points are cumulative and the total amount determines the project's level of green certification. LEED has approximately eighteen prerequisites within its system. Points are not received for meeting the prerequisites. Minimum points are required in 4 of the 8 divisions. The LEED rating system has 136 available points over and above the prerequisites.

LEED includes a house size adjustment factor. LEED lowers the minimum number of points required in each tier for homes that are below the national average, and raises the threshold for homes that are larger than average. LEED allows for the number of bedrooms to reduce or increase the required points for each tier.

LEED has four tiers of certification. In successive order from lowest to highest they are “certified”, “silver”, “gold”, and “platinum”. The points required for each tier depend on the house size and number of bedrooms.

LEED offers project teams more than one path toward certification within its energy division: a Prescriptive Path and a Performance Path. The Prescriptive Path lists specific strategies and level of performance of strategies that have to be attained in order for the building to reach the successively higher tiers of certification. The Performance Path describes how well the whole building must perform. The manner in which the project meets those goals is largely up to the project team. LEED minimum energy performance

is based on Energy Star level of performance, which is verified by site testing and inspections and resultant HERS score.

LEED is regional in two ways. First, LEED's energy division contains criteria from Energy Star that has county-defined Builder Option Packages thereby linking the project to its region. Second, many of the points in LEED are organized by climate zone as defined by the International Energy Conservation Code.

Renovations and Additions for LEED for Homes

LEED certifies entire homes, not parts of projects. Certification of renovations and additions requires that the finished project, which includes the entire house, must follow the entire LEED certification process. This includes meeting the minimum point thresholds for each tier and all mandatory practices in the entire Rating System. In short, certification of renovations and additions is permitted, but in most cases it requires a full renovation of the entire home or "gut-rehab".

For example, LEED is based on Energy Star certification, which requires certain levels of performance, inspection, and verification. This typically entails many broad renovation strategies including removal of all interior or exterior finishes to review insulation, new mechanical equipment, and new windows. There are gut-rehab projects in Cincinnati seeking LEED certification, but an extensive amount of work is required to reach the minimum tier. The verifications for additions and renovations are the same as verifications for new homes.

Verification for LEED for Homes

The project team is required to hire a regional LEED for Homes Provider who acts as the intermediary between USGBC and the local project Green Rater. The local Green Rater conducts field inspections and performance testing with a minimum of two site visits, one before drywall is installed and one near project completion. Performance testing required includes Energy Star requirements, envelope air leakage, duct leakage, and refrigerant charge. Optional testing includes outdoor airflow test, exhaust airflow test, and supply airflow test. The Provider and/or the Green Rater verify all credits earned.

NAHB National Green Building Standard Overview

The National Association of Home Builders (NAHB) has developed the National Green Building Standard (NGBS) residential green building rating system. The National Green Building Standard was developed along with the International Code Council (ICC) and is ANSI approved as ICC 700-2008. The rating system was developed in a consensus-based process by a diverse group of interested parties. This Study uses the term “NGBS” to refer to the National Green Building Standard.

Applicability for NAHB-NGBS

The NGBS is applicable to subdivisions, building sites, alterations, additions, renovations, mixed use residential, and residential portions of any building.

Requirements for NAHB-NGBS

The NGBS is a voluntary point-based rating system that rates houses in a number of divisions, including lot design, resource efficiency, energy efficiency, water efficiency, indoor air quality, operations and education, and innovation. NGBS requires verification by third party NAHB accredited inspectors called Verifiers.

Similar to LEED, projects receive points in each division for reaching certain performance or construction goals. The points are cumulative and the total points determine the project's tier of green certification. NGBS has several mandatory practices within its system, but does not rely on mandatory measures as much as LEED. Points can be earned by meeting certain mandatory practices. In contrast to LEED, there are minimum points required in all of the 6 divisions, and a higher number of points are required in each division for each successive tier. The NGBS rating system has over 1100 available points, compared to LEED's 136 available points.

NGBS considers home size by awarding points for houses equal to or less than 2,500 square feet. The required number of points for each tier is raised for houses over 4,000 square feet. Unlike LEED, there is no adjustment for the number of bedrooms.

NGBS has four tiers of certification. In successive order from lowest to highest they are: “bronze”, “silver”, “gold”, and “emerald”. The number of credits required for each tier remains the same, except as previously noted for houses above 4,000 square feet.

Similar to LEED, NGBS offers project teams more than one path toward certification within its energy division, a Prescriptive Path and Performance Path. NGBS requires a software-modeled minimum energy performance, but does not require a site-tested minimum energy performance level. However, points are available for performance that exceeds IECC.

Similar to LEED, NGBS is regional since many of the credits are organized by climate zone as defined by the IECC.

Renovations and Additions for NAHB-NGBS

NGBS includes additional sections that are structured specifically for renovations and additions. The project team must follow the requirements of either the “Green Building Path” or the “Green Remodel Path”.

All additions or renovations to a home built after Jan 1, 1980 must follow the “Green Building Path”. The combined new work and the existing building must meet the mandatory requirements and minimum point thresholds for each tier. There are also mandatory practices for renovations and additions that are additional to practices required for new homes. Verification is accomplished through the typical Rating System requirements just as it is done for a new house.

All additions or renovations to a home built before December 31, 1979 can follow either the “Green Building Path” or the “Green Remodel Path”. The “Green Remodel Path” requires an audit by an accredited inspector who records the consumption of water and energy before and after construction, then the project is awarded certification depending on the percentage of water and energy that is reduced. No specific Rating System practices are required in water or energy, just a percentage of consumption reduction. There are several indoor air quality practices required for this path. No points are required in the site, material, or education divisions.

Verification for NAHB-NGBS

The NAHB Research Center is the sole certifier. The project team submits an online checklist and hires a local NGBS accredited Verifier who conducts field inspections and performs testing with a minimum of two site visits, one before drywall and another near project completion. The Verifier also verifies all credits earned.

Charts

To compare LEED and NGBS, the Committee began by analyzing the major divisions and the individual credits of each Rating System to create a side-by-side comparison. The Charts 1-8 included in this Study represent the Committee's research.

Major Divisions and Individual Credits - Horizontal Rows

The charts are organized horizontally and vertically. Listed vertically on the left are the LEED major divisions and credits. Listed vertically on the right are the corresponding NGBS major divisions and credits, reorganized by the Committee. The organization of the charts follow the organization of LEED since it is the rating system currently in place for the Cincinnati tax abatement.

The major divisions of LEED are: "Innovation and Design Process, Location and Linkages, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Awareness and Education". To correspond with NGBS, the Committee combined LEED Location and Linkages division with the Sustainable Sites division.

The major divisions of NGBS are "Lot Design, Preparation and Development, Water Efficiency, Energy Efficiency, Resource Efficiency, Indoor Environmental Quality, and Operation, Maintenance, and Building Owner Education". The Committee created an additional division for NGBS titled "Other" so that the credits within NGBS that are similar to LEED "Innovation and Design Process" could be placed appropriately. Once they are reorganized, the divisions of each Rating System correspond very well.

Each Rating System requires a certain number points within most of the divisions to reach minimum certification. The Committee calculated the number of points required in each Rating System's divisions and divided that number by the total allowable points within that division. This calculation is listed in the heading of each Rating System's division, shown as a percentage and as footnotes 5, 6, and 7.

After aligning the similar divisions, the Committee reorganized NGBS credits across from the corresponding LEED credits. It is difficult to reorganize credits that do not match exactly since different strategies are suggested to accomplish a similar intent. The Committee recognizes that the side-by-side reorganization is not seamless, but with a few exceptions, a comparable credit-by-credit reorganization is possible.

If the intent of one NGBS credit matched the intent of a LEED credit, they were placed across from each other between horizontal lines. If the intent of several NGBS credits matched the intent of one LEED credit, they were grouped with that LEED credit between horizontal lines. Some NGBS credits are listed more than once if the NGBS credit included more than one intent, or matched more than one LEED credit.

Some credits within each Rating System did not have a corresponding credit. These credits have an empty circle in the corresponding line of the other Rating System.

Credit Comparisons - Vertical Columns

There were several important comparisons the Committee was interested in studying. The Committee put a high priority on the following four subjects “Mandatory Credits, Modeled Credits, Site Verified Credits, and Site Tested Credits.” These are shown in the vertical columns between the list of credits of each Rating System, also shown as footnotes 1, 2, 3, and 4. Each column compares the attributes of both LEED and NGBS credits.

The first comparison notes if the credits are mandatory for its Rating System. The term “mandatory” refers to a practice that must be accomplished in order for the home to be certified. A black circle in the cell indicates that the credit is mandatory in the corresponding Rating System. If the cell is blank, then the credit is not mandatory. A circle with an “X” in the cell indicates that one Rating System has a significant mandatory credit and the other Rating System does not. However, the lack of a corresponding mandatory credit is not always indicated by a circle with an “X”. To keep the Study focused on important issues, only significant differences between mandatory credits are noted. The credits with circles with an “X” will be discussed in the Conclusions and the Recommendations chapters.

The second comparison notes if the credits are modeled. The term “modeled” refers to computer simulated performance modeling of the home or specific equipment within the home. The Green Rater or the Verifier performs the modeling with software approved by the Rating System. Modeling takes place before construction and is only an estimate of performance, not actual performance.

The third comparison notes if the credits are site verified. The term “site verified” refers to a credit that is site inspected and verified by a third party Green Rater or Verifier accredited by the Rating System, not the designer, builder, subcontractor, or manufacturer. This column does not include any software testing, documentation review, or site testing. LEED credits requiring an Accountability Form did not receive a black circle. This information is listed in the LEED Reference Guide and the NAHB-NGBS Verifier’s Reference Guide.

The fourth comparison notes if the credits are to be site tested. The term “site tested” refers to a credit that is site or field tested by a third party testing agent accredited by the Rating System, usually the Green Rater or Verifier, not the designer, builder, subcontractor, or manufacturer. The tests are performed after construction of the equipment or assembly is complete. The black circles indicate an optional test. A black circle with an “M” indicates that the site test is mandatory and the project will not be certified if the home does not meet the minimum requirements. Again, a circle with an “X” indicates that one Rating System requires a significant mandatory site test and the other Rating System does not.

Percentage of Credits Required for Certification

The Committee was also interested in the percentage of available points required to meet successive tiers in each Rating System. The percentages are listed on Chart 7 shown as footnotes 10 and 11.

Neither rating system calculates the tier level by percentage. This calculation is based on a 2600 square foot home with 4 bedrooms, which requires no additional points for LEED or gives no additional points for NGBS. The required points for each tier is then divided by the available 136 points for LEED and approximately 1100-1200 points available for NGBS. The percentages are approximate.

Cost Comparison

Lastly, the fees associated with each Rating System were reviewed. The approximate costs for minimum certification for a 2600 square foot home are listed in Chart 7 and also shown as footnote 12. These costs are approximate for members of either USGBC or NAHB organizations. Non-member costs are higher. These costs are based on information from one Cincinnati accredited LEED Green Rater and NAHB Verifier. The fees can vary with each project, Green Rater, Verifier, or Provider. The minimum fees include all required minimum site verification, site testing, registration, and certification fees. There are typically additional costs for larger houses, houses seeking a higher tier of certification, and for optional site testing for additional points.

Conclusions

Both programs are strong residential green building rating systems. Both are well-intentioned, consensus developed, flexible, voluntary, and tested by third parties. There are accusations of bias and self-serving intentions for each of the programs. These claims were ignored by the Committee and the programs were researched on their own merit. It is the Committee's opinion that there is a market and need for additional green building rating systems.

Since a tax incentive is currently offered by the City of Cincinnati for LEED certification, it is imperative that any additional green building rating system that is adopted by the City meets or exceeds the performance level and rigor of proof that LEED requires.

Since the current abatement allows for the same tax abatement at LEED's lowest level ("certified") and the next succeeding levels ("silver" and "gold"), the committee focused on loopholes and ways around minimum requirements. While most architects, designers, builders and program verifiers in the area are respectable and of high quality, the Committee had to compare the Rating Systems with a pessimistic but realistic approach that someone will find the loopholes and try to certify a home that does not perform effectively or has not been proven to perform effectively.

Available Credits

When the individual credits of each Rating Systems are studied, some differences are apparent. NGBS has more available practices or strategies, which could be interpreted as a more flexible rating system. However, when compared to LEED the additional practices available in NGBS are relatively minor. In the opinion of the Committee this is not a significant difference.

Rating System Divisions

For this Study, both Rating Systems are divided into similar divisions, generally grouped as site, water, energy, materials, indoor air quality, and education. Any practice not part of one of these categories is placed in the "other" division. While the practices in the "other" division are important, the differences are not significant enough to be a major criticism of either Rating System.

For minimum certification, LEED requires a certain number of points in the divisions of Sustainable Sites, Water Efficiency, Materials and Resources, and Indoor Environmental Quality. The divisions of Innovation and Design, Location and Linkages, Energy and Atmosphere, and Awareness and Education do not require a minimum number of points. NGBS requires a certain number of points within each division for minimum certification. However, when the divisions are reorganized in the charts and percentage of available points in each division is calculated, it becomes apparent that the two Rating Systems are quite similar, with the exception of the Education division and the Energy division.

A special point should be made about the LEED division of Energy and Atmosphere. LEED does not require a minimum level of points within this division. Instead, LEED requires a minimum site tested performance that is in effect equivalent to Energy Star certification, either by the Prescriptive Path or the Performance Path. NGBS does not have a required site tested minimum performance. LEED's absence of energy required points may seem low, but LEED's minimum mandatory performance level aligns with nationally accepted high standards of energy performance.

There is one major difference between the two Rating Systems in the requirements to achieve higher certification. NGBS requires higher point totals within each division as higher certification levels are sought. LEED does not require higher point totals within each division when seeking higher tier certification; only the minimum point level is required, allowing for a project to possibly be very strong in several divisions and weak in others. The committee applauds the NGBS requirement for higher point totals within each division as higher certification is sought, thus creating a more balanced project.

Mandatory Minimum Performance

The Committee reviewed the mandatory performance level in each Rating System. It is difficult to compare individual credits, since different strategies are suggested to accomplish a similar intent. However, it is possible to compare the required minimum level of performance.

For example, the LEED Performance Energy Path requires meeting Energy Star standards, resulting in a reduction in energy consumption of 15%-20% when compared to an average home. NGBS does not require Energy Star certification. Also, the LEED Prescriptive Energy Path requires meeting minimum levels for an envelope leakage test, an HVAC ductwork pressure test, window values, and lighting. LEED also mandates erosion controls, a minimum indoor air filter rating, fireplace doors, closed combustion or power vented exhaust, and prohibits locating HVAC equipment in the garage. NGBS does not mandate a minimum performance level for the measures previously listed; they are optional practices for each project.

It can be said that LEED is too restrictive in this requirement and NGBS is more flexible since NGBS has fewer mandatory measures. While the LEED mandatory measures do limit the flexibility of choice, in the opinion of the Committee they ensure a minimum and effective level of performance.

Mandatory Site Testing

The Committee put a high priority on actual proof that a home performs as stated. There are many credits in both Rating Systems that include optional site testing and verification. There are also credits that are computer simulated during the design stage. But unlike NGBS, LEED mandates that the high priority practices must be site tested after construction.

For example, the LEED Performance Energy Path requires a post construction HERS score meeting Energy Star performance. NGBS does not require a post construction test; it is an optional practice. Also, the LEED Prescriptive Energy Path requires an envelope leakage test and HVAC ductwork pressure test that meet Energy Star minimum standards. NGBS does not mandate these site tests; they are optional practices.

Again, it can be said that LEED is too restrictive in this requirement and NGBS is more flexible. However, in the opinion of the Committee, post construction testing is imperative to ensure a minimum and effective level of proof.

Optional Credits Level of Performance

The Committee reviewed the performance level for each credit in each the Rating Systems. Again, it is difficult to compare credits that do not exactly correspond since different strategies are suggested to accomplish a similar intent.

However, when compared, the Committee found many optional NGBS credits that meet or exceed what is listed in LEED. But there are also a few practices that collect points for meeting minimum building code requirements in Ohio. This tends to minimize the strength of the environmental intent of the NGBS Rating System and leans toward an easy rating system versus a rigorous rating system.

Rigor of Proof

The Committee reviewed the rigor of proof in each Rating System. LEED has a reputation for rigidity in the required documentation and expertise. In effect, it can seem demanding and difficult. However, the Committee sees the reasons why a clear definition of proof is required. This is especially true for LEED's reliance on third party Energy Star certification.

There are a few NGBS requirements for documentation and expertise that seem more subjective than LEED. The Committee is frustrated by the terms "qualified professional" or "measures are planned" since back-up definition of these open-ended terms is not documented. When considering the Rating Systems in a protective manner to avoid opportunities for a project to become certified without documented proof of performance, this subjectivity becomes even more questionable. In conversations with a local NGBS verifier, it was noted that more work is required of the local verifier to direct the project team as opposed to LEED, which includes support information in its reference guide.

Third Party Inspections

Both Rating Systems require two third party site inspections by program accredited Green Raters and Verifiers. The inspections include a pre-drywall inspection and a final inspection. Other third party inspections are available to the project team to gain more points, but are optional in both Rating Systems.

Renovations and Additions

LEED requires the entire post-construction home to meet all of the requirements of the Rating System. These stringent requirements mandate a Thermal Bypass Inspection as defined by Energy Star. This entails many detailed inspections, but the most costly is the removal of the majority of the interior or exterior finish to inspect the insulation of the entire house. Also, upgrades are virtually required for new mechanical equipment and windows, which adds cost to a project.

The NGBS “Green Building Path” for renovations and additions is similar to LEED when considering existing homes. The entire house, addition, and renovations must meet the minimum point thresholds of the tiers of each respective Rating System. Both have mandatory practices. However, as previously discussed, NGBS does not require site testing, even for renovations and additions.

The NGBS “Green Remodel Path” is more lenient in terms of required construction, verification, and inspection. For this path, the consumption of water and energy before and after construction is recorded, then certification is awarded depending on the percentage of water and energy that is reduced.

For the “Green Remodel Path,” certification is awarded on a percentage of resources reduced, not on the amount of resources the home eventually consumes. Therefore, an existing home may be very inefficient before construction, reduce its consumption in water and energy by 20%, and then receive NGBS certification, even though there is the possibility that the home is still very inefficient.

The NGBS “Green Remodel Path” focuses on water and energy reduction. There are a few practices required for indoor air quality. There are no practices required in the site, materials or education divisions. These requirements seem minimal, perhaps reflecting the inherent value of maintaining an existing building, which has substantial embodied energy, even though this value is not explicitly stated.

Ease of Use and Project Approval

The committee discussed the ease of use of both Rating Systems. It also interviewed several people who have reviewed and implemented both Rating Systems. There was no clear consensus as to which Rating System is easier to use. People familiar with LEED preferred LEED. Those familiar with NGBS preferred NGBS. The Committee was also split amongst themselves as to which Rating System was easier to use. In the end, it may come down to which Rating System the project team is familiar with and chooses to use.

The one consultant the Committee interviewed who knew both Rating Systems very well preferred NGBS. The consultant preferred NGBS because the approval process is much quicker. LEED has a reputation for being very slow to complete the approval process. It can take 6 months after construction is complete for a project to receive certification.

LEED includes an additional level of oversight in the role of the Provider, who acts as the intermediary between the local Rater and USGBC. This additional step adds time to the entire process. NGBS requires that the approval process occur within 24 hours of receiving the final documentation. It is not known by the Committee if the speed of approval is through efficient office policies or if the rigor of proof is more lax. The local Verifier works directly with the NAHB Research Center to expedite the paperwork and approval process. This is important for builders trying to sell a home contingent on certification and potential property tax abatement.

Cost

In general, the costs for NGBS are lower than LEED. The difference listed in this Study is approximately \$800. This is a relatively small portion of the project construction costs for a large home, but can have a major impact on smaller speculative builder homes as the additional cost is multiplied over the total number of the models built.

It is important to note that the listed costs for certification for each Rating System are minimums; they do not include optional testing. One reason the NGBS cost is lower is that the NGBS does not require post construction site testing. Many local projects have opted to include site testing, so the final fees for NGBS can be similar to the cost for LEED. If Energy Star certification is included with NGBS certification, then the costs for each Rating System are more comparable.

Recommendations

The Committee appreciates the City of Cincinnati's intent to minimize residential environmental impacts. Green rating systems are a good way to not only incentivize environmental strategies, but also to prove it. The Committee appreciates all green rating systems and feels that there is room for many programs. But if the City of Cincinnati adopts the NAHB National Green Building Standard, the Committee recommends the following:

NGBS and Energy Star - New Construction

LEED and NGBS are comparable in more ways than they are dissimilar. There are minor differences that should not be major criticisms of either Rating System. However, the mandatory minimum performance level and mandatory site testing are major differences.

LEED certification is predicated on meeting Energy Star performance and testing. This includes meeting a minimum energy performance level that is approximately 15% below national averages. This also includes required energy modeling, site testing for envelope leakage and ductwork tightness, and mandatory site visual inspections by an accredited third party to prove the measures are in place.

The Committee recognizes that most homes seeking NGBS certification will probably include the optional site testing and also meet in effect the performance levels of Energy Star. However, it is realistic to expect that there will be some projects that will try to avoid the extra costs for performance upgrades and site testing. To lessen this possibility, the Committee recommends the City require Energy Star certification along with NGBS certification.

This will have two effects: 1) it will add the requirement that all homes meet Energy Star level of performance similar to LEED and 2) it will require site testing and therefore proof that the home meets Energy Star level of performance. This recommendation is for the new construction 15-year tax abatement.

Energy Star is a nationally accepted rating system that awards final certification documentation similar to LEED and NGBS. Energy Star usually employs the same Raters and Verifiers as LEED and NGBS. And similar to LEED and NGBS, it leaves the burden of proof to the design, construction, and verification team and not the City.

NGBS and HERS Score - Renovations and Additions

For new construction, the Committee recommends Energy Star certification along with NGBS certification. But for renovations and additions, Energy Star certification entails costly procedures to allow inspections, such as the Thermal Bypass Inspection. The Thermal Bypass Inspection is easy during new construction before the drywall is installed, but in a new home it is costly and invasive. The Committee reviewed other procedures that test the overall performance of the home without destructive and

expensive measures. In an effort to find a way to incentivize green remodeling strategies for existing homes, and also have an acceptable level of performance and proof, the Committee recommends the City require documentation of a post-construction HERS rating of 85 or less (per 2006 IECC) along with NGBS certification.

This will have three effects. It will 1) add the requirement that all homes meet a level of performance by a nationally known scoring system; 2) require site testing and therefore proof that the home meets a nationally known standard level of performance, and 3) not require destructive and costly measures just to be tested.

This recommendation is for the renovated home 10-year tax abatement only, not for new construction. It applies to both the Green Building Path and the Green Remodel Path of the NGBS Rating System for renovations and additions.

HERS certification requires site measurements by the accredited auditor, review of existing construction and equipment, computer simulation HERS score, then a post-construction actual HERS score. Tests include a blower door test and a ductwork pressure test. The HERS test is a nationally known and accepted performance test administered through RESNET. The HERS score is the core test for Energy Star and a project must score an 85 or lower to be certified by Energy Star. So in effect, a remodeled home will meet the overall performance for Energy Star, but will not have Energy Star certification since the Thermal Bypass Inspection was not completed.

The HERS testing agents are typically the same Green Raters and Verifiers as LEED and NGBS. It is a nationally accepted test administered through RESNET. HERS certification documentation is received similar to LEED and NAHB. And again, as with LEED and NGBS, it leaves the burden of proof to the design, construction, and verification team and not the City.

Platinum and Emerald

Cincinnati's current tax abatement allows for property tax abatement up to a value of \$515,000 when the certified tier is "certified", "silver", or "gold". At the platinum tier, the value is unlimited. Just as in LEED, NGBS requires many points to reach the highest tier of "platinum" or "emerald". It is impossible to compare the exact performance of a home certified as "platinum" in LEED and "emerald" in NGBS since both are flexible rating systems that allow the project to score in as many divisions and practices as the project team decides.

The Committee compared the percentage of available points required to meet each tier in each Rating System, as noted in Chart 7. The comparisons do not match perfectly. LEED typically requires a higher percentage of its credits for each tier than NGBS, but the team recognizes that the differences are comparable enough to recommend that a NGBS emerald certified home performs similarly to a LEED platinum home. The Committee's research has seen that this is generally agreed among people familiar with both Rating Systems, though not empirically proven. Therefore a NGBS emerald

certified home should receive the same tax abatement as a LEED platinum certified home. In fact, an emerald certified NGBS home may have fewer environmental impacts in a more balanced way since NGBS requires a higher number of points in each division for each successively higher tier.

Graduated Tax Abatement

Lastly, the Committee would like to make the case for a revision to the current tax abatement ordinance. Currently, the same tax abatement is allowed for LEED certification at the first three tiers (“certified”, “silver”, and “gold”). Only at the highest LEED tier (“platinum”) is a higher tax incentive given. It can safely be assumed that a higher level of LEED certification will result in a higher performance and lower environmental impact of each project. The consequence of the current tax abatement is that there is no incentive for a project to be built at the LEED “silver” or “gold” level. If a project is only motivated by cost and tax incentive and not environmental benefits, then the current system encourages projects to only be built to the minimum certification. To encourage more projects to be built to the middle ranges of the rating systems, the Committee recommends a graduated incentive for each level of certification.

Disclaimer

None of the parties involved in the creation of this Study, including the members of this Committee, AIA Cincinnati, or AIA National assume any liability or responsibility to the user or any third parties for the accuracy, completeness, use of or reliance on any information contained in this Study. The City of Cincinnati is solely responsible for all decisions, tax abatements, and ordinances pertaining to the findings and recommendations contained within this Study.

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Comparison of USGBC LEED-H and the NGBS National Green Building Program

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Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"		Credit Mandatory ¹		Credit Modeled ²		Credit Site Verified ³		Credit Site Tested ⁴		NAHB "National Green Building Standard"	
LEED-H Innovation and Design Process										NAHB Other	
% of Section Credits Required OVER Mandatory Credits ⁵		0%		LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB
		LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	0% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶
Preliminary Rating	ID 1.1	●								n/a	Preliminary Green Scoring Tool
Integrated Project Team	ID 1.2									502.1	Project Team, Mission Statement, Goals:
Certification Program Credentialed Professional	ID 1.3									○	
Design Charrette	ID 1.4									502.1	Project Team, Mission Statement, Goals:
Building Orientation for Solar Design	ID 1.5							●		704.3.1.1	Sun Tempered Design
Durability Planning; (Pre-Construction)	ID 2.1	●						●		704.3.1.3	Passive Cooling Features
			●					●		602.1	Exterior Doors
								●		602.2	Roof Overhangs
								●		602.3.1	Foundation Drainage - Exterior Drain Tile
								●		602.3.2	Foundation Drainage - Int and Ext Drain Tile to Daylight
								●		602.4	Drip Edge
								●		602.5	Roof Water Discharge
					●			●		602.6	Finished Grade
					●			●		602.7	Termite Barrier
					●			●		602.8	Termite Resistant Materials
					●			●		602.9	Water Resistive Barrier
					●			●		602.10	Ice Barrier
Quality Management	ID 2.2	●								602.11	Foundation Waterproofing
Third Party Durability Management Verification	ID 2.3					●				602.12	Flashing
Innovation Credits	ID 3									903.1	Tile Backing Materials
Size Factor Built into Point Requirements	n/a									○	
										○	
										n/a	Found Throughout Each Section
										601.1	Conditioned Floor Area

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Footnotes listed on Chart 8

Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"	Credit Mandatory ¹	Credit Modeled ²	Credit Site Verified ³	Credit Site Tested ⁴	NAHB "National Green Building Standard"								
LEED-H Location and Linkages combined with Sustainable Sites					NAHB Lot Design, Preparation, and Development								
% of Section Credits Required OVER Mandatory Credits ⁵	16%		LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	17% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶	
LEED for Neighborhood Development	LL 1										400	Site Design and Development	
Site Selection	LL 2										503.8	Environmentally Sensitive Areas	
Edge Development	LL 3.1										501.1.2	Greyfield or Brownfield Lot	
Infill	LL 3.2												
Previously Developed	LL 3.3												
Existing Infrastructure	LL 4										501.1.1	Infill Lot	
Basic Community Resources/Transit	LL 5.1										501.2	Mass Transportation	
Extensive Community Resources/Transit	LL 5.2												
Outstanding Community Resources/Transit	LL 5.3												
Access to Open Space	LL 6												
Erosion Controls (During Construction)	SS 1.1	●	⊗				●	●				○	
Minimize Disturbed Area of Site	SS 1.2						●	●				503.2	Slope Disturbance
No Invasive Plants	SS 2.1	●	⊗				●	●				504.3	Soil Disturbance and Erosion
Basic Landscape Design	SS 2.2							●				503.3	Soil Disturbance and Erosion
Limit Conventional Turf	SS 2.3							●				504.2	Trees and Vegetation
Drought Tolerant Plants	SS 2.4						●	●				504.3	Soil Disturbance and Erosion
Reduce Overall Irrigation Demand by at Least 20%	SS 2.5							●				○	
Reduced Local Heat Island Effects	SS 3							●				801.7	Irrigation Systems
Permeable Lot	SS 4.1							●				503.5	Landscape Plan
Permanent Erosion Controls	SS 4.2						●	●				503.5	Landscape Plan
Management of Run-off from Roof	SS 4.3						●	●				○	
Pest Control Alternatives	SS 5						●	●				503.4	Stormwater Management
Moderate Density	SS 6.1											503.2	Slope Disturbance
High Density	SS 6.2											503.4	Stormwater Management
Very High Density	SS 6.3											○	
○								●				503.9	Density
○								●				503.1	Natural Resources
○								●				503.2.5	Slope Disturbance, Underground Parking
○								●				503.6	Wildlife Habitat
○								●				503.7	Mixed Use Development
○								●				504.1	On Site Supervision

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Footnotes listed on Chart 8

Chart 2

Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"		Credit Mandatory ¹		Credit Modeled ²		Credit Site Verified ³		Credit Site Tested ⁴		NAHB "National Green Building Standard"	
LEED-H Water Efficiency		NAHB Water Efficiency									
% of Section Credits Required OVER Mandatory Credits ⁵	20%	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	12% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶
Rainwater Harvesting System	WE 1.1					•	•			801.8	Rainwater Collection and Distribution
Greywater Reuse System	WE 1.2					•	•			802.1	Gray Water
Use of Municipal Recycled Water System	WE 1.3					•	•			○	
High Efficiency Irrigation System	WE 2.1					•	•			801.7	Irrigation Systems
Reduced Overall Irrigation Demand by at Least 45%	WE 2.3									○	
Third Party Inspection of Irrigation System	WE 2.2					•	•				
High Efficiency Fixtures and Fittings	WE 3.1					•	•			801.4	Showerheads
Very High Efficiency Fixtures and Fittings	WE 3.2					•	•			801.5	Faucets
○							•			801.6	Water Closets and Urinals
○							•			801.3	Food Waste Disposers
○							•			801.5.2	Intermittent Faucet Control
○							•			801.9	Water Filters
○							•			802.3	Automatic Shutoff Water Devices

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Footnotes listed on Chart 8

Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"		Credit Mandatory ¹		Credit Modeled ²		Credit Site Verified ³		Credit Site Tested ⁴		NAHB "National Green Building Standard"	
LEED-H Energy and Atmosphere (Prescriptive Path)										NAHB Energy Efficiency (Prescriptive Path)	
% of Section Credits Required OVER Mandatory Credits ⁵	0%	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	11% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶
Performance Path of Energy Star for Homes ⁸	EA 1.1			•	•	•	•	Ⓜ	⊗	702	Performance Path Minimum Requirements ⁹
Performance Path for Exceptional Energy Performance ⁸	EA 1.2			•		•		•	Ⓜ		
Basic Insulation	EA 2.1	•	⊗		•			•			
Enhanced Insulation	EA 2.2		•			•		•			
Reduced Envelope Leakage	EA 3.1	•	⊗					•	Ⓜ	•	
Greatly Reduced Envelope Leakage	EA 3.2							•	Ⓜ		
Minimal Envelope Leakage	EA 3.3							•	Ⓜ		
Good Windows	EA 4.1	•	⊗					•			
Enhanced Windows	EA 4.2		•					•			
Exceptional Windows	EA 4.3							•			
Reduced Distribution Losses	EA 5.1	•	⊗					•	Ⓜ	•	
Greatly Reduced Distribution Losses	EA 5.2		•					•	Ⓜ		
Minimal Distribution Losses	EA 5.3		•					•	Ⓜ		
Good HVAC Equipment and Installation	EA 6.1	•	⊗			•	•				
High Efficiency HVAC	EA 6.2		•			•	•				
Very High Efficiency HVAC	EA 6.3					•	•				
Efficient Hot Water Distribution	EA 7.1					•	•				
Pipe Insulation	EA 7.2					•	•				
Efficient Domestic Hot Water Equipment	EA 7.3							•			
ENERGY STAR labeled Light Fixtures (or CFLs)	EA 8.1	•	⊗			•	•				
Improved Lighting	EA 8.2					•					
Advanced Lighting Package	EA 8.3					•					
High Efficiency Appliances	EA 9.1							•			
Water Efficient Clothes Washer	EA 9.2							•			
Renewable Energy System	EA 10			•		•	•				
Refrigerant Charge Test	EA 11.1	•				•	•				
Appropriate HVAC Refrigerants	EA 11.2							•			
○	○							•			
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Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"		Credit Mandatory ¹		Credit Modeled ²		Credit Site Verified ³		Credit Site Tested ⁴		NAHB "National Green Building Standard"	
LEED-H Materials and Resources		NAHB Resource Efficiency									
% of Section Credits Required OVER Mandatory Credits ⁵	13%	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	19% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶
Framing Order Waste Factor Limit	MR 1.1	●								○	
Detailed Framing Documents	MR 1.2									601.4	Framing and Structural Plans
Detailed Cut List and Lumber Order	MR 1.3									601.4	Framing and Structural Plans
Framing Efficiencies	MR 1.4					●				601.2	Material Usage
Off-Site Fabrication	MR 1.5					●				601.5	Prefabricated Components
FSC Certified Tropical Woods	MR 2.1	●	⊗							606.2	Wood Based Products
Environmentally Preferable Products	MR 2.2									603.2	Salvaged Materials
										604.1	Recycled Content
										606.1	Biobased Products
										607.1	Resource Efficient Materials
										608.1	Indigenous Materials
										901.4	Wood Materials
										901.5	Carpets
										901.6	Hard Surface Flooring
										901.7	Wall Coverings
										901.8	Architectural Coatings
										901.9	Adhesives and Sealants
										901.10	Cabinets
										901.11	Insulation
Construction Waste Management Planning	MR 3.1	●								605.1	Construction Waste Management Plan
Construction Waste Reduction	MR 3.2									603.3	Scrap Materials
										605.2	On-Site Recycling
										605.3	Recycled Construction Materials
										601.3	Building Dimensions and Layouts
										601.6	Stacked Stories
										601.7	Site Applied Finish Materials
										601.8	Foundations
										601.9	Above Grade Wall Systems
										602.14	Recycling
										603.1	Reuse of Existing Building
										606.3	Manufacturing Energy
										609.1	Life Cycle Analysis

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- Ⓜ Denotes mandatory site testing.
- Denotes comparable credit is not present in this Rating System.

Footnotes listed on Chart 8

Chart 5

Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"	Credit	Mandatory ¹	Credit	Modeled ²	Credit	Site Verified ³	Credit	Site Tested ⁴	NAHB "National Green Building Standard"	
LEED-H Indoor Environmental Quality					NAHB Indoor Environmental Quality					
% of Section Credits Required OVER Mandatory Credits ⁵	29%		LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	15% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶
Energy Star with Indoor Air Package	EQ 1	●	⊗			●	●			
Basic Combustion Venting Measures	EQ 2.1	●	●			●	●	●		901.1 Space and Water Heating Options
Enhanced Combustion Measures	EQ 2.2		⊗			●	●			901.2 Fireplaces and Fuel Burning Appliances
										901.12 Carbon Monoxide Monitors
Moisture Load Control	EQ 3					●	●			903.7 Relative Humidity
Basic Outdoor Air Ventilation	EQ 4.1	●				●	●			902.2 Building Ventilation Systems
Enhanced Outdoor Air Ventilation	EQ 4.2					●	●			
Third Party Performance Testing of Building Ventilation	EQ 4.3					●	●	●		902.2.2 Ventilation Testing
Basic Local Exhaust	EQ 5.1	●	●			●	●			902.1 Spot Ventilation
Enhanced Local Exhaust	EQ 5.2					●	●			
Third Party Performance Testing	EQ 5.3					●	●	●		○
Room by Room Load Calculations	EQ 6.1	●	●			●	●			701.4.1.1 HVAC Systems (Design to Manual J)
Return Air Flow/Room by Room Controls	EQ 6.2					●	●			704.4.5 Return Ducts in Every Room
Third Party Performance Test/Multiple Zones	EQ 6.3					●	●	●		704.6.2.3 Balanced HVAC Test
Good Filters	EQ 7.1	●	⊗			●	●			902.2.3 Filters
Better Filters	EQ 7.2					●	●			
Best Filters	EQ 7.3					●	●			
Indoor Contaminant Control During Construction	EQ 8.1					●	●			902.4 HVAC System Protection
Indoor Contaminant Control	EQ 8.2					●	●			901.13 Building Entrance Pollutants Control
										902.5 Central Vacuum Systems
Preoccupancy Flush	EQ 8.3									○
Radon Resistant Construction in High Risk Areas	EQ 9.1	●	●			●	●			902.3.1 Radon Control Zone 1
Radon Resistant Construction in Moderate Risk Areas	EQ 9.2					●	●			902.3.2 Radon Control Zone 2
No HVAC in Garage	EQ 10.1	●	⊗			●	●			901.1.2 Equipment not in Garage
										704.4.4 Equipment in Conditioned Space
Minimize Pollutants from Garage	EQ 10.2		●			●	●			901.3.1.ab Garages
Exhaust Fan in Garage	EQ 10.3					●	●			901.3.1.c Garages
Detached Garage or No Garage	EQ 10.4					●	●			901.3.2 Garages
○										704.5.3 Performance Verified by HVAC Contractor
○										704.5.5 Sealed Air Handler Documentation
○			●							903.2.1 Capillary Breaks Concrete Slabs
○										903.2.2 Capillary Breaks Concrete Footings
○			●				●			903.3.1.2 Crawlspace Damp-proofing
○							●			903.3.2 Crawlspace Conditioned
○							●			903.4 Moisture Control Measures

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Footnotes listed on Chart 8

Chart 6

Comparison of USGBC "LEED for Homes" and NAHB "National Green Building Standard"

American Institute of Architects - Cincinnati Chapter
January 19, 2010

USGBC "LEED For Homes"		Credit Mandatory ¹		Credit Modeled ²		Credit Site Verified ³		Credit Site Tested ⁴		NAHB "National Green Building Standard"			
LEED-H Awareness and Education				NAHB Operation, Maintenance, and Building Owner Education									
% of Section Credits Required OVER Mandatory Credits ⁵		0%		LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	LEED-H	NAHB	50% ⁷	% of Section Credits Required INCLUDING Mandatory Credits ⁶
Basic Operations Training		AE 1.1		•	•							1001.1	Building Owner's Manual
Enhanced Training		AE 1.2										1002.1	O&M Training
Public Awareness		AE 1.3										○	

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Ⓜ Denotes mandatory site testing.

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Footnotes listed on Chart 8

% of Total Credits Required for Minimum Certification ¹⁰	33%	LEED-H Certified	Bronze NAHB	20%	% of Total Credits Required for Minimum Certification ^{10, 11}
% of Total Credits Required for Certification ¹⁰	44%	LEED-H Silver	Silver NAHB	37%	% of Total Credits Required for Certification ^{10, 11}
% of Total Credits Required for Certification ¹⁰	55%	LEED-H Gold	Gold NAHB	50%	% of Total Credits Required for Certification ^{10, 11}
% of Total Credits Required for Certification ¹⁰	66%	LEED-H Platinum	Emerald NAHB	63%	% of Total Credits Required for Certification ^{10, 11}

Registration Fees	\$150	Minimum Program Fees ¹²	\$200	Registration Fees
Green Rater/Fees for Mandatory Inspections	\$1,150		\$1,150	Green Verifier/Fees for Mandatory Inspections
Provider Fees	\$625		\$0	Provider Fees
Certification Fees	\$225		\$0	Certification Fees
Total Minimum Program Costs	\$2,150		\$1,350	Total Minimum Program Costs

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FOOTNOTES:

¹ Credit is mandatory or a prerequisite for each Rating System.

² Credit is modeled or simulated with Rating System approved software.

³ Credit is site inspected and verified by program accredited Green Rater or Verifier (not builder). This column does not include any software or site testing or documentation review.

⁴ Credit is site or field tested by program accredited third party testing agent (not builder or contractor). Mandatory site testing credits are noted.

⁵ For minimum certification, LEED-H credits are required in each division OVER mandatory credits. No points available for mandatory credits.

⁶ For minimum certification, NGBS offers points for mandatory credits, but these are for optional practices such as fireplaces and garages when they are included. This study includes these points in the calculation.

⁷ NAHB innovative practices included if they are included in LEED-H, NAHB multiunit credits not included.

⁸ LEED-H Performance Path requires Energy Star site testing (blower door, duct test, insulation placement, etc)

⁹ NAHB-NGBS Performance Path does not require site testing (blower door, duct test, insulation placement, etc)

¹⁰ Assuming average house with 2600 SF and 4 bedrooms, which requires no additional points for LEED or gives no additional points for NAHB.

¹¹ Points are available in NAHB for meeting minimum building code requirements of the International Residential Code (IRC).

¹² Program fees are based on an average 2600 SF home through one Cincinnati Green Rater/Verifier. Costs are for USGBC or NAHB member rates. Costs will vary per project.

ADDITIONAL NOTES:

For this Study, it was decided to compare a 2600 SF house with 4 bedrooms, fireplace, and attached garage.

NAHB-NGBS requirements for Additions and Renovations not included in this chart, but are addressed in the written Study.

NAHB-NGBS Green Subdivision Category "Site Design and Development" for new developments was not included in this Study.

USGBC-LEEDH Neighborhood Development was not included in this Study.

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