

Maximizing Indoor Environmental Quality using the National Green Building Standard

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Research Center History

- Founded in 1964
- Wholly-owned subsidiary of NAHB
- Independent, for-profit research firm
- Originally a small product testing lab
- Grown to full-service housing technology/product research firm



Research Center

Mission

- Improve the quality, affordability, durability, environmental performance of housing

Methodology

- Promote innovation in home building products/systems, technology, & construction processes by helping to remove barriers

Diffusion of Innovation

25 years to gain full market penetration

- Innovation Impediments
 - Dominance of small firms
 - Lack of industry integration
 - Poor flow of information among industry players
 - High cost of deployment
 - Diverse, local building codes

NAHB Research Center

Integrated Consulting Services

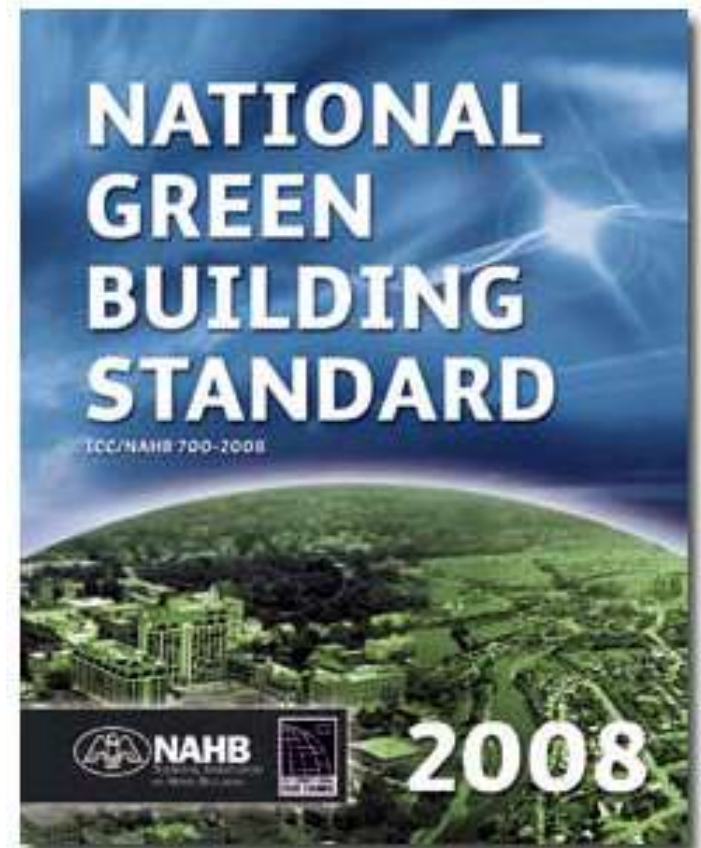
To Improve the Quality and Affordability of Housing



- **Market Research**
- **Lab Testing, Approval & Certification**
 - Third-party accredited
- **Field Evaluations & Demonstrations**
- **Code Development & Compliance**
- **Information Dissemination**
 - ToolBase.org

National Green Building Standard

- Approved by American National Institute of Standards (ANSI) January 2009
- Provides rating system of a home's environmental impact
- Sets four performance levels for green homes
- Government entities look to ANSI standards to set industry benchmarks
- Designed to be voluntary, above-code program

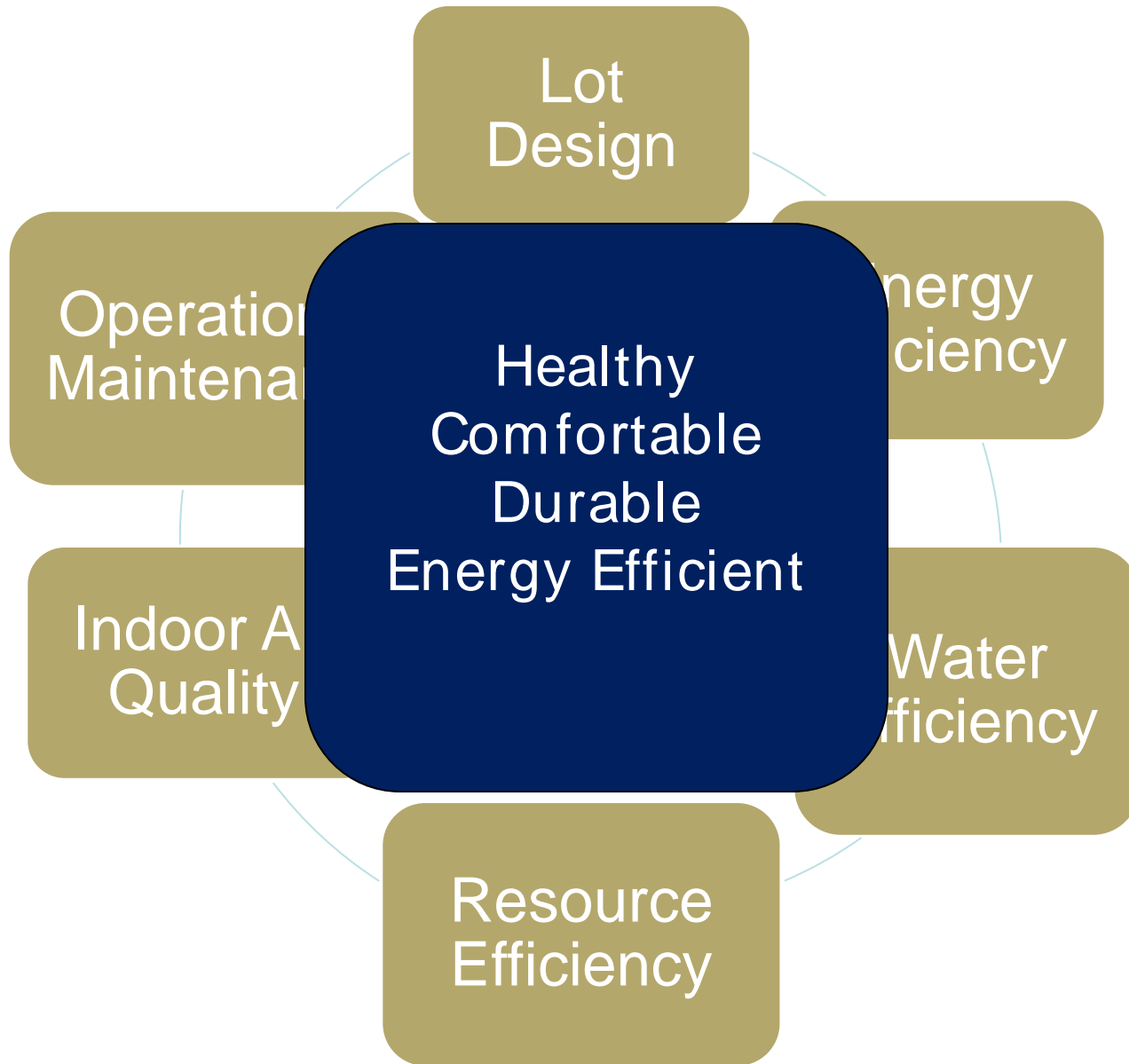


Hallmarks of ANSI Process

- Consensus by balance of stakeholders
- Broad-based public review and comment
- Consideration of comments submitted
- Incorporation of approved changes into standard
- Right to appeal for anyone who believes due process was not respected

The Difference

- ANSI-approved consensus standard
- Written in code language
- Few mandatory provisions
- Expansive, flexible point-based system
- Multiple paths for energy compliance
- All residential



Performance Levels

Green Building Categories			Performance Level Points ^{(1) (2)}			
			BRONZE	SILVER	GOLD	EMERALD
1.	Chapter 5	Lot Design, Preparation, and Development	39	66	93	119
2.	Chapter 6	Resource Efficiency	45	79	113	146
3.	Chapter 7	Energy Efficiency	30	60	100	120
4.	Chapter 8	Water Efficiency	14	26	41	60
5.	Chapter 9	Indoor Environmental Quality	36	65	100	140
6.	Chapter 10	Operation, Maintenance, and Building Owner Education	8	10	11	12
7.		Additional Points from any category	50	100	100	100
Total Points:			222	406	558	697



Indoor Environmental Quality

CHAPTER 9

Mandatory Practices

- Fireplaces in conditioned spaces
- Attached garage requirements
- No carpet in bathrooms
- Bathrooms vented to outdoors
- Clothes dryers vented to outdoors
- Passive radon system in Zone 1
- Tiles in wet areas have proper backing
- Capillary breaks and vapor retarder in concrete slabs
- Damp-proof walls below grade
- Wet insulations dried before closing wall
- Duct insulation

Optional Practices

- Categories
 - Pollutant Source Control
 - Pollutant Control
 - Pollutants generated in the building are controlled
 - Moisture Management
 - Moisture and effects are controlled
 - Innovative Practices

Why Focus on IAQ?

- Women make 85% purchasing decisions of households
- Research says women don't care much about energy efficiency
- Women do care the most about having a healthy home

Scope of NGBS

- Communities
- Homes
 - Single Family
 - Additions
 - Renovations
 - Multi-family
 - Additions
 - Renovations
 - Green Remodel Path

Land Development



Land Development

- One - Four Stars
- Point-based performance criteria
- Measures for planning, design, and construction
- Mixed-use development
- Urban, suburban, rural
- Various certification options
- Can help builders earn points for home compliance

Single-Family



Single-Family



Single-Family



Habitat for Humanity Homes



Multifamily



Multifamily



Multifamily



Multifamily



- Green practice in all units for points
- MF remodeling
- One verification report per building
- Mixed-use

Green Remodel Path



Green Remodel MF



Certification to the NGBS





www.NAHBGreen.org

THE GREEN SCORING TOOL

NAHBGreen: Educating Builders • Advocating Green

NAHB Research Center: Certifying Homes

[Home](#) [Green Building Overview](#) [Education](#) [ICC 700 National Green Building Standard](#) [About NAHBGreen](#)

[Green Scoring Tool](#)

[Certification](#)

Home > Green Scoring Tool

0 0 2 1 1 0 **Projects Green Certified**



Green Scoring Tool



Photo: Redstone Homes

Green Scoring Tool

[National Green Building Standard Scoring Spreadsheet](#)

SIGN IN

User ID:

Password:

Password required

[Not yet registered? Sign up!](#)

Forgot your [user ID?](#)

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How does your residential green building project rate? The Green Scoring Tool lets you score your project to the practices of the [ICC 700 National Green Building Standard](#), and is the first step toward [National Green Building Certification](#).

The Green Scoring Tool was designed to be used with the *ICC 700 National Green Building Standard* and the *National Green Building Standard Commentary*, available at www.builderbooks.com.

New to the National Green Building Standard?

Use the *web-based* Green Scoring Tool for continual feedback and supplementary information as you move through the practices. *Sign in to start scoring your project online.*

[Green Scoring Tool registration](#) is FREE. It is required to create projects online.

Familiar with the National Green Building Standard?

Download the [NGBS Scoring for New Construction spreadsheet](#) to streamline the



Gold Certified Home

Single-Family New Construction
[R.J. Walter Homes](#)

The National Green Building Standard establishes design & construction practices for new single-family homes -- including detached single-family homes,

[Quick Links](#)

Green Scoring Tool for the National Green Building Standard

Scoring Tool Navigation

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- [Marketing Materials](#)
- [NGBS Scoring Spreadsheet](#)
- [Sign Out](#)

My Projects

Project Name	Scoring Path	Score	Green Level Achieved	Options
Green Acres Emerald Model Home Created on 4/17/2009 12:27:19 PM	Single-Family New Construction	323	Bronze	Checklist Project Scoring Analysis Reports Edit Project Details Copy Project Delete Project
Greener Pastures Bronze Starter Home Created on 4/17/2009 3:03:13 PM	Single-Family New Construction	0	None	Checklist Project Scoring Analysis Reports Edit Project Details Copy Project Delete Project
Energy Smart Park Gold Standard Home Created on 4/20/2009 3:07:08 PM	Single-Family Green Remodel Renovation	N/A	None	Checklist Project Scoring Analysis Reports Edit Project Details Copy Project Delete Project
OBrien home Created on 4/29/2009 2:24:15 PM	Single-Family New Construction	28	None	Checklist Project Scoring Analysis Reports Edit Project Details Copy Project Delete Project
Steve's Home house 1 Created on 5/14/2009 12:49:00 PM	Single-Family New Construction	6	None	Checklist Project Scoring Analysis Reports Edit Project Details Copy Project Delete Project
Copy of Green Acres Emerald Model Home Created on 5/22/2009 5:17:02 PM	Single-Family New Construction	102	None	Checklist Project Scoring Analysis Reports Edit Project Details Copy Project Delete Project
Home Makeover	Single-Family	N/A	None	Checklist Project Scoring Analysis Reports

Scoring Tool Navigation

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Scoring Tool Checklist

- [Reports](#)
- [Project Scoring Analysis](#)
- [Builders Challenge](#)

Hide Chapter Navigation

- Chapter 5 - Lot Design, Preparation, and Development
- Chapter 6 - Resource Efficiency
 - Chapter 6 Introduction
 - 601 Quality of Construction Materials and Waste
 - 602 Enhanced Durability and Reduced Maintenance
 - 603 Reused or Salvaged Materials
 - 604 Recycled Content Building Materials
 - 604.1 Recycled Content

Green Scoring Tool for the National Green Building Standard

Scoring Tool Checklist

Project Name: Green Acres
Project Description: Emerald Model Home
Scoring Path: Single-Family New Construction
Green Level Achieved: Bronze
 This project is 1234 square feet, requiring 50 additional points for Bronze and 100 additional points for Silver, Gold, and Emerald.

Chapter 6, Step 28 of 39

Chapter 6: Resource Efficiency

Section 604 - Recycled-Content Building Materials

604.1 Recycled Content

604.1(1)

Building materials with the following percentages of recycled content are used for at least two *minor* components of the building.

[See available Green Approved Products](#)

	Points Possible	Check only one Points Claimed
25% to less than 50%	1	<input type="checkbox"/>
50% to less than 75%	2	<input type="checkbox"/>
75% or more	3	<input type="checkbox"/>

[How to Verify](#) | [Intent](#) | [How to Implement](#) | [Resources](#)

Show Your Comments

Chapter Status | Project Status

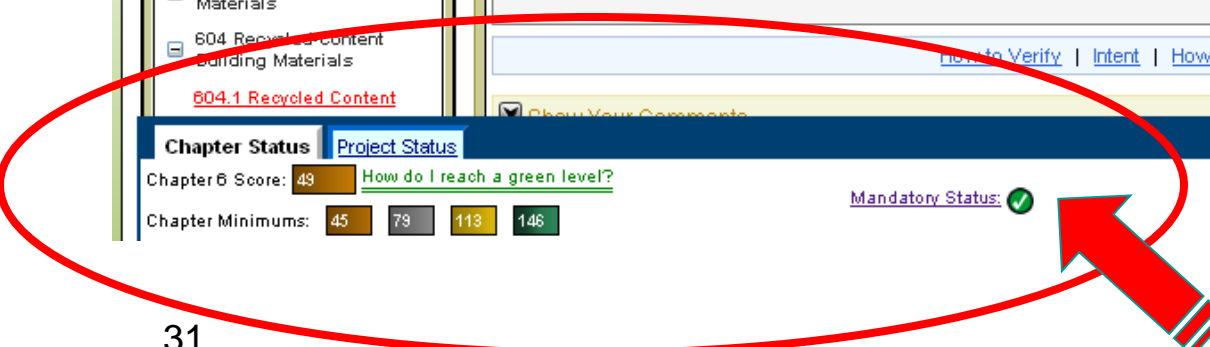
Chapter 6 Score: 49 [How do I reach a green level?](#)

Mandatory Status:

[Don't forget your Additional Points](#)

Chapter Minimums: 45 79 113 146

[Chapter Summary](#) | [Project Scoring Analysis](#) | [Project Report](#)



Project Dashboard

Project Scoring Analysis

[Brochures](#)
[View Guidelines Projects](#)
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[Scoring Tool Checklist](#)
[Reports](#)
[Project Scoring Analysis](#)

Scoring Requirements Tally

! Please read carefully

Additional Points

According to 601.1 of the National Green Building Standard, a dwelling greater than 4,000 square feet will require an increase in the additional points needed to reach a particular level (1 point per every 100 square feet over 4,000).

For this project:

Square Footage = 1234

Additional Points needed for Bronze = 50

Additional Points need for Silver, Gold, or Emerald = 100

Energy Efficiency Path

Path chosen = Performance Path

Because this project follows the Performance Path, it is eligible to attain the Emerald

The Project Scoring Analysis provides an overview of the points achieved for your project, and allows you to see what points are necessary to reach each level of green building.

Hide Bronze Scoring Analysis

Chapter	Required Points	Claimed Points	Additional Claimed Points Above Bronze	Point Shortfall	Mandatory Status
Chapter 5: Lot Design, Preparation, and Development	39	58	19		Not Applicable
Chapter 6: Resource Efficiency	45	25		20	Not Met
Chapter 7: Energy Efficiency	30	60	30		Not Met
Chapter 8: Water Efficiency	14	4		10	Not Applicable
Chapter 9: Indoor Environmental Quality	36	53	17		Not Met
Chapter 10: Operation, Maintenance, and Building Owner Education	8	3		5	Met
SECTION TOTALS	172	203	66	35	
Additional Points Above Bronze	50	--	66	0	
TOTAL POINTS	222	203	--	35	

To achieve Bronze:

- Reach required Bronze score for each chapter
- Reach required Additional Points for this project
- Meet all mandatory items

Independent, Third-party

VERIFICATION

Third-Party Verification



Compliance, Verification, Certification

CERTIFICATION COSTS

Cost Analysis



Cost Comparison

Rating System	Bronze / Certified	Silver	Gold	Emerald/ Platinum
National Green Building Standard	1 - 2%	3%	7%	16%
LEED-H	3-6%	5 – 7%	11 –13%	17 – 23%

Total costs shown as a % of baseline house costs


ANSI Revision Process

- Comments collected since ANSI-approval
- Consensus Committee announced
- June meeting to consider 450 proposed changes
- Process to take 18 months
- Public comment and hearings
- Transition period after completion before effective date

Retrospective evaluation of 8 affordable housing designs

USING NATIONAL GREEN BUILDING STANDARD

Green Ratings for IEQ Programs

Indoor Environmental Quality Programs 	Chapter 9 Indoor Environmental Quality
EPA's Indoor airPlus http://www.epa.gov/indoorairplus/	173 EMERALD
Breathe Easy Homes http://breatheeasyhomes.com/	104 GOLD
National Center for Healthy Housing http://www.nchh.org/Home.aspx	151 EMERALD

Overview of HUD Green Building Study

- Using ICC 700-2008 as the benchmark:
 - Evaluate (8) Affordable House Designs
 - Evaluate (4) Apartment Units for Remodeling
- Selection Criteria for the Study
 - Green Building Program (or green attributes)
 - A stated interest in improving indoor air quality
 - Apartment complex in weatherization program

Overview of HUD Green Building Study

House Designs & Specifications ↓	Chapter 5 Land/Lot Use	Chapter 6 Resource Efficiency	Chapter 7 Energy Efficiency	Chapter 8 Water Efficiency	Chapter 9 Indoor Environmental Quality	Chapter 10 Green Education For Owner
LRA ¹ KC-910	26 NR ¹	52 BRONZE	35 BRONZE	16 BRONZE	43 BRONZE	0 NR ¹
City of La Batre AMT2356A	21 NR ¹	56 BRONZE	49 BRONZE	5 NR ¹	71 SILVER	1 NR ¹
OHA ¹ Townhouse	110 GOLD	49 BRONZE	145 EMERALD	18 BRONZE	43 BRONZE	0 NR ¹
RRHA ¹ Rowhouse	68 SILVER	78 BRONZE	70 SILVER	8 NR ¹	103 GOLD	0 NR ¹
SHA ¹ Two-Story Multi-Unit	109 GOLD	99 SILVER	49 BRONZE	11 NR ¹	104 GOLD	6 NR ¹
AMHA ¹ Townhouse Type A	76 SILVER	66 BRONZE	53 BRONZE	35 SILVER	39 BRONZE	0 NR ¹
AMHA ¹ Single-Family Type D	72 SILVER	57 BRONZE	42 BRONZE	36 SILVER	49 BRONZE	0 NR ¹
CMHA ¹ One-BR Apartment	96 GOLD	81 SILVER	19 NR ¹	10 NR ¹	46 BRONZE	6 NR ¹

Indoor Environmental Quality

House Designs & Specifications ⬇	Chapter 9 Indoor Environmental Quality	Added Cost To Meet Mandatory Requirements
LRA KC-910	43 BRONZE	NONE
City of La Batre AMT2356A	71 SILVER	NONE
OHA Townhouse	43 BRONZE	NONE
RRHA Rowhouse	103 GOLD	NONE
SHA Two-Story Multi-Unit	104 GOLD	NONE
AMHA Townhouse Type A	39 BRONZE	\$106
AMHA Single-Family Type D	49 BRONZE	\$140
CMHA One-BR Apartment	46 BRONZE	NONE

Indoor Environmental Quality

- Gold-Rated Features:
 - Breathe Easy Home (Seattle, WA – High Point)
 - Earth Craft House™ (Richmond, VA – Blackwell)
 - Whole-Bldg Ventilation Systems/Merv Filtration
 - Extensive use of No- and Low-VOC products
- Silver-Rated Features:
 - Alternative Housing Pilot Program (Alabama)
 - Extensive use of No- and Low-VOC products

Indoor Environmental Quality

- IEQ Requirements for Green Remodeling:
 - No natural draft equipment in conditioned space
 - New carpets must comply with CDPH 01350
 - Ventilation required in bath, kitchen, and dryer
 - HVAC ductwork and grilles inspected and cleaned
 - Replace unsealed combustion gas dryer vent
- Incremental Cost for Apartment Units:
 - \$590 to \$981

Indoor Environmental Quality

- Challenges for improving IEQ focus:
 - Metric for quantifying benefits of IEQ (when compared to energy and water efficiency)
 - Can the claims be stated and demonstrated (without causing legal issues or violating FTC environmental marketing guidelines)?
 - Can builders convey the value of IEQ when a direct monetary saving can not be demonstrated to the home buyer?

Findings

- Affordable designs built with green programs lacked a balanced approach
 - Designs focused on maximizing 1 or 2 categories of green building, while other areas were rated lower or neglected
- Green education for homeowners was significantly lacking in most
- Use Energy Star rated appliances
- Use products that have multiple green features
- HUD should look to National Green Building Standard for a more balanced green building approach

Water Efficiency

- Simple payback for water efficiency <5 years for bronze / silver ratings and 5 to 13 years for gold / emerald ratings
 - Water efficiency was most cost effective and most neglected design option for programs evaluated
 - Use low-flow plumbing fixtures

Questions?