ENERGY SOLUTIONS CENTER

Track: Residential Natural Gas

Unit # 11: Natural Gas, Energy Efficiency and Green Building – USA and Canada

Rob DiVenere , Energy Solutions Center

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Presentation Outline

- Defining Green
- ESC carbon calculator
- Residential benefits of natural gas
- Green home building
- HERS rating
- Green Home programs in the US
- Green Home programs in Canada
- US EnergyGuide Label
- Other Green Information & Resources

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Defining Green

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What is Green Building?

- Sustainable or “green building” design and construction is the opportunity to use our resources more efficiently, while creating healthier and more energy-efficient homes.
- It includes protecting and restoring human health and the environment throughout the building life-cycle: siting, design, construction, operation, maintenance, renovation and deconstruction.

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Why a Green Home?

- Market differentiation and long-term increased resale value
- "Green loans" for purchasing energy-efficient homes or making energy-saving upgrades
- Savings on monthly utility bills
- Healthier place to live
- Sustainability
- Potential rebate and incentive programs.
- Potential state and/or local tax credits

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How We Build Affects our "Green"

- Typical home causes 1.5- 2 times the pollution of typical car
- Residential sector accounts for 6-7% of CO2 emissions from fossil fuel combustion based on 2024 data from the US EIA
- Recent trends: 2024 saw residential emissions decline ~3 %
- Construction of a 2,000 ft2 home generates 4 tons of waste

Source: ENERGY STAR, EPA, NAHB, EIA

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Natural Gas Blue can Make You "Green"

- Environmental benefits
- Homeowner Benefits
- Promotes green home-building standards throughout the world
- Efficient natural gas products are important to residential green building
- Green is growing and the growth is expected to continue

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The Environmental Benefits of Natural Gas

- Cleanest burning fossil fuel
- Produces no sulfur dioxide or particulate emissions
- Much lower levels of carbon dioxide and nitrogen oxides than oil or coal
- Delivered to the customer at about 90% efficiency, compared to electricity which is about 30%
- Unlike oil, coal and nuclear, the natural gas process produces no solid waste

Source: American Gas Association

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ESC's Carbon Calculator

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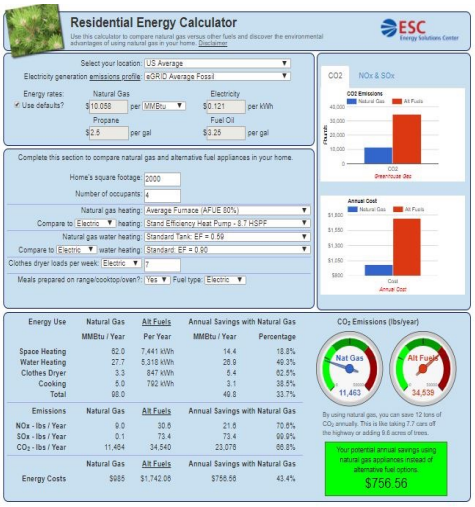
ESC's On-Line Carbon Calculator

- Simple User Inputs
- Home Size
- Family Size
- Loads of laundry per week
- Cook or not cook
- Various heating and water heating appliances and efficiencies can be selected
- Example to follow:
- 2000 foot2 home, average heater efficiencies
- Family of 3, average water heater efficiencies
- 7 loads of laundry dried per week

https://esc.energydepot.com/user-information/home



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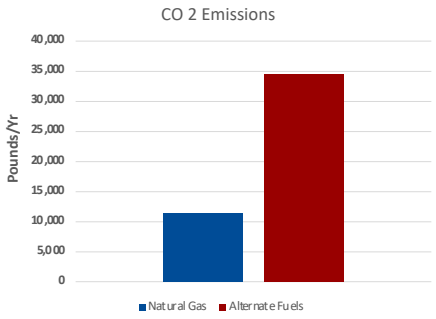
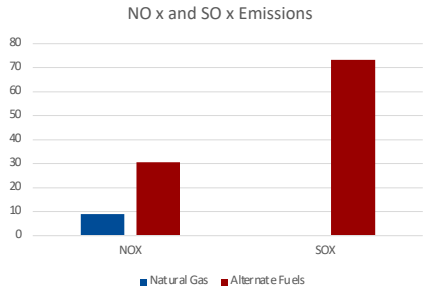
ESC's Carbon Calculator





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The Residential Benefits of Natural Gas

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The Residential Benefits of Natural Gas

- **Cost Effective** – operate at up to half the cost of non-gas appliances
- **Reliable** – delivered via underground pipes so it is there when you need it
- **Comfortable** – natural gas heat is delivered at temperatures between 110°F and 120°F (43.3°C and 48.8°C)
- **Safe** – excellent safety record due to the physical characteristics of gas
- **Abundant** - 99% of natural gas is produced in North America, with enough supplies to last 100+ years

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Green Home Building

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Green Home Building US

- In 2005, only ~2% of new homes had strong green/efficiency credentials
- In 2024, over 436,000 homes received a HERS rating (~33% of new single-family homes)
- Average HERS Index = 55 in 2024 (~45% more efficient than 2006 baseline)
- 96% of builders report using at least one green practice (NAHB, 2024)
- Growth since 2019: +17 pts energy efficiency, +9 pts water, +12 pts materials (NAHB, 2024)
- Note: HERS rating ≠ full certification (LEED, ENERGY STAR, etc.), but shows strong trend
- Additional costs associated with green building will be recouped through lower energy bills over the lifespan of the green home.

Source: US Green Building Council, RESNET, National Association of Home Builders

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Green Home Building Canada

- Canada has over 16 million homes; the building sector is a key target for emissions reductions.
- CHBA is expanding its Net Zero Home Labelling Program, pushing new homes to meet ultra-efficient/low-carbon standards.
- CAGBC's "Two Million Green Homes" initiative underscores national commitment to scale up sustainable housing.
- Reliable national data on what percentage of new homes are fully "green" is not yet available.
- Buyer behavior in Canada strongly emphasizes utility cost considerations — especially in colder climates.

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Residential Green Building Practices

- Homes are designed and constructed to use energy, building materials and water more efficiently
- Designed to reduce impact on the physical environment
- Promote a healthy indoor environment.
- Use an integrated design approach that sees the house as a system.

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The HERS Index

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What is HERS®

- A nationally recognized system for inspecting and calculating a home's energy performance
- A standard by which a home's energy efficiency is measured
- Developed by the Residential Energy Services Network (RESNET)
- Over 4 million homes rated

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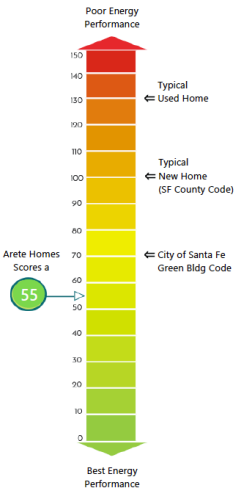
How does the HERS® Index Work

- A certified Home Energy Rater assesses the energy efficiency of a home, assigning it a relative performance score
- The lower the number, the more energy efficient the home
- As of 2024, the average HERS Index Score for rated homes in the United States was 55, reflecting a 45% improvement in energy efficiency over a standard new home built to 2006 energy codes, which is benchmarked at a HERS score of 100.



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Green Home Programs in the US and Canada

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Green Home Programs in the United States

- U.S. Green Building Council: Leadership in Energy and Environmental Design (LEED™)
- ENERGY STAR®
- DOE Zero Energy Ready Home
- International Code Council (ICC) National Green Building Standard

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Green Home Programs in Canada

- Canada Greener Homes Loan
- Canada Greener Homes Affordability Program (CGHAP)
- R-2000 Standard
- EnerGuide Rating System
- LEED

LEED™ and USGBC

- LEED is administered by the U.S. Green Building Council (USGBC), a non-profit organization committed to a prosperous and sustainable future for our nation through cost-efficient and energy-saving green buildings
- USGBC is comprised of more than 12,000 member organizations as well as more than 190,000 LEED professionals from across the building and utility industries

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Facts About LEED for New Home Building

- Started as a pilot in 2005, LEED's national home rating system was launched in December 2007
- The rating system clearly defines and establishes benchmarks for green home building
- Over 550,000 new homes have been LEED certified around the world as of 2024- USGBC

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According to LEED for Homes…

- The certification process is affordable, and costs can range from 2% to 5% of the original non-LEED budget.
- There are 3 types of costs:
  - Hard Costs: the costs of materials and labor
  - Certification Fees: registration and certification fees due to the USGBC
  - Verification Fees: can be adjusted based on size of the home

U.S. GREEN BUILDING COUNCIL
THE GREEN HOME GUIDE

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Canada and LEED

- The Canada Green Building Council (CaGBC) is a not-for-profit, national organization that has been working since 2002 to advance green building and sustainable community development practices in Canada.
- In July 2003 CaGBC obtained executive license from USGBC to adapt LEED to Canadian circumstances.
- Canada is ranked 3rd in the world in LEED adoption

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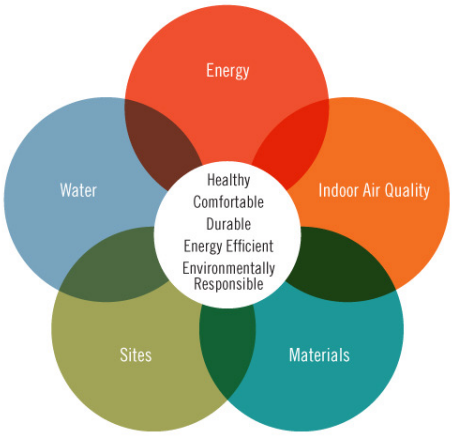
How Does LEED Define a Green Home



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LEED Certification Points & Levels

- For new homes, LEED certification is based on a 110-point scale
- Levels:

40-49 Points Certified	50-59 Points Silver	60-79 Points Gold	80 Points & above Platinum

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LEED Homes are Rated in 9 Categories

1. Innovation
2. Location and transportation
3. Sustainable sites
4. Water efficiency
5. Energy and atmosphere
6. Materials and resources
7. Indoor environmental quality
8. Awareness and education
9. Regional Priority

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LEED Homes Measures

- Prerequisites
- Credits
- Points

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LEED Rating Information

- 18 prerequisites in 9 categories
- Credit Interpretation Requests (CIR's) available to projects that need clarification or special consideration
- Requires third-party verification as part of certification

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Mandatory and Optional LEED Points

Credit Category	No. of Prerequisite (Mandatory) Measures	Maximum No. of Points Available
Integrative Process (IP)	0	2
Location & Transportation (LT)	1	15
Sustainable Sites (SS)	2	7
Water Efficiency (WE)	1	12
Energy & Atmosphere (EA)	4	38
Materials & Resources (MR)	2	10
Indoor Environmental Quality (EQ)	7	16
Innovation (IN)	1	6
Regional Priority (RP)	0	4
Total	**18**	**110**

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Minimum Energy Requirements LEED V4.1

- Complete all mandatory measures of ENERGY STAR for Homes version 3.1 or 3.2 (depending on location)
- If installed, at least one of the following appliances must be ENERGY STAR qualified (or performance equivalent for projects outside the U.S.) in each dwelling unit:
- refrigerator;
- dishwasher; or
- clothes washer
- All duct runs must be fully ducted (i.e., building cavities may not be used as ducts).

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LEED Rating and Certifying

- LEED Providers are local and regional organizations chosen by the GBCI
- LEED Homes are rated by Homes Providers who are under contract with the GBCI to:
  - Recruit and register projects
  - Provide oversight of Green Raters
  - Certify LEED homes
  - Assure quality for the certifications
  - Coordinate USGBC and local USGBC chapters
- A Green Rater works as part of the LEED for Homes Provider Team to perform field inspections and performance testing
- An updated list of providers can be found at **https://www.usgbc.org/leed/rating-systems/residential**

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Steps for Homes Certification

1. Register
2. Verify
3. Review
4. Certify

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Verification Team and Their Roles

- LEED for Homes Provider Organization
  - A provider can be found at: https://www.usgbc.org/organizations/members/homes-providers
- LEED for Homes Green Rater
  - A green rater can be found at: https://www.usgbc.org/people/green-raters

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Five Steps to Participate in LEED

1. Contact a LEED for Homes Provider and join the program
2. Identify the Project Team and complete the following steps:
   a) Performance testing of a typical example of the builder's home design
   b) Completion of preliminary project checklist
   c) A preliminary estimate of LEED score and certification level
3. Build the home
4. Certify the home – the documentation includes:
   a) Completed and signed checklist
   b) Completed and signed accountability forms
   c) Completed and signed Durability Risk Evaluation Form and durability inspection checklist
5. Market and sell the home

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LEED Fees

- Registration fees
- Certification fees
- Other fees

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Costs Associated with LEED-Single Family Housing

Residential fees	Silver, Gold and Platinum level members	Organizational or non-members
Single Family (per home)		
Registration (1-25 homes)	$150	$225
Registration (>25 homes)	$50	$125
Certification (1 home)	$225	$300
Certification (per batch submittal)	$175 per batch	$225 per batch
	plus $50 per home	plus $75 per home
Expedited review (reduce from 20-25 business days to 10-12, available based on GBCI review capacity)	$1,000 per project	$1,000 per project

NOTE:
Registration and certification fees are subject to change and are calculated on the dates of registration and certification submission.
Green Rater verification costs are additive.

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Canada R-2000 Standard

- Voluntary energy-efficiency standard for new houses that is continually upgraded
- It has become the benchmark for new home construction since introduction over 25 years ago
- Performance-based; homes designed to perform above building codes
- Ongoing education and training for home builders; plus testing and certification
- More than 20,000* R-2000 homes; 5,000 builders licensed to build R-2000 homes

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Canada Greener Homes Loan

- Eligibility highlights
- Must own and live in the home (primary residence)
- Pre-retrofit EnerGuide evaluation required
- Retrofits must not already be started
- Credit check and program requirements apply
- Eligible upgrades (examples)
- Insulation, air sealing
- ENERGY STAR windows & doors Heat pumps, solar PV & battery storage
- Terms & funding
- Repayment: 10 years, 0% interest
- Application deadline: October 1, 2025 (or sooner if funds exhausted)
- Remaining funds: ~$444.5 million (as of mid-2025)
- Key considerations & challenges
- Up-front cost barrier: only up to 15% of the loan is advanced before work begins
- First-come, first-served: program may close when funds are used

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Canada Greener Homes Affordability Program

- Free Retrofits for low- to median income households
- Covers insulation, air sealing, heat pumps, windows/doors
- No up front cost to participate
- Delivered through provincial and territorial partners
- First rollout in Manitoba with Efficiency Manitoba

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EnerGuide Canda: The Home Energy Rating System

- **Standardized rating** of a home's energy performance
- **Scale: 0–100** (lower = less efficient, higher = more efficient)
- Based on **EnerGuide evaluation** by certified energy advisors
- Helps identify **retrofit opportunities & savings**
- Required for **federal programs** (e.g., Greener Homes Loan/Grant)

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ENERGY STAR® US

ENERGY STAR® was established in 1992 as a joint, voluntary program of the U.S. Environmental Protection Agency and the U.S. Department of Energy "to help businesses and individuals save money and protect our climate through superior energy efficiency"

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Energy Star® in Canada

- Administered by Natural Resources Canada (NRCan) under the Office of Energy Efficiency
- Canada has participated in ENERGY STAR since 2001 as the official international partner of the U.S. EPA program
- Program applies to:
- Products – 80+ categories tested to meet strict performance specifications
- Homes – Built by licensed ENERGY STAR builders and verified by certified energy advisors
- Consumers benefit from:
- Rebates and incentives through utilities and provinces
- Registry of certified buildings published by NRCan
- ENERGY STAR Awards recognize Canadian organizations and builders for excellence in energy efficiency

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Facts about ENERGY STAR Qualified Homes

- Energy Star® certified homes are at least 10% more energy efficient than homes built to code & achieve a 20% improvement on average
- The average annual savings from an Energy Star ® home is $300
- Each Energy Star® certified home reduces greenhouse gas (GHG) emissions by 3,700 lbs/yr compared to a typical home
- This is the equivalent GHG that would be absorbed by planting 43 trees
- ENERGY STAR® qualified homes do not include levels like other programs

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33 Years of ENERGY STAR® Homes

Here are the accomplishments so far!

- 33 years of building Energy Star ® homes
- Over 4 million homes have received the ENERGY STAR® label to date
- Over 2,500 builders, developers, and manufactured housing plants are active in the Energy Star program in 2025.

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Primary Features of an ENERGY STAR® Home

- High performance envelope
- Complete thermal enclosure with efficient heating and cooling
- High efficiency water heating
- Energy-efficient lighting and appliances
- Independent inspections and tests
- Lower utility bills & environmental impact

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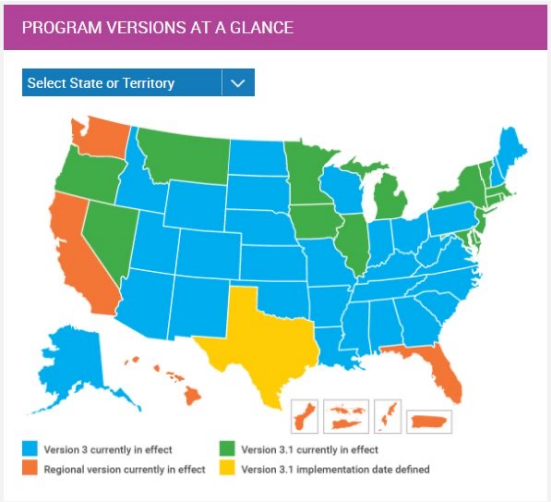
Program Requirements



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Steps to Certification

1. Builder fills out EPA Partnership Agreement.
2. Builder works with a Home Energy Rater (verification organization) that evaluates home plans. Homes must meet requirements in several key areas

   Builder has flexibility in some areas
3. Builder constructs home and Rater verifies features and performance – Performance testing is on-going during construction
4. Rater qualifies the home as Energy Star® and issues the Energy Star® label

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Key Requirements on HVAC Checklists

- Whole-building mechanical ventilation
- Heating & cooling system design and efficiency standards
- Duct installation, leakage, insulation
- Furnaces, boilers, water heaters in home's pressure boundary mechanically drafted or direct-vented
  - Some exceptions for Climate Zones 1-3
- Exhaust flow requirements for fireplaces not mechanically drafted or direct-vented

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Indoor airPLUS – Additional Design and Construction Features

Focuses solely on indoor air quality, builds on the Energy Star qualifications.

- Moisture control
- HVAC
- Combustion venting systems
- Radon resistant construction
- Low-emitting building materials

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Indoor airPLUS v2 (2024/25): Key HVAC Requirements

- Whole-home mechanical ventilation that meets ASHRAE 62.2-2019 airflow; Gold requires a balanced system and documented measured rates.
- Kitchen range hood vented outdoors with measured airflow (≥200 CFM Certified / ≥300 CFM Gold); bathrooms vent outdoors and meet airflow & sound limits.
- Filtration: final HVAC filters ≥ MERV 11 (Certified) or ≥ MERV 13 (Gold). Outdoor-air paths filtered ≥ MERV 8 (Certified) / ≥ MERV 13 (Gold). No ozone-generating devices.
- Ducts & equipment: Design per ACCA Manual D; leakage performance tested. Keep ducts/equipment out of garages. Gold: locate HVAC and ducts inside the building enclosure (limited exceptions).
- Humidity control: Size/operate to maintain indoor RH ≤ 60% in moist climates; Gold includes required humidity monitoring.
- Commissioning & documentation: verify measured ventilation rates, fan flows, and balancing; provide owner operation & maintenance information.

Sources: EPA Indoor airPLUS Version 2 Specifications & Verification Checklist (updated 2024; EPA page last updated Jan 30, 2025).

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Indoor airPLUS v2 (2024/25): Key Combustion Requirements

- Space & water heating: Gold uses direct-vented or mechanically drafted appliances. Certified allows naturally drafted only if strict depressurization and exhaust-location limits are met.
- No unvented combustion space heaters or unvented fireplaces.
- Fireplaces & solid-fuel appliances: use direct-vent/mechanical draft with sealed combustion and gasketed/tempered glass doors; solid-fuel units must meet applicable EPA/UL standards and outside-air requirements where specified.
- Cooking appliances: when gas cooking is installed, provide a vented range hood per HVAC requirements; verify capture effectiveness and makeup air as required by code.
- Carbon monoxide protection: install CO alarms per IRC R315/IBC 915—UL-listed, hardwired with battery backup—and protect devices during construction.
- Garage isolation: air-seal and pressure-isolate attached garages from living spaces; avoid locating HVAC air-handlers or ductwork in garages (Gold: keep HVAC/ducts within the enclosure).

Sources: EPA Indoor airPLUS Version 2 Specifications & Verification Checklist (updated 2024; EPA page last updated Jan 30, 2025).

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Meeting National Requirements

- Flexibility to select a custom combination of measures for each home that is equivalent in performance to the minimum requirements of the ENERGY STAR Reference Design Home
- Uses a RESNET-accredited Home Energy Rating software program to determine the ENERGY STAR HERS Index Target

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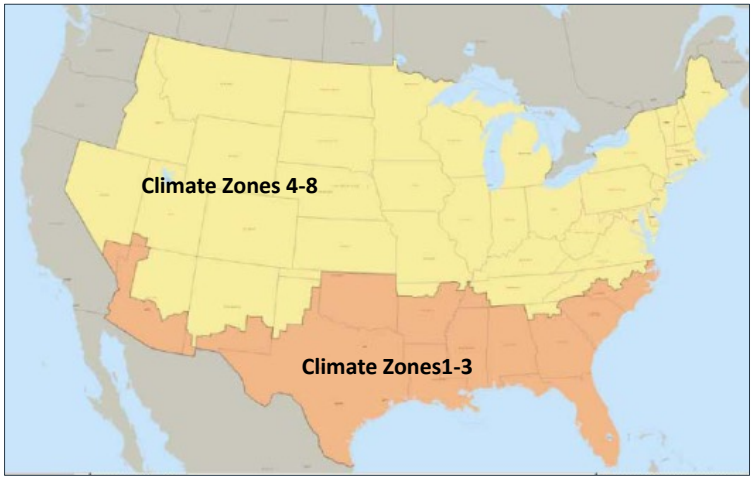
Reference Design: HVAC Requirements Vary by Hot vs. Mixed/Cold Climate Zones



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Minimum ENERGY STAR® Reference Design

ENERGY STAR — 2025 HVAC Efficiency (Residential Single-Family)

Hot Climates — ENERGY STAR Furnace Region: South	Mixed & Cold Climates — ENERGY STAR Furnace Region: North
Cooling Equipment (Where Provided)	**Cooling Equipment (Where Provided)**
• Central AC (split): ≥ 15.2 SEER2 and ≥ 12.0 EER2 (ENERGY STAR v6.2). • Central AC (single-package): ≥ 15.2 SEER2 and ≥ 11.5 EER2. • Heat pump (cooling): see Heat Pump criteria under Heating Equipment.	• Central AC (split): ≥ 15.2 SEER2 and ≥ 12.0 EER2 (ENERGY STAR v6.2). • Central AC (single-package): ≥ 15.2 SEER2 and ≥ 11.5 EER2. • Heat pump (cooling): see Heat Pump criteria under Heating Equipment.
Heating Equipment	**Heating Equipment**
• Gas furnace (South region): ≥ 90% AFUE. • Oil furnace: ≥ 85% AFUE. • Gas boiler: ≥ 90% AFUE; Oil boiler: ≥ 87% AFUE. • Heat pump (split): ≥ 15.2 SEER2, ≥ 11.0 EER2, and ≥ 7.8 HSPF2. • Optional Cold-Climate Heat Pump (if applicable): ducted ≥ 8.1 HSPF2; non-ducted ≥ 8.5 HSPF2; COP @ 5°F ≥ 1.75 and ≥ 70% of 47°F capacity; includes controls verification (CVP).	• Gas furnace (North region): ≥ 95% AFUE. • Oil furnace: ≥ 85% AFUE. • Gas boiler: ≥ 90% AFUE; Oil boiler: ≥ 87% AFUE. • Heat pump (split): ≥ 15.2 SEER2, ≥ 11.0 EER2, and ≥ 7.8 HSPF2. • Optional Cold-Climate Heat Pump (if applicable): ducted ≥ 8.1 HSPF2; non-ducted ≥ 8.5 HSPF2; COP @ 5°F ≥ 1.75 and ≥ 70% of 47°F capacity; includes controls verification (CVP).

Sources — ENERGY STAR (2025)
• Central Air Conditioners & Air-Source Heat Pumps — Version 6.2 Final Specification (Tables 1-3). • Furnaces — Key Product Criteria (North/South). • Residential Boilers — Key Product Criteria. • Cold-Climate Heat Pump — Key Product Criteria.

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Water Heater – Uniform Energy Factor

New formulas (V equals volume of storage)

	Volume (Gal)	Medium UEF Example	Very Small Draw (UEF)	Low Draw (UEF)	Medium Draw (UEF)	High Draw (UEF)
Electric Storage	≥20 and ≤55 gal	**40 Gal = .92**	.8808-.0008V	.9254-.0003V	.9307-.0002V	.9349-.0001V
Electric Storage	>55 and ≤120 gal	**80 gal = 2.03**	1.9236-.0011V	2.0440-.0011V	2.1171-.0011V	2.2418-.0011V
Electric Tankless	<2 gal	**.91**	.91	.91	.91	.92
Gas Storage	≥20 and ≤55	**40 Gal = .58**	.3456-.0020V	.5982-.0019V	.6483-.0017V	.6920-.0013V
Gas Storage	>55 and ≤100	**80 gal = .76**	.6470-.0006V	.7689-.0005V	.7897-.0004V	.8072-.0003V
Gas Tankless	<2 gal and >50,000 Btu/h	**.81**	0.80	0.81	0.81	0.81
Oil Storage	≤50 gal	**40 Gal = .54**	.2509-.0012V	.5330-.0016V	.6078-.0016V	.6815-.0014V
Grid Enabled	>75 gal	**80 gal = .91**	1.0136-.0028V	.9984-.0014V	.9853-.0010V	.9720-.0007V

https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-430/subpart-C/section-430.32

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Unique HERS Index for Each Home

- RESNET accredited software program determines unique ENERGY STAR HERS Index Target threshold for each individual home
- Index Target uses ENERGY STAR Reference Design specifications
- The software* accounts for state energy codes, if they exceed ENERGY STAR requirements
- Renewable energy systems cannot be used to meet base value of Reference Design HERS index

*ENERGY STAR provides guidance for manual calculations

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DOE Zero Energy Ready Home

- A high performance home which is so energy efficient, that a renewable energy system can offset all or most of its annual energy consumption
- Leading edge green building – at least 40% to 50% more energy efficient than typical new home
- Verified by a qualified third-party
- Low HERS score (Performance Path homes) – typically in 50s, depending on home size & region

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DOE Zero Energy Ready Home Requirements

- Comply with Energy Star for Homes Program Requirements and Inspection Checklists for:
  - Thermal Enclosure
  - HVAC Quality Installation (Contractor and HERS Rater)*
  - Water Management
  - Feature energy efficient appliances and fixtures that are Energy Star qualified
  - Use high performance windows that meet Energy Star v5.0 and v6.0 specs (depends on climate zone)

* There are exceptions

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Qualifying as a Zero Energy Ready Home

Builders can follow two different paths.

1. **The Prescriptive Path:** Provides a single set of measures – modeling is not required but no tradeoffs are allowed, HERS Index not required
2. **The Performance Path:** All mandatory requirements must be met but this path provides flexibility to select a custom combination of measures equivalent in performance to DOE Zero Energy Ready Home HERS Target Home

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DOE Zero Energy Ready Home — Single-Family V2 (2025)

- Top-tier DOE label for new single-family homes; so efficient that a small renewable system could offset most/all annual use.
- Certification by an approved Rater through a DOE-recognized Home Certification Organization (HCO).
- Applies to homes permitted under the Single-Family Version 2 requirements.
- Prerequisites (must be met): ENERGY STAR® Single-Family New Homes (V3.2) and EPA Indoor airPLUS (V2).

Scope: Single-Family Version 2 only. See DOE ZERH SF V2 National Program Requirements.

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Envelope & HVAC Distribution (SF V2)

- Thermal enclosure meets or exceeds 2021 IECC Target UA levels; high-performance fenestration per climate zone.
- Continuous air, thermal, and water barriers aligned and detailed at critical assemblies.
- Ducts and air-handlers located within the thermal/air boundary (i.e., in conditioned space).
- HVAC design and installation per ACCA Manuals J/S/D; ventilation per ASHRAE 62.2 via Indoor airPLUS prerequisite.

From ZERH SF V2 Exhibit 1 (Envelope & HVAC distribution) and ENERGY STAR/Indoor airPLUS prerequisites.

Hot Water, Lighting & Appliances (SF V2)

- Choose a hot-water compliance path: efficient distribution, or qualified high-efficiency water heater/fixtures, or WaterSense Labeled Homes v2.0.
- All builder-installed major appliances are ENERGY STAR certified (where applicable).
- 100% of permanent fixtures/lamps are high-efficacy (LED); bath fans are ENERGY STAR.

ZERH SF V2 Exhibit 1 (Hot Water & Efficient Equipment) and program notes.

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Solar- & Electric-Ready (SF V2)

- Complete the DOE PV-Ready Checklist (V2) to prepare roof, space, and pathways for future PV.
- EV-ready: provide a 208/240V, 30A receptacle in garage or within 6 ft of private driveway; label dedicated panel space.
- Heat Pump Ready provisions: dedicated circuits/space for heat pump water heater and space-heating conversion (if currently using fossil fuel).
- On-site renewables may not be used to meet the ZERH performance target (see ERI slide).

ZERH SF V2 (PV-Ready, Electric-Ready) requirements and notes.

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Performance Target & Verification (SF V2)

- Energy Rating Index (ERI): Modeled ERI must be ≤ the DOE ZERH Target Home ERI produced by approved software.
- Photovoltaics cannot be counted toward meeting the Target ERI.
- Verification: minimum pre-drywall and final inspections by an approved Rater using DOE/RESNET protocols.
- Documentation: retain completed ZERH and prerequisite checklists; HCO quality assurance and recordkeeping apply.

ZERH SF V2 Certification Process & Exhibit 2.

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HVAC Minimum Requirements

- Performance Path homes must meet these requirements.
- Prescriptive Path must demonstrate equivalent performance.

HVAC / Ventilation	Very Hot & Hot (2021 IECC CZ 1–2)	Warm & Mixed (2021 IECC CZ 3, 4A, 4B)	Cold & Very Cold (2021 IECC CZ 4C, 5–8)
Furnace AFUE	80%	CZ3: 92% CZ4: 95%	95%
SEER (cooling)	18	16	16 (ASHP) / 14 (A/C)
HSPF (heat pump)	9.2	9.2	9.5
Mechanical ventilation	Indoor airPLUS + ASHRAE 62.2-2019	Indoor airPLUS + ASHRAE 62.2-2019	Indoor airPLUS + ASHRAE 62.2-2019; Balanced HRV/ERV required in CZ 6–8

Notes: Values reflect the DOE ZERH Single-Family V2 (Rev. 2) Target Home Exhibit 2 and Indoor air requirements in Exhibit 1. ZERH V2 uses SEER/HSPF nomenclature for target-home equipment; balanced HRV/ERV is required in Climate Zones 6–8.

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Water Heating

- ENERGY STAR levels for the system Energy Factor, as follows:
- Gas/propane systems of ≤ 55 gallons, EF = 0.67
- Gas/propane systems of > 55 gallons, EF = 0.77
- Electric systems, EF = 2.0
- For heating oil water heaters use EF = 0.60

Hot water delivery systems must meet the requirements listed under EPA WaterSense Single-Family New Home Specification

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Efficient Hot Water Delivery

- To minimize wasted water while waiting for hot water, hot water systems store no more than 0.5 gallons of hot water in any piping/manifold between the source of hot water and the furthest fixture
- Recirculation systems that are activated based solely on a timer and/or temperature sensor do not meet this requirement

Prescriptive Path Zero Energy Ready Home

- Single set of measures.
- Based on DOE Zero Energy Ready Home Target Home
- Conditioned floor area (CFA) of home to be built must be within CFA of Benchmark Home size – if not, must use Performance Path
- Verifier confirms that all requirements met
- Verification submitted through a DOE-recognized Home Certification Organization (HCO) following HCO QA and recordkeeping procedures

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Performance Path Zero Energy Ready Home

- Builder/home-owner can select a custom combination of measures
- The HERS Index of the DOE Zero Energy Ready Home Target Home is determined
- A size modification factor is next calculated
- The HERS Index of the DOE Zero Energy Ready Home Target Home is calculated next
- Complete HERS software calculations for preferred set of energy measures and verify resulting HERS Index Score falls at or below DOE Zero Energy Ready Home Target Home HERS Index Score
- Construct the home and have it verified.

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National Green Building Standard™ (ICC 700)

- Developed by NAHB and the International Code Council (ICC) to define residential green building.
- Only ANSI-approved residential green building standard in the U.S.
- Provides a flexible, point-based blueprint for builders covering energy, water, materials, site, and indoor air quality.
- Applies to new and renovated single-family homes, multifamily buildings, and land developments.
- Most recent edition: 2020 NGBS (updates every ~5 years; 2024/25 update in progress).
- Nearly 350,000+ dwelling units certified to date.

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Overview of Certification Process

- Register project via NGBS / AXIS portal (Verifier registers project)
- Score project using NGBS scoring tool (downloadable or portal-based)
- Submit design documentation; Verifier reviews and signs client agreement (AXIS)
- Verifier conducts rough (pre-drywall) and final inspections
- Submit verification reports, documentation, and pay certification fee
- Home Innovation reviews and issues NGBS Green certificate

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NGBS Certification is Available for:

1. New single-family structures
2. New multifamily structures
3. Remodeling
4. Land development

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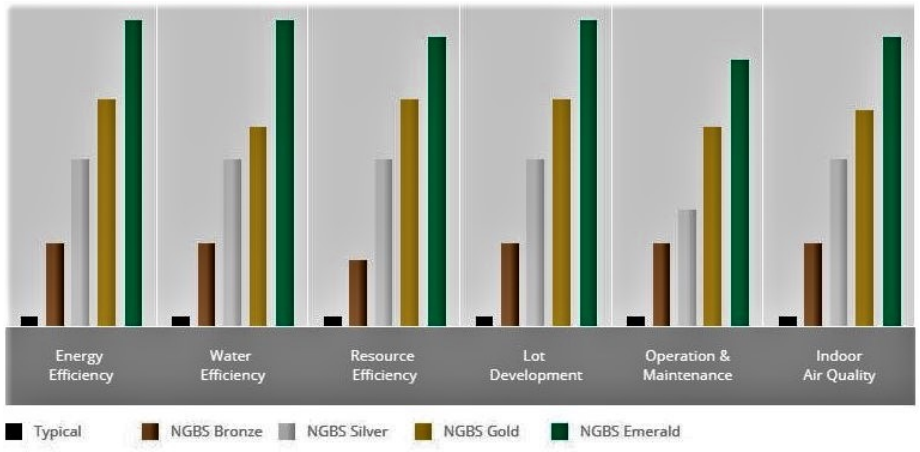
National Green Building Standard™



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Threshold Point Ratings – NGBS 2025

Category	Bronze Level	Silver Level	Gold Level	Emerald Level
Lot design, preparation and development	50	64	93	121
Resource efficiency	43	59	89	119
Energy efficiency	30	45	60	70
Water Efficiency	25	39	67	92
Indoor environmental quality	25	42	69	97
Operation, maintenance, building owner education	8	10	11	12
Additional points from any category	50	75	100	100
Total	**231**	**334**	**489**	**611**

Source: NGBS Green (Home Innovation Research Labs) — category minimums & totals for certification levels.

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Three Paths for Energy Efficiency – NGBS

1. **The Prescriptive Path:** More extensive; many requirements are climate-zone specific. Analysis of building envelope may be conducted through RES*check* or other software, or third-party verification. Points available vary by type of HVAC, home location, other factors.
2. **The Performance Path:** Minimum requirement is that performance must equal the IECC. Home can earn an additional 30, 60, 80 or 100 points in this category by exceeding energy cost performance of IECC baseline by 15, 30, 40 or 50% respectively. Performance demonstrated by approved software. Achievement of Emerald Level must be through Performance Path.
3. **Energy Rating Pathway:** This option allows builders to earn a certain percentage of the total points in the energy-efficiency section by achieving a specific performance rating from an approved energy-efficiency program, such as Energy Star.

ESC

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Mandatory Key Energy Efficiency HVAC Items- NGBS

All homes must meet following in HVAC:

- Heating and cooling equipment sized using ACCA Manual S
- Radiant or hydronic must be designed using industry-approved guidelines or standards (ACCA Manual J, AHRI I=B=R, etc.) or an accredited professional following manufacturer requirements
- Ducts sealed per reference standards (UL181A or UL181B); no building cavities serving as supply ducts
- Air barrier & envelope testing + insulation verification; Grade 1 insulation only; blower-door test per ANSI/RESNET/ICC 380 or ASTM E779/E1827 — §701.4.3.2(1)

ESC

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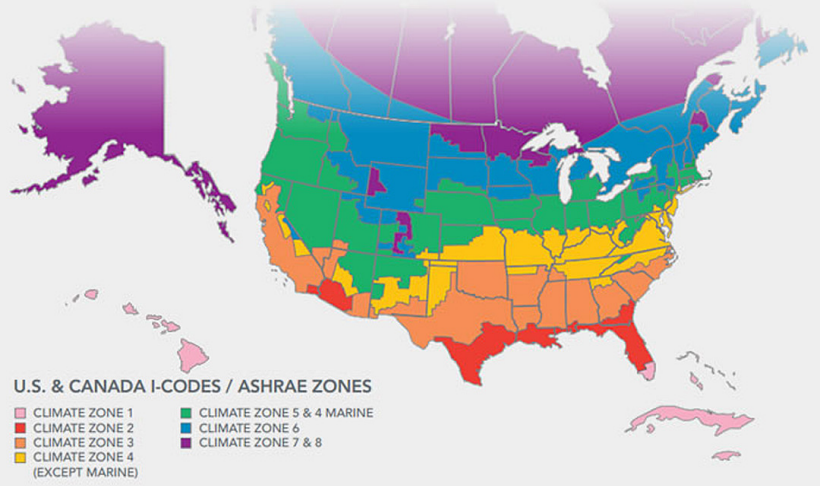
Climate Zones of the US and Canada



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Gas Heaters – Points by Climate Zone

Climate Zone								
	1	2	3	4	5	6	7	8
	POINTS							
≥ 90% AFUE	0	2	3	6	6	9	10	12
≥ 92% AFUE	0	2	4	7	8	10	12	14
≥ 94% AFUE	0	3	4	9	9	12	14	16
≥ 96% AFUE	1	3	5	10	10	14	16	19
≥ 98% AFUE	1	3	6	11	12	16	18	21

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Gas Boilers – Points by Climate Zone

	Climate Zone							
	1	2	3	4	5	6	7	8
	POINTS							
≥ 85% AFUE	0	1	1	2	3	4	4	4
≥ 90% AFUE	0	1	2	4	6	7	8	6
≥ 94% AFUE	0	2	3	5	8	9	10	8
≥ 96% AFUE	0	2	4	6	9	11	12	10

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Natural Gas Water Heater Points

	Climate Zone							
	1	2	3	4	5	6	7	8
	POINTS							
0.67 EF to <.8 EF	3	3	2	2	2	2	2	1
≥ 0.80 EF	4	4	3	3	3	3	3	2

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Scoring Tools for NGBS Green Certification

- Scoring tools are available for new construction, remodeling and land development projects through Home Innovation's NGBS Green program.
- The Home Innovation Research Labs also provides installations specifications, including quantity of product and method of installation; as well as pre-approval of products that are eligible for certification points
- Allows for the verification and certification process to be streamlined for builders, architects and developers

Home Innovation NGBS GREEN CERTIFIED

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Primary Attributes of Certification Process

- Healthy Homes
  - Improved indoor air quality
  - Limiting pollutants in the home
  - Preventing moisture problems
- Lower Operating Costs
  - Reduced utility costs
  - Lower maintenance costs
  - Ensuring optimum performance
- Sustainable Lifestyle
  - Promoting walkability
  - Reduced maintenance
  - Preserving natural resources

Home Innovation NGBS GREEN VERIFIER

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NGBS Certification Fees

- Fees set by The Home Innovation Research Labs
- Cost is $200 per single-family structure
- Volume discounts are available
- Verification is an additional fee. The Home Innovation Research Labs provide a list of verifiers by state

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U.S. Energy Guide Label

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United States EnergyGuide Label

- The Federal Trade Commission's Energy Labeling Rule helps consumers comparison shop for energy-efficient appliances
- Manufacturers of most major home appliances must attach FTC's yellow EnergyGuide label
- Label **estimates** how much energy the appliance uses and displays an estimate of annual operating cost (based on national average energy costs) – this is not a guarantee of operating costs
- National averages energy costs are updated every 5 years

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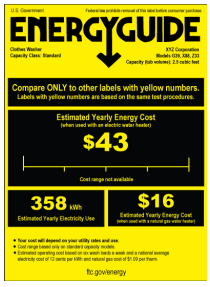
United States EnergyGuide Label

- EnergyGuide label also shows the range of operating costs for models with similar features
- Some appliances are being rated with updated energy efficiency tests and as of 2025, have new EnergyGuide labels with bright yellow numbers
- When comparing appliances, be sure to compare all black number guides or all yellow number guides



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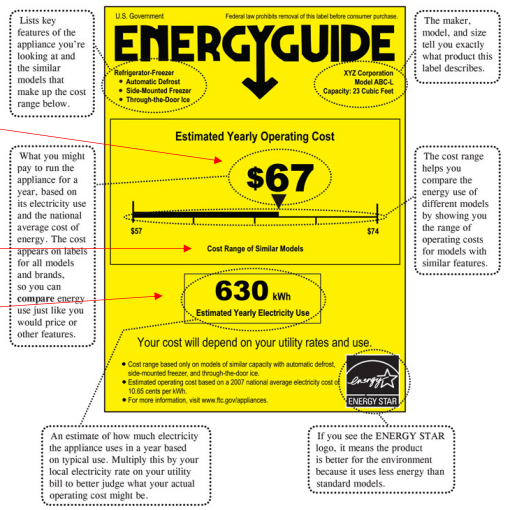
How to Read the U.S. EnergyGuide Label

1) Estimated yearly operating cost based on the national average cost of gas or electricity.
2) Cost range for appliances with similar features
3) Estimated annual energy consumption



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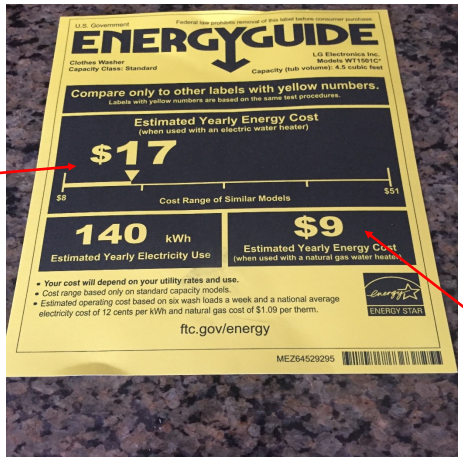
EnergyGuide Labels Promote Gas!

Cost with an electric water heater



EnergyGuide Label for a clothes washer

Cost with a natural gas water heater

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"Equivalent" Water Heater Comparison

- **40-gallon gas water heater**
- First Hour rating = 67 Gallons
- Expected annual cost = $220

- **50-gallon electric water heater**
- First Hour rating = 62 Gallons
- Expected annual cost = $419

Natural gas water heaters are so fast that a 40-gallon gas unit typically can do the job of a 50-gallon or larger electric unit

ESC

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Examples of Energy Efficient Natural Gas Products Include:

- Water heaters
- Boilers
- Furnaces
- Gas Heat Pumps

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Other Green Information and Resources

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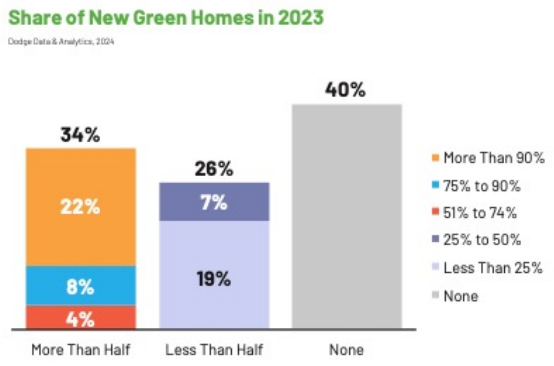
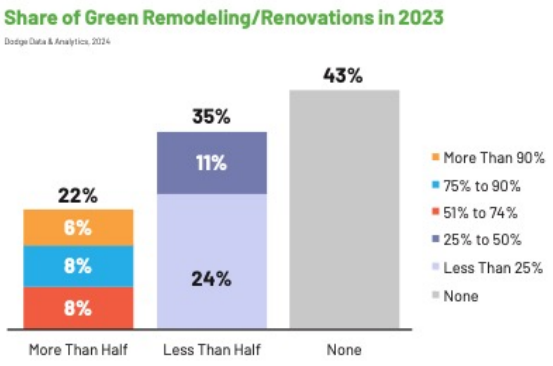
Builders Plans for Green





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How to Market Green

Selling Points for Consumers

- A healthier home environment through improved indoor air quality
- A more comfortable home due to fewer temperature variations
- A return on investment through energy savings and lower maintenance costs
- A positive environmental impact
- A reduction in the use of natural resources

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Hurdles to Building Green Homes

- Higher perceived first cost of a green home
- Lack of consumer education about green building
- Finding certified, knowledgeable builders
- Home market value and home sales
- Certification costs
- Communication among the team – from design to installation

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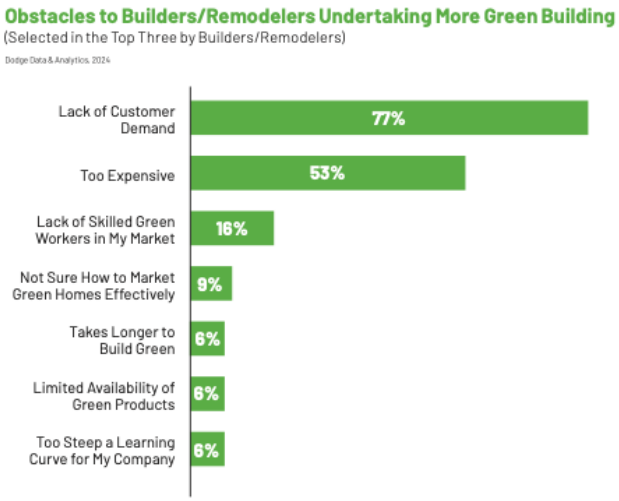
Hurdles – A Builder's Perspective



Remember: Natural Gas is the Green/Energy Efficient Choice

- The cleanest burning fossil fuel
- Virtually no emissions of sulfur dioxide or particulate matter and far lower levels of "greenhouse" gases when burned
- Produces virtually no solid waste
- Delivered to the customer with around 90 % efficiency
- Almost 100% of natural gas is produced in North America

Rebates, Incentives, Tax Credits

- Energy Efficient Home Improvement Credit — property installed by Dec 31, 2025
  - 30% of qualified costs; annual cap $1,200 (combined).
  - Sub-limits: gas furnace $600; gas boiler $600; gas water heater $600; home energy audit $150.
  - Must meet ENERGY STAR tax-credit criteria (furnace ≥97% AFUE; boiler ≥95% AFUE; storage WH UEF ≥0.81/<55 gal, ≥0.86/≥55 gal; tankless UEF ≥0.95).
  - 2025 filing: include product PIN or manufacturer QM code.
- Rebates (non-tax): DOE Home Energy Rebates (HOMES/HEAR) rolling out via states; amounts vary.
  - Send customers to the state program page for current status.
- Builder note: Credit for qualifying homes acquired before July 1, 2026.

Sources:
ENERGY STAR — Federal Tax Credits (2025 overview)
IRS — Energy Efficient Home Improvement Credit (Form 5695)
DOE — Home Energy Rebates (state programs)

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Resources

Energy Solutions Center
www.energysolutionscenter.org
www.naturalgasefficiency.com

USGBC
www.usgbc.org

ENERGY STAR
www.energystar.gov

NAHB
http://www.nahbgreen.org/

AGA
www.aga.org

U.S. Department of Energy
www1.eere.energy.gov

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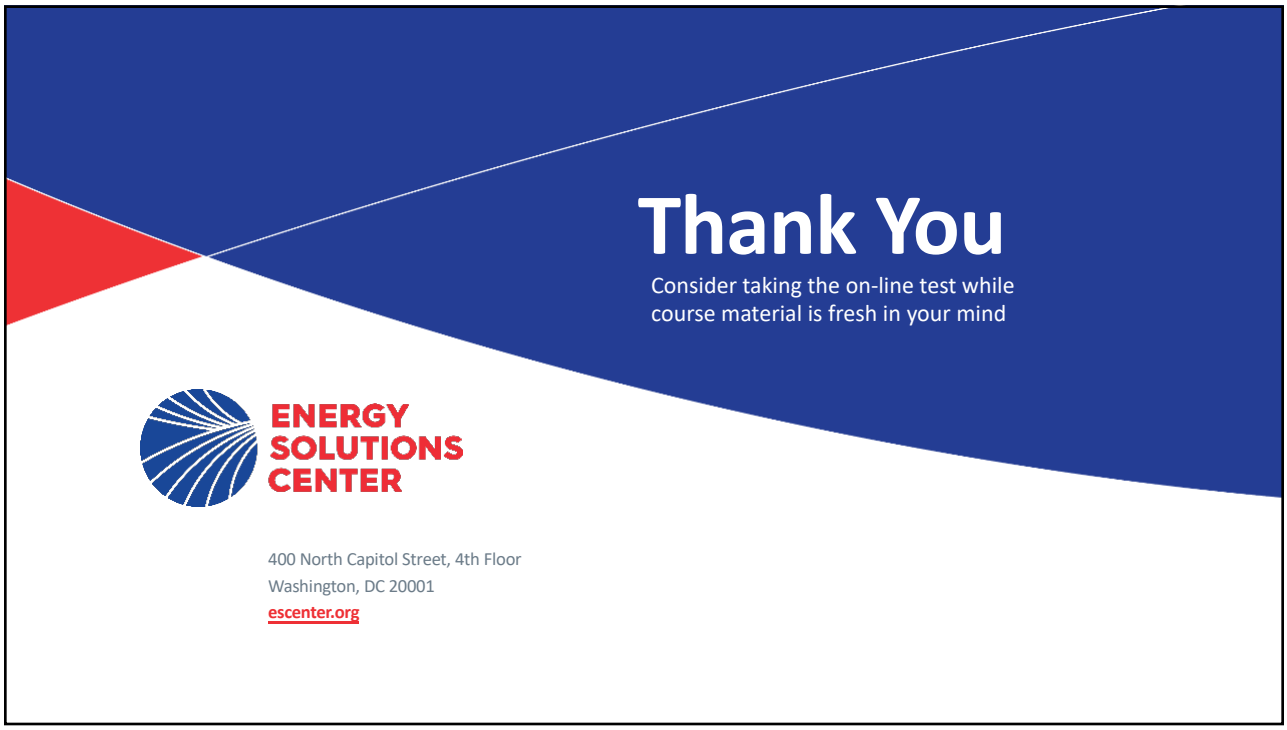

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