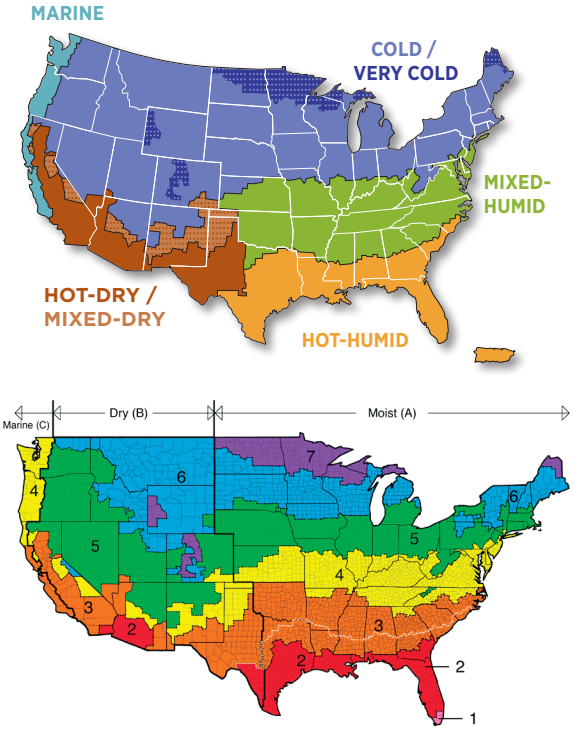
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building America's Optimized Solutions for New Homes

Mixed-Humid Climate



Climate Zone Maps

Map of Building America climate regions (top) for program reporting and IECC climate zones (bottom) as a reference for compliance information

The U.S. Department of Energy's (DOE's) Building America program has been a source of innovations in residential building energy performance, durability, and affordability for over 20 years. This world-class research program partners with many of the top U.S. home builders, contractors, and manufacturers to bring cutting-edge construction and design solutions and resources to market.

The most recent goal of the Building America program is to demonstrate how cost-effective strategies can reduce home energy use by about 30%[1] in new homes, in all climate regions, by 2015. As part of the strategy to prove that this level of performance is achievable in the market, DOE created a labeling program called the DOE Zero Energy Ready Home program.

Working together, Building America and the DOE Zero Energy Ready Home programs have created this series of optimized solutions to demonstrate how builders can achieve these high savings goals, cost effectively, in each climate zone.

Building America's five major climate regions include: cold/very-cold, mixed-humid, hot-humid, hot-dry/mixed-dry and marine[2]. These climate regions are outlined in Figure 1, along with a map of the International Energy Conservation Code (IECC) climate regions as a reference for compliance information. This document outlines the Building America recommendations for achieving incremental savings in the mixed-humid climate region.

Due to the tradeoff decisions that are made when building a home, there are hundreds of ways to meet Building America's savings target. The package listed in Table 1, shows just one way to cost effectively meet this goal. The far right column provides options for common building practices that can be used to obtain each particular performance objective. Unless otherwise noted, the performance values in the table are minimums. In depth descriptions, installation guidance and code compliance information for most of the options listed in Table 1 are available on the Building America Solution Center (basc.energy.gov).

Building America SM U.S. Department of Energy

DOE's Building America Solution Center

Decades of research in energy-efficient design have led to the Building America Solution Center. Builders and contractors are encouraged to use this resource to improve the durability and performance of energy efficiency options listed in Table 1.

The Building America Solution Center provides access to expert information on hundreds of high-performance construction topics, including air sealing and insulation, HVAC components, windows, indoor air quality, and much more.

Users can navigate the Solution Center in one of four ways:

- Building components
- Labeling program checklists
- Alphabetically
- By publications

Registered users can also save customized content in their own field-kits!

Find what you are looking for on the Building America Solution Center website: ***basc.energy.gov***

Table 1. Optimized Solution: Mixed-Humid Climate

Measure	Performance	Options
THERMAL ENCLOSURE		
High-R Ceiling	R-38	• Unvented Attics - Spray Foam Underside Roof - Spray Foam and Permeable Insulation - Exterior Rigid Insulation over Sheathing - SIP Roof • Vented Attics - Blown-in Insulation or Batt Insulation
High-R Walls	R-20 Cavity and R-5 Continuous	• Single-Wall Cavity Insulation with Advanced Framing - Spray Foam - Spray Foam and Permeable Insulation - Exterior Rigid Insulation • Double-Wall Cavity Insulation • SIP Walls • Insulated Concrete Walls
Crawlspace Foundation	R-13 Cavity or R-5 Continuous	• Unvented Crawlspace • Vented Crawlspace
High-R Window	U≤0.3, R≥3.3 SHGC≤0.27	• ENERGY STAR® Certified Window • Ideally R-5 Window
Air Tightness	ACH50≤2	• Air Sealing • Air Barriers
HVAC SYSTEM		
Heating Equipment	92.5% AFUE (Gas), or 9 HSPF (Electric)	• Direct Vent Gas Furnace • Air-Source Heat Pump • Geothermal Heat Pump • Ductless Mini-Split Heat Pump
Cooling Equipment	SEER 17	• Air-Source Heat Pump/Air Conditioner • Geothermal Heat Pump • Ductless Mini-Split Heat Pump
Duct Location	Conditioned Space	• Raised Ceiling • Dropped Ceiling • Buried and Encapsulated Ducts
Whole-House Ventilation	ASHRAE 62.2 5 cfm/W and No Heat Recovery	• Exhaust-Only Ventilation • Supply-Only Ventilation • Balanced Ventilation
ENERGY EFFICIENT COMPONENTS		
Water Heating	EF 0.8	• Gas Tankless • Heat Pump Water Heater • Solar
Lighting	ENERGY STAR	• Compact Florescent Lighting (CFL) • Light Emitting Diode (LED)
Appliances	ENERGY STAR	
Exhaust Fans	ENERGY STAR	• Individual Room • Central Exhaust
Ceiling Fans	ENERGY STAR	

Abbreviations: Solar Heat Gain Coefficient (SHGC), Annual Fuel Utilization Efficiency (AFUE), Heating Seasonal Performance Factor (HSPF), Air Changes Per Hour (ACH), Seasonal Energy Efficiency Ratio (SEER), and Energy Factor (EF).

The case studies in this section show real-world examples of how builders can meet (or even exceed) the savings target, even if they don't meet all of the recommendations in Table 1. Tradeoff decisions are often based on local materials, labor costs, and market preferences.

Nexus EnergyHomes: Frederick, MD

When Nexus EnergyHomes' founder Paul Zanecki partnered with Mike Murphy, formerly of Toll Brothers, to start a home construction company in Maryland, some might have questioned his timing. After all, it was 2008, and the country's building industry was on a steep downward trajectory. But Zanecki, a land-use lawyer, had a clear vision in mind—to revolutionize the home building industry by implementing the energy-efficient technologies already available to build net-zero energy homes at a cost consumers could afford. His research told him there was a market for energy-efficient homes if he could come up with the right suite of high-performance measures that would make sense from a building science and cost-competitive perspective.

The impressive package the builder has developed includes Structurally Insulated Panels (SIP) walls, geothermal heat pumps, solar photovoltaic panels, and a proprietary energy management system, among other things. What sets Nexus EnergyHomes apart is that these high-powered features aren't optional upgrades; they are part of the standard package, integrated into a whole building approach that is implemented on every home. Nexus EnergyHomes charges about 10% more for their zero energy homes than a similar sized home built to code, and they are selling twice as fast. This consistent approach has helped Nexus gain the distinction of having built the most emerald-level certified homes in the country based on the National Green Building Standard (ANSI ICC 700).

See the full case study online:
http://energy.gov/sites/prod/files/2013/11/f5/hiawinner_nexus_100213.pdf

Ferguson Design & Construction, Inc.: Sagaponack, NY

Sarah Ferguson and Kim Kakerbeck, the principles for Ferguson Design and Construction, Inc., have recently completed their first DOE Zero Energy Ready Home. The 6-bedroom home achieves a HERS score of 43 even before photovoltaic panels are installed and will cut utility bills dramatically for its owners. This marks a significant achievement for the builders—two women who came into construction from other careers on Wall Street.

The home is constructed of double walls consisting of two sets of 2x4s, with the studs at 16 inches on center. The studs are staggered so that heat cannot transfer directly through the studs. Together the two walls form a 7-inch wall cavity that is filled with blown-in fiberglass insulation for an R value of R-25. The exterior wall is covered with OSB (oriented strand board) that has a proprietary coating on it. When taped at the seams with the sheathing manufacturer's specified tape, the coated sheathing forms an airtight, weather-resistant barrier and drainage plane that does not need housewrap. Water-savings faucets, LED lighting, and ENERGY STAR appliances add to energy savings. All interior finishes are no, or low-VOC (volatile organic compound), and cabinets and furniture were made from recycled barn boards and trees salvaged from the property.

See the full case study online:
http://energy.gov/sites/prod/files/2013/11/f5/hiawinner_fergusondesign_100213.pdf

DOE Zero Energy Ready Home

The DOE Zero Energy Ready Home label establishes a framework for continuous improvement that will help propel the market toward net-zero energy performance. In the future, a consumer will have the option to buy an affordable DOE Zero Energy Ready Home anywhere in the United States—a home that can seamlessly accept a small photovoltaic solar array to offset the energy use of the home over the course of a year.

Find technical resources and learn how to become a Zero Energy Ready Home partner on the Building Technologies Office website: *http://energy.gov/eere/buildings/zero-energy-ready-home*

The Imery Group: Serenbe, GA

Home builder Luis Imery has built a home any homeowner would be proud of, the first DOE Zero Energy Ready Home in the state of Georgia.

The home is heated with a mini-split heat pump system. These mini-split systems are ideal for the low heating and cooling loads of very energy-efficient homes. The Proud Green Home's heating load is 22,020 Btu/h, equivalent to a 1.5- to 2-ton air conditioning system. Most standard central furnace and cooling systems would be oversized for that load. Because mini-split heat pumps have variable speed compressors and fans, they can better match low cooling or heating load conditions, thus increasing their efficiency. The heat pump's heating seasonal performance factor (HSPF) is 8.20 and its cooling efficiency is 14.30 SEER (seasonal energy-efficiency ratio) and 10.10 EER (energy efficiency ratio).

Imery stated that the performance criteria helped the home reduce energy consumption by 60% when compared to a similar home built to the current energy code, which in Georgia is equivalent to the 2009 IECC (International Energy Conservation Code). The home achieves a Home Energy Rating System (HERS) Index of 40.

See the full case study online:
http://energy.gov/sites/prod/files/2014/09/f18/DOE_ZEH_ImeryGroup_SG%2009-20-14_.pdf

Through targeted research, industry partnerships, and collaboration with related DOE residential initiatives, Building America works to make cost-effective, energy-efficient homes a reality for all Americans.

Along with energy savings, the program also focuses on solutions that lead to:

- Risk identification and mitigation
- Improved indoor air quality, which can benefit occupant health
- Higher comfort levels in all rooms throughout the home
- Durable and moisture-resistant building designs and renovation
- Increased builder profitability through reduced construction time
- Opportunities for new product designs that save energy, material, and installation costs.

1 Compared to the most recent House Simulation Protocols, roughly consistent with IECC 2009 and updated lighting, appliances and miscellaneous electric loads: *http://energy.gov/sites/prod/files/2014/03/f13/house_simulation_protocols_2014.pdf*

2 A detailed description of Building America climate regions is available at *http://energy.gov/eere/buildings/climate-zones*

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For more information, visit:
buildingamerica.gov

DOE/PNNL-SA-105501 • December 2014

The U.S. Department of Energy's Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.