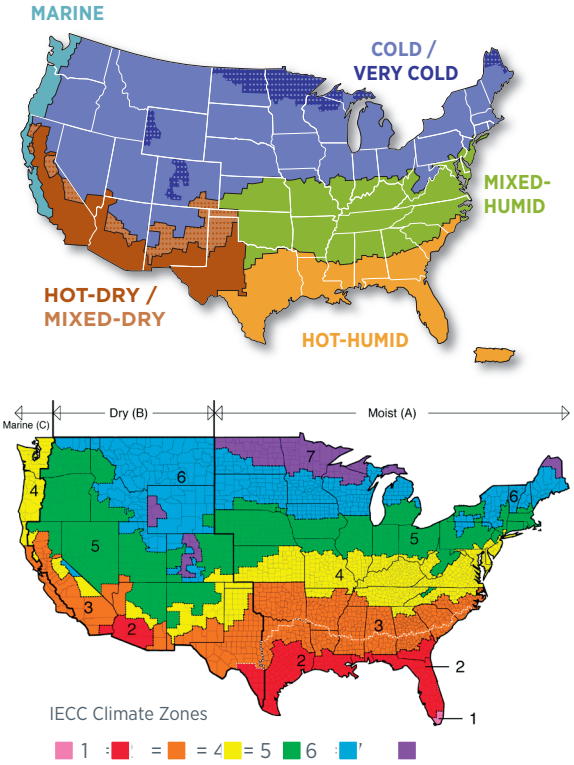
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building America's
Optimized Solutions for New Homes

Hot-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 nearly 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 more than 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 (ZERH) program.

Working together, the Building America and ZERH programs have created a series of optimized solutions to demonstrate how builders have achieved, and often exceeded, these high savings goals. These optimized solutions provide guidance to other builders to cost effectively meet the 30% energy savings goal in their climate zones.

Building America's five major climate regions include cold/very-cold, mixed-humid, hot-humid, hot-dry/mixed-dry, and marine. These climate regions are outlined in Figure 1, along with a map of the International Energy Conservation Code (IECC) climate regions for comparison[2]. This document outlines the Building America recommendations for achieving 30% savings in the hot-humid climate region (southwest region under white line).

The hot-humid climate performance package detailed in Table 1 uses common building practices to meet the performance criteria of 30% energy savings. Due to the tradeoff decisions that are made when building a home, there are hundreds of ways to meet the 30% performance goal. The table simply lists a subset of common recommendations.

Building America U.S. Department of Energy

Photo (top left): David Weekley

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. Building America Optimized Solution: 30% Savings for the Hot-Humid Climate

Measure	Performance	Options
THERMAL ENCLOSURE		
High-R Ceiling	R-49	• Unvented Attics - Spray Foam Underside Roof - Spray Foam and Permeable Insulation - Exterior Rigid Insulation Over Sheathing - SIP Roof • Vented Attics - Blown-in Insulation - Batt Insulation
High-R Walls	R-21 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
Slab Foundation	Uninsulated	
High-R Window	R-2.5	• ENERGY STAR® Certified Window • R-5 Window recommended
Air Tightness	2 ACH50	• Air Sealing • Air Barriers
HVAC SYSTEM		
Heating Equipment	80% AFUE (Gas), or 8.2 HSPF (Electric)	• Direct Vent Gas Furnace • Air-Source Heat Pump • Geothermal Heat Pump • Ductless Mini-Split Heat Pump
Cooling Equipment	18 SEER	• Air-Source Heat Pump/Air Conditioner • Geothermal Heat Pump • Ductless Mini-Split Heat Pump
Whole-House Ventilation	ASHRAE 62.2	• Exhaust-Only Ventilation • Supply-Only Ventilation • Balanced Ventilation
ENERGY EFFICIENT COMPONENTS		
Water Heating	EF>0.8	• Gas Storage • Gas Tankless • Heat Pump Water Heater • Solar
Lighting	ENERGY STAR	• CFL • LED
Appliances	ENERGY STAR	
Exhaust Fans	ENERGY STAR	• Individual Room • Central Exhaust
Ceiling Fans	ENERGY STAR	

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 website (*basc.energy.gov*).

The case studies in this section demonstrate real-world examples of builders meeting the 30% goal. These case studies show that builders can reach the 30% savings target even if they don't meet all of the recommendations in Table 1. Tradeoffs are often based on local materials, labor costs, and market preferences.

Manatee County Habitat for Humanity: Ellenton, FL

Volunteers with the Manatee County Habitat for Humanity are giving hope to 18 families at the Habitat affiliate's aptly named Hope Landing in Ellenton, Florida, just across the bay from Tampa. They are giving them the hope of homeownership, and hope for homes that are healthy to live in and affordable for the long term.

The biggest change was to switch from 2x4 stud framed walls to insulated concrete form construction. ICF walls provide an R-23 insulation value, a complete thermal break around the home's exterior (i.e., there are no studs extending through the wall to provide thermal bridging from the interior to the exterior), and the ICF provides the thermal mass benefits of a concrete wall (it heats up slowly during the day and releases that heat slowly at night). The solid ICF walls provide an exceptionally air-tight wall and they are rated for 200 mph winds, far exceeding the 150 mph rating required by the Florida Building Code.

See the full case study online:
http://energy.gov/sites/prod/files/2013/11/f5/hiawinner_manatee_habitatforhumanity_100213.pdf

Tommy Williams: Gainesville, FL

These high-performance homes in northern Florida are two that have achieved Home Energy Rating System (HERS) ratings of less than zero since Building America (BA) partners started building them in 2010.

The homes (TW1 and TW2) were built in the Gainesville area by Tommy Williams Homes (TW), with technical assistance from Florida H.E.R.O. and energy-efficient home design input provided by Energy Smart Home Plans. The homes have been metered by the Florida Solar Energy Center (FSEC) and takes advantage of energy efficient features such as air source heat pumps, ducts in conditioned space, spray foam as well as blown in insulation, ENERGY STAR appliances and a solar water heater.

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

Imery Group: Serenbe, GA

Home builder Luis Imery has built a home any homeowner would be proud of, the first U.S. Department of Energy-certified 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).

See the full case study online:
http://energy.gov/sites/prod/files/2014/07/f17/ba_zerh_case_study_imery.pdf

Southeast Volusia Habitat for Humanity: Edgewater, FL

In August 2013, Southeast Volusia County Habitat for Humanity (Volusia Habitat) completed its first U.S. Department of Energy (DOE) Zero Energy Ready Home in Edgewater, on the Atlantic coast of central Florida. This 1,250 ft^2, 3-bedroom, 2-bath home achieved a Home Energy Rating System (HERS) score of 49. That is 70 points better than typical existing homes, which have an average HERS score of 120 or higher. And it means substantially lower utility bills for the Habitat affiliate's homeowners.

Volusia Habitat has been building progressively more energy-efficient homes over the last several years thanks to an ongoing relationship with the Florida Solar Energy Center, a DOE Building America research partner. Volusia Habitat uses a raised heel roof truss (also known as an energy truss) to provide more insulation at the attic perimeter. The team installs pieces of rigid foam as baffles in each truss bay, which help to maintain the full depth of 8 inches of insulation over the top plates while preventing the insulation from spilling into the soffit vents.

See the full case study online:
http://energy.gov/sites/prod/files/2014/07/f17/ba_zerh_case_study_volusia.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.

Zero Energy Ready Home

The 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 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.

ZERO ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

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

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*

DOE/PNNL-SA-103733 • September 2014

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