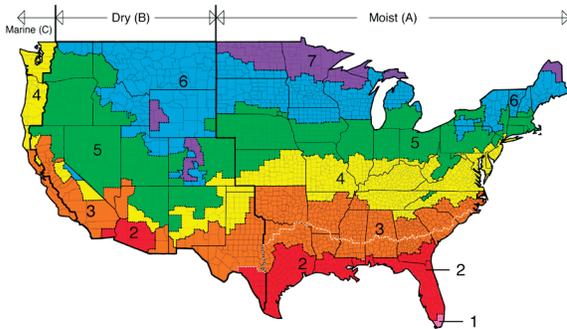
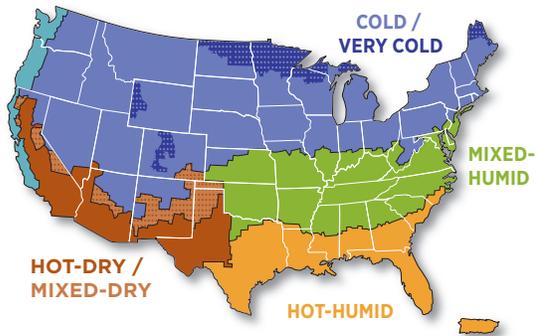




## Building America's Optimized Solutions for New Homes

# Mixed-Humid Climate

### MARINE



### IECC Climate Zones

1 = 1 2 = 2 3 = 3 4 = 4 5 = 5 6 = 6 7 = 7

## 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%<sup>1</sup> 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 all 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 the figure at left, along with a map of the International Energy Conservation Code (IECC) climate regions for comparison<sup>2</sup>. This document outlines the Building America recommendations for achieving 30% 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 the 30% performance goal. The performance levels listed in the mixed-humid table below, show just one way to cost effectively meet this goal. The far right column provides options for common building practices that could also be used to meet the performance goal.



## 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](http://basc.energy.gov)

**Table 1. Building America Optimized Solution: 30% Savings for the Mixed-Humid Climate**

Measure	Performance	Options
<b>THERMAL ENCLOSURE</b>		
High-R Ceiling	R-49	<ul style="list-style-type: none"> <li>• Unvented Attics               <ul style="list-style-type: none"> <li>- Spray Foam Underside Roof</li> <li>- Spray Foam and Permeable Insulation</li> <li>- Exterior Rigid Insulation over Sheathing</li> <li>- SIP Roof</li> </ul> </li> <li>• Vented Attics               <ul style="list-style-type: none"> <li>- Blown-in Insulation</li> <li>- Batt Insulation</li> </ul> </li> </ul>
High-R Walls	R-21 cavity and R-10 continuous	<ul style="list-style-type: none"> <li>• Single-Wall Cavity Insulation with Advanced Framing               <ul style="list-style-type: none"> <li>- Spray Foam</li> <li>- Spray Foam and Permeable Insulation</li> <li>- Exterior Rigid Insulation</li> </ul> </li> <li>• Double-Wall Cavity Insulation</li> <li>• SIP Walls</li> <li>• Insulated Concrete Walls</li> </ul>
Crawlspace Foundation	R-13 cavity	
High-R Window	R-3.3	<ul style="list-style-type: none"> <li>• ENERGY STAR® Certified Window</li> <li>• R-5 Window recommended</li> </ul>
Air Tightness	2 ACH50	<ul style="list-style-type: none"> <li>• Air Sealing</li> <li>• Air Barriers</li> </ul>
<b>HVAC SYSTEM</b>		
Heating Equipment	90% AFUE (Gas), or 9 HSPF (Electric)	<ul style="list-style-type: none"> <li>• Direct Vent Gas Furnace</li> <li>• Air-Source Heat Pump</li> <li>• Geothermal Heat Pump</li> <li>• Ductless Mini-Split Heat Pump</li> </ul>
Cooling Equipment	17 SEER	<ul style="list-style-type: none"> <li>• Air-Source Heat Pump/Air Conditioner</li> <li>• Geothermal Heat Pump</li> <li>• Ductless Mini-Split Heat Pump</li> </ul>
Whole-House Ventilation	ASHRAE 62.2	<ul style="list-style-type: none"> <li>• Exhaust-Only Ventilation</li> <li>• Supply-Only Ventilation</li> <li>• Balanced Ventilation</li> </ul>
<b>ENERGY EFFICIENT COMPONENTS</b>		
Water Heating	EF>0.8	<ul style="list-style-type: none"> <li>• Gas Storage</li> <li>• Gas Tankless</li> <li>• Heat Pump Water Heater</li> <li>• Solar</li> </ul>
Lighting	ENERGY STAR	<ul style="list-style-type: none"> <li>• CFL</li> <li>• LED</li> </ul>
Appliances	ENERGY STAR	
Exhaust Fans	ENERGY STAR	<ul style="list-style-type: none"> <li>• Individual Room</li> <li>• Central Exhaust</li> </ul>
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](http://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.

## 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](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 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, 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](http://energy.gov/sites/prod/files/2013/11/f5/hiawinner_fergusondesign_100213.pdf)





## 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.



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 U.S. Department of Energy-certified DOE Zero Energy Ready Home (ZERH) 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 ZERH 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. 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](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](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>