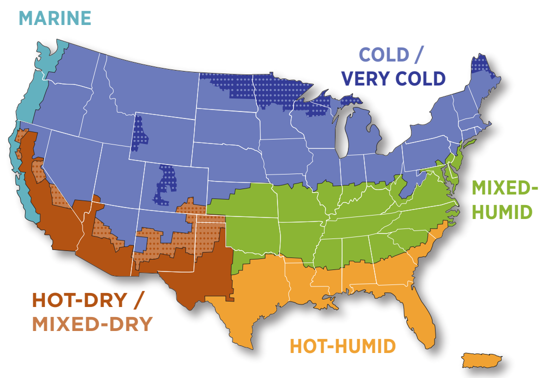
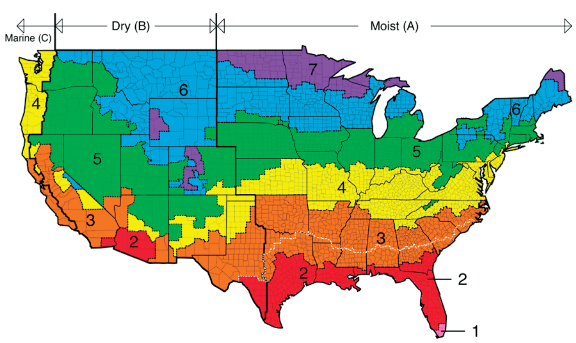
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Building America's Optimized Solutions for New Homes

Hot-Dry Climate





IECC Climate Zones

= 1 = 2 = 3 = 4 = 5 = 6 = 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 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 hot-dry 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 U.S. Department of Energy

Photo (top left): Centex is a Building America builder at Windemere in San Ramon, CA.

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: Hot-Dry Climate

Measure	Performance	Options
THERMAL ENCLOSURE		
High-R Ceiling	R-30	• 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-13 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	U≤0.4, R≥2.5 SHGC≤0.25	• ENERGY STAR® Certified Window • Ideally R-5 Window
Air Tightness	ACH50≤2	• 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	SEER 18	• 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.

Palo Duro Homes, Inc.: Albuquerque, NM

Palo Duro Homes, Inc., certified its first home to the DOE Zero Energy Ready Home program criteria in late 2012, and as of September 2013, the New Mexico production home builder has already certified 65 Zero Energy Ready Homes, far more than any other builder in the program.

The efficiency starts with an ordinary wood-framed wall done very well, with 2x6 rather than 2x4 framing and studs spaced 24 inches rather than 16 inches apart, so the wall is sturdy but has a deeper cavity for insulation. Other advanced framing measures like open headers above windows and doors on non-load-bearing walls, 2-stud rather than 3-stud corners, and single top plates and bottom plates mean there is less wood framing in the walls. This allows more space for insulation and causes less thermal bridging (which occurs when wood studs transfer heat through the wall). The wall cavity is filled with R-21 of blown-in formaldehyde-free fiberglass insulation. Less framing is used, which results in lower lumber costs.

See the full case study online:
http://energy.gov/sites/prod/files/2013/11/f5/hiawinner_palodurohomes_100213.pdf

Mandalay Homes: Phoenix, AZ

In 2013, production home builder, Dave Everson of Mandalay Homes built his first home to meet the rigorous energy-efficiency requirements of the DOE Zero Energy Ready Home program. Since then, he has certified 20 homes and plans to certify 50 more in six developments around the state of Arizona. In addition to being DOE Zero Energy Ready Home certified, every home will have a Home Energy Rating System (HERS) score of 50 or less.

The above-grade walls consist of 2x6 framing set 16 inches on center. The walls are filled with 3.5-in. (R-13) of open-cell spray foam and are sheathed with plywood, then house wrap, then a 1-in. layer of rigid foam, then lathe and a two-coat layer of stucco as an exterior finish. Mandalay trains its insulation contractors to caulk all wiring and plumbing holes through the top and bottom plates, exterior walls, and roof prior to filling the walls with spray foam. The rigid foam provides a continuous layer of insulation around the outside of the house and serves as a thermal break to prevent heat transfer between the inside and outside of the home. Mandalay uses advanced framing details, including open or insulated rather than solid wood headers over doors and windows, two-stud rather than three-stud corners, and ladder blocking where interior walls intersect exterior walls, to reduce the amount of lumber in the walls and increase the wall cavity space for insulation.

See the full case study online:
http://energy.gov/sites/prod/files/2014/09/f18/DOE_ZEH_Mandalay_080614.pdf

KB Home: San Marcos, CA

KB Home, based in Los Angeles, CA, has made a corporate commitment to build all of its homes nationwide to meet the ENERGY STAR for Homes Version 3 specifications. In 2012 this resulted in more than 6,200 new ENERGY STAR-certified homes for the builder, who ranked fifth in the nation on Builder Magazine's 2012 Top 100 ranking of U.S. home builders based on number of housing starts. In 2013 KB Home took high performance to the next level by building its first DOE Zero Energy Ready Home. The home is one of KB Homes' ZeroHouse 2.0 models, a net-zero-energy home that produces more energy each year than it consumes.

The whole-house approach includes tightly sealed and highly insulated walls. The 2x4 24-inch on-center stud walls are air sealed with a non-hardening sealant that is applied with a proprietary powered applicator. A ¼-inch bead is applied along the surfaces of all top and bottom plates, corner studs, and door and window framing to form a compressible gasket-like seal between the studs and the drywall. The sealant is also used to seal holes around piping and wiring and joints at rim joists and between top and bottom plates and exterior sheathing. To insulate the walls, the wall cavities were filled with R-15 fiberglass batts then covered on the exterior with R-4 of continuous rigid foam insulation.

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

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

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