

Element Design Build

The 2016
New American Home
Henderson, NV



BUILDER PROFILE

Element Design Build, Henderson, NV
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FEATURED HOME/DEVELOPMENT:

Project Data:

- Name: The New American Home, 2016
- Location: Henderson, NV
- Layout: 4 bdrm, 4.5 bath, 2 fl + bsmt, 6,541 ft²
- Climate Zone: IECC 3B, hot-dry
- Completion: January 2016
- Category: custom spec

Modeled Performance Data:

- HERS Index: without PV 44, with PV -17
- Projected Annual Energy Costs: without PV \$3,714, with PV -\$549
- Projected Annual Energy Cost Savings (vs home built to 2009 IECC): without PV \$2,800, with PV \$7,062
- Projected Annual Energy Savings: without PV 22,482 kWh, 164 therms; with PV 58,672 kWh, 164 therms
- Added Construction Cost: without PV NA, with PV \$74,304

Every year since 1984, visitors to the International Builders Show have gotten to tour a cutting edge new home built just for IBS by the National Association of Home Builders' Leading Suppliers Council (NAHB LSC) and *Professional Builder Magazine*. Dubbed "The New American Home," each year's version showcases the latest in home construction products and gadgetry from NAHB LSC members and project sponsors. Visitors to the 2016 IBS in Las Vegas were treated to tours of a modern multi-level 6,541-ft² home constructed by Element Design Build in the hills of Henderson, Nevada, with views of the Las Vegas strip.

Along with its large size and large expanses of glass, one might expect large energy bills. But this home was constructed to the energy saving criteria of the U.S. Department of Energy Zero Energy Ready Home program. The home, constructed by builder Element Design Build of Henderson, achieved a Home Energy Rating System (HERS) score of minus 17 (remarkably low considering the typical new home built to code in the U.S. would score a HERS 80 to 100.) The home's 19.2-kW solar photovoltaic system should produce so much power that the homeowner will get a credit on their bill averaging \$46/month. In other words, the home is expected to perform as a Net Zero energy home (one that produces at least as much energy as it uses in a year) with enough surplus to potentially power an electric car. Even without the PV, the home would perform at a respectable HERS 44, which corresponds to calculated bills of about \$250 per month.

This was the first New American Home to be certified through the DOE Zero Energy Ready Home program and the first DOE Zero Energy Ready certified home constructed by Element Design Build.

Fortunately, the path to achieving the DOE Zero Energy Ready Home certification is clear cut. Every home must be certified to ENERGY STAR



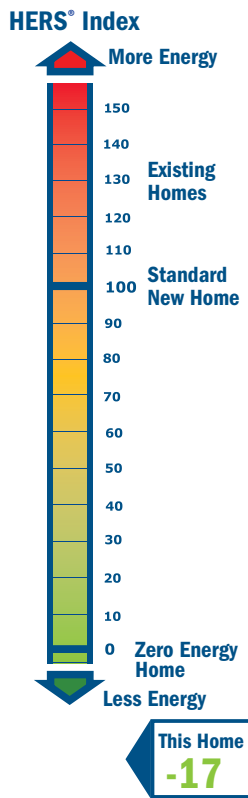
The U.S. Department of Energy invites home builders across the country to meet the extraordinary levels of excellence and quality specified in DOE's Zero Energy Ready Home program (formerly known as Challenge Home). Every DOE Zero Energy Ready Home starts with ENERGY STAR Certified Homes Version 3.0 for an energy-efficient home built on a solid foundation of building science research. Advanced technologies are designed in to give you superior construction, durability, and comfort; healthy indoor air; high-performance HVAC, lighting, and appliances; and solar-ready components for low or no utility bills in a quality home that will last for generations to come.

Element Design Build built this 6,541-ft² show home in Henderson, Nevada, to the performance criteria of the DOE Zero Energy Ready Home (ZERH) program. For water savings, the home's tankless gas water heaters met the EPA WaterSense water distribution specifications. WaterSense-rated plumbing fixtures, ENERGY STAR-labeled appliances, and 100% LED lighting added to water and energy savings. To help encourage indoor air quality the home met all of the requirements of the EPA Indoor airPLUS program.



What makes a home a DOE ZERO ENERGY READY HOME?

- 1 **BASELINE**
ENERGY STAR Certified Homes Version 3.0
- 2 **ENVELOPE**
meets or exceeds 2012 IECC levels
- 3 **DUCT SYSTEM**
located within the home's thermal boundary
- 4 **WATER EFFICIENCY**
meets or exceeds the EPA WaterSense Section 3.3 specs
- 5 **LIGHTING AND APPLIANCES**
ENERGY STAR qualified
- 6 **INDOOR AIR QUALITY**
meets or exceeds the EPA Indoor airPLUS Verification Checklist
- 7 **RENEWABLE READY**
meets EPA Renewable Energy-Ready Home.



Certified Homes Version 3.0 and the U.S. Environmental Protection Agency's Indoor airPLUS program. All homes must meet the hot water distribution requirements of the EPA's WaterSense program and the insulation requirements of the 2012 International Energy Conservation Code. In addition, homes are required to have solar electric panels installed or have the conduit and electrical panel space in place for future installation of solar panels.

To achieve these high-performance requirements, Element Design Build started with an insulated foundation slab for the walk-out basement level, which was built into the side of the hill. After pouring the footings, Element constructed basement walls of 10-inch-thick insulated concrete form (ICFs). The ICFs are hollow foam blocks that stack like bricks then are reinforced with rebar and filled with concrete to form a durable mold-, pest-, fire-, and earthquake-resistant wall. The two layers of foam provide continuous thermal protection for a true R-22 insulation value across the whole wall. Within the foundation walls, Element laid two 1-inch layers (R-10 total) of rigid extruded polystyrene (XPS) foam directly on the ground with seams staggered and taped. Over this an 8-inch structural concrete floor slab was poured. The truss cavities for the first and second floors and the roof were filled with R-57 of blown fiberglass insulation.

The remaining first-floor and second-floor walls were framed with 2x6s and sheathed with 1/2-inch OSB. The builder installed sill seal under sill plates and between the sill plates and subfloor; the foam fabric compresses into irregular surfaces forming a tight seal that keeps out air and bugs and also provides a vapor barrier. The builder also installed it as a gasket behind drywall at the top plates and in framed corners. For extra air sealing, the builder applied a sprayer-applied sealant over this insulation mesh before installing the drywall. The wall cavities were filled with dense-packed blown fiberglass for an R-23 insulation value. On the exterior, over the OSB sheathing, the builder installed house wrap and taped the seams, then covered this with R-10 of rigid foam and taped the seams in the foam. The insulation value for the whole wall was R-33. The walls were clad with an off-white smooth stucco or tan stone; light colors were chosen to minimize solar heat gain. Before installing the interior drywall, contractors tested the ducts by blowing theatrical smoke through the ducting to help them spot leaks while they were still easy to fix.

The home had vaulted ceilings and unvented, nearly flat roofs that were air sealed at the roof decking. The low attic spaces were dense-packed with blown fiberglass for an insulation value of R-58. The level roofs provided 3,834 ft² of surface area,



Element Design Build worked with the insulation provider to conduct WUFI calculations to determine the optimal blend of components for the walls, floors, and ceilings. ICF basement walls plus a combination of advanced framing, sill seal plate and drywall gaskets, dense-packed fiberglass, OSB, rigid foam, house wrap, and stucco provided an R-31 thermal blanket in the walls and comprehensive draft protection for the high-performance home.

more than enough space for the 19.2 kW of photovoltaic panels that were installed over the standing seam metal roofing. The light-colored metal was ENERGY STAR rated as a cool roof with an initial solar reflectance of 0.6.

A critical part of the building envelope was the glazing, as windows and sliding doors comprised more than 50% of the main living area walls. Element selected high-performance windows and patio doors with solar ban 70 glazing. The aluminum-clad wood-framed windows have invisible low-emissivity coatings on three of the glass surfaces to minimize heat transfer. An argon gas fill between the panes also slows heat transfer.

Space conditioning was provided by high-efficiency air-to-air SEER 21 mini-split heat pumps with variable speed compressors to help match varying loads for greater efficiency and quietness. All of the HVAC equipment was located within the home's conditioned space.

With careful air sealing of the walls and roof, plus the airtight ICF foundation, when tested with a blower door the home showed a whole-house airtightness of 2.69 air changes per hour at 50 Pascals pressure difference. To provide fresh air to the home, mechanical ventilation was provided with heat recovery ventilators (HRV) which were ducted to bring in filtered fresh air that was distributed through the central air handler. The HRVs pull stale air out of the home. The exhaust air and intake air ducts cross in a heat exchanger where heat is transferred from the warmer duct to the cooler duct warming incoming air in the winter and cooling incoming air in the summer.

The New American Home was also equipped with an integrated home automation system that enables home owners to control their lighting, climate, shades, entertainment, and security from a single interface. The system provides multiple control options for controlling or scheduling features individually, by room, or throughout the home. The system offers secure, cloud-based remote access that allows home owners to control their system from anywhere.

The Element Design Build team employed a systems-engineering approach, which seeks to make construction more cost effective. Element worked with their building partners to produce a home that incorporates energy- and material-saving strategies from design through construction. First, the team analyzed and selected cost-effective strategies for improving home performance. Next, the team evaluated design, business, and construction practices within individual partnerships to

HOME CERTIFICATIONS

DOE Zero Energy Ready Home Program, 100% commitment

ENERGY STAR Certified Homes Version 3.1

EPA Indoor airPLUS

LEED for Homes, platinum

NAHB National Green Building Standard — emerald

Water Smart Home

Southern Nevada Green Building Partnership



Every DOE Zero Energy Ready Home combines a building science baseline specified by ENERGY STAR Certified Homes with advanced technologies and practices from DOE's Building America research program.



Deep overhangs and covered porches provide views while keeping summer sun out of interior spaces.

The entire project team worked to come up with solutions, which included facing most of the home's windows northeast, and using outdoor spaces, such as the one off the kitchen, to take advantage of the views. Those windows that do face south and west have generous overhangs.

The home has achieved several high performance, sustainable certifications. In addition to the U.S. DOE Zero Energy Ready Home certification, which includes EPA ENERGY STAR and Indoor airPLUS, the home was also awarded the National Green Building Standard – emerald certification, LEED for Homes platinum certification, the Water Smart Home program certification, and the Southern Nevada Green Building Partnership qualification.

“We are proud to be selected as the builders of this 33rd edition of The New American Home,” said Anderson. “It is America’s premier show home and it serves as a construction technology laboratory, offering real-world demonstrations of the latest concepts in architecture, construction methods, trends, and new products.”

Element Design Build led all phases of this year’s project, including architecture, construction, and interior design. They worked with Home Innovation Research Labs of Upper Marlboro, Maryland, a DOE research partner formerly known as the NAHB Research Center. The green, sustainable building, and energy consultant was Two Trails, Inc., of Sarasota, Florida.

Anderson added, “the overall purpose of this IBS showcase home is to educate.” Throughout the show, buses shuttled conference attendees to the home for guided tours describing the energy saving features of the home. More than 7,000 builders, architects, and building professionals visited the home during the four days of IBS in January 2016. In addition, there were three special sessions at IBS talking about the home including an education class session, a press conference, and a conference floor session open to all of the 100,000 plus attendees at IBS. Media coverage and consumer outreach by product partners reached thousands more.

Photos courtesy of Element Design Build

identify cost savings. Cost savings could then be reinvested to improve energy performance and product quality. Lessons learned from this prototype can be incorporated into future houses.

This systems-engineering approach can also help builders make the trade-offs needed to achieve high-efficiency performance. The New American Home’s desert location posed special challenges. The original design called for many more operable windows and doors to capture the “eye-popping views” of the mountains and the Las Vegas strip to the south and west, but calculations showed solar heat gain through those windows would severely undermine the home’s energy

KEY FEATURES

- **DOE Zero Energy Ready Home Path:** Performance.
- **Walls:** R-31 blown fiberglass.
- **Roof:** ENERGY STAR cool roof, metal.
- **Attic:** Unvented attic with R-58 blown fiberglass.
- **Foundation:** Uninsulated slabs. Above-grade floors insulated to R-21 with batt fiberglass plus R-10 rigid foam.
- **Windows:** Double-pane; low-e; argon-gas filled; vinyl, wood, or aluminum frame.
- **Air Sealing:** 2.69 ACH 50.
- **Ventilation:** HRV.
- **HVAC:** Mini-split heat pumps SEER 19.
- **Hot Water:** Tankless gas water heaters, EF 0.95.
- **Lighting:** 100% LED.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, clothes washer.
- **Solar:** 19.21-kW PV.
- **Water Conservation:** WaterSense-qualifying fixtures and toilets.
- **Energy Management System:** Internet-controlled lighting, HVAC, shades, security.
- **Other:** Low-VOC paints and sealants.

“One of the things we were excited about was hitting this super high level of building performance with traditional building products. We’ve always pushed the envelope on the quality of our build. Now we’re adding science behind it.”

— Josh Anderson, owner of Element Design Build