BUILDING AMERICA TOP INNOVATIONS 2013 PROFILE

INNOVATIONS CATEGORY:
2. House as a System Business Case
2.1 New Home with Whole House Package

TOP INNOVATOR:
BA-PIRC, IBACOS, PHI, CARB, BSC, Northern STAR, ARBI

Zero Energy-Ready Single-Family Homes

Since 2008, the U.S. Department of Energy's (DOE) Builders Challenge and Challenge Home programs have recognized hundreds of leading builders for their achievements in energy efficiency—resulting in over 14,000 energy-efficient homes and millions of dollars in energy savings.

BUILDING AMERICA TOP INNOVATIONS

Recognizing Top Innovations in Building Science – The U.S. Department of Energy's Building America program was started in 1995 to provide research and development to the residential new construction and remodeling industry. As a national center for world-class research, Building America funds integrated research in market-ready technology solutions through collaborative partnerships between building and remodeling industry leaders, nationally recognized building scientists, and the national laboratories. Building America Top Innovation Awards recognize those projects that have had a profound or transforming impact on the new and retrofit housing industries on the road to high-performance homes.

Building America U.S. Department of Energy

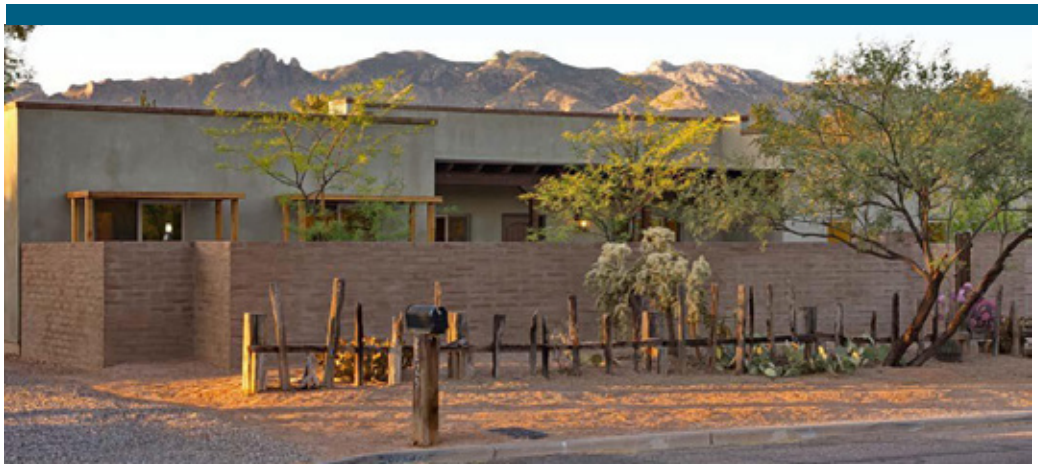
Building homes that are zero energy ready is a goal of the U.S. Department of Energy's Building America program and one embodied in Building America's premier home certification program, the Challenge Home program.

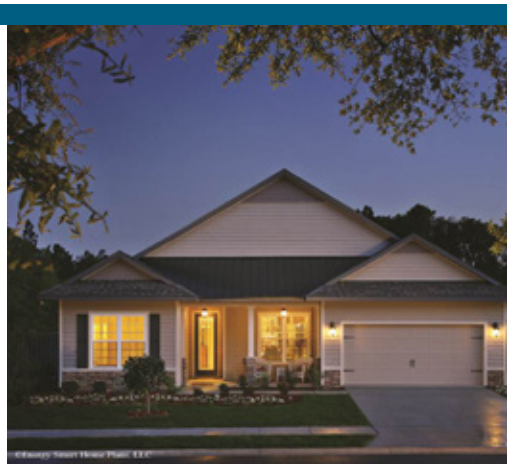
A net zero energy home is one that produces as much energy as the home uses. Solar power from photovoltaic panels can provide the energy but before the panels go on, there is a lot the builder can do to reduce the amount of power the home will consume. Increasing insulation levels, air sealing the building envelope, and installing the most efficient HVAC, lighting, and appliances, when done with a whole-house approach that also takes into account building durability and moisture issues, will all help to reduce energy demand. Conduit, wiring, and plumbing for solar photovoltaic and water heating panels can be conveniently added while the home is under construction, resulting in a zero energy-ready home, ready for solar panels whenever the homeowner is ready to purchase them. With a super-efficient home, not only will the homeowner have lower utility bills, when they are ready to install solar, they'll need fewer panels to reach net zero, and fewer panels mean lower costs to purchase and install.

Much of Building America's research is aimed directly at the goal of constructing high-performance homes and many of the Building America research teams have been directly involved with builders who are constructing zero energy or zero energy-ready homes. Here are just a few examples.

The Consortium for Advanced Residential Buildings, operated by Steven Winter Associates, worked with Preferred Builders, Inc., on a high-performance test home in Old Greenwich, CT. Technologies and strategies used in the "Performance House" were not cutting-edge, but simply "best practices practiced." Closed-cell spray foam insulated the unvented attic and the interior of the foundation wall and wrapped the underside and sides of the slab while 1.5 inches of rigid foam sheathing covered the outside of the walls, which were filled with R-21 of blown insulation. The HVAC consisted of a natural gas wall-mounted boiler, which provided heat for two hydro coils with variable speed fans. An ERV provides fresh air to the tightly sealed home, which blower door tested at 1.0 air changes per hour at 50 Pascals. The home achieved 30% source energy savings and a HERS score of 43 before adding the PV, providing the home owner with low energy bills of only $910 a year in this cold climate.

(Top left) Building Science Corporation worked with Transformations, Inc., on a subdivision of super-insulated homes that earned HERS scores of 35 before adding solar PV.





(Left) The ARBI team, led by Davis Energy Group, worked with La Mirada Homes on this SIP prototype home in Tucson that uses an air-to-water heat pump to heat water for radiant floor heat and chill water for fan coil and radiant floor cooling.

(Right) The BAPIRC team, led by Florida Solar Energy Center, worked with Tommy Williams Homes, whose high-performance homes outsold a competitor's 4 to 1 from 2009-2012 at a higher price. FSEC helped Lifestyle Homes improve the efficiency of its homes and the builder doubled sales from 2008 to 2009.

The Partnership for Home Innovation, led by the Home Innovation Research Labs, worked with Nexus Energy Homes on net-zero energy house designs for a community of homes in the mid-Atlantic region using the latest technologies to enhance the indoor environment, conserve resources, and save energy and money. Nexus incorporates high-performance features including a geothermal heat pump, structural insulated panel (SIP) walls and floors, efficient lighting and appliances, and solar photovoltaic systems in every home as standard features. Whole-house integrated electronics, controls, and monitoring devices provide the homeowner with measured functions, feedback, and performance data accessible by phone or computer. Houses come standard with sustainable features for indoor air quality, such as bamboo flooring, no-VOC adhesives, and a central vacuum. Homebuyers can choose architectural features, interior finishes, and fixtures such as flooring, cabinets, and lighting. Nexus spends considerable effort educating homeowners, appraisers, banks, and lenders on the value of high-performance homes. Nexus' homes qualified for DOE Challenge Home, ENERGY STAR, and the National Green Building Standard emerald level.

IBACOS prepared a report providing builders with guidance on developing partnerships with their subcontractors, material and product suppliers, and manufacturers, *Partnering for High Performance Homes*. IBACOS noted that historically, relationships in the residential construction industry are adversarial. But, they explained, high-performance homes require a high degree of coordination and significant interdependencies among various systems in order to perform properly, meet customer expectations, and minimize risks for the builder. Responsibility for the key performance attributes is shared across the project team and must be well coordinated. IBACOS identified several critical success factors for partnering including support from top management, mutual trust, effective and open communication, effective coordination around common goals, team building, appropriate use of an outside facilitator, a partnership charter or agreement, adequate resources, progress toward common goals, an effective problem-solving process, long-term commitment, continuous improvement, and a positive experience for all involved.

REFERENCES

German, A., B. Dakin, C. Backman, E. Weitzel, and D. Springer. 2012. *S.E.E.D. Home Evaluation*, Davis Energy Group.

PHI. 2013. *Case Study: Nexus EnergyHomes*, Partnership for Home Innovation

Prahl, Duncan. 2013. *Strategy Guideline: Partnering for High Performance Homes*, IBACOS, Inc., http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/strategy_guide_partnering_high_perf_homes.pdf

Puttagunta, S, J. Gra, and J. Williamson. 2013. *The Performance House – A Cold Climate Challenge Home*, Consortium for Advanced Residential Buildings, http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/performance_house_cold_ch.pdf%20

Thomas-Rees, S., D. Beal, E. Martin, and K. Fonorow. 2013. *Approaches to 30% Energy Savings in the Hot-Humid Climate,* NREL/SR-5500-57823, NREL. www.nrel.gov/docs/fy13osti/57823.pdf

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

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PNNL-SA-98661 September 2013

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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.