

BIR A meter

LEADING THE WAY TOWARD MARKETABLE ZERO ENERGY HOMES

4th QUARTER | 2008



Building America's 40% Marine Prototype: New Tradition Homes

BIRA has been working with five builders in the Pacific Northwest to develop communities that cost-effectively achieve 40% energy savings over the Building America (BA) Benchmark through the use of efficiency measures. Four Northern Marine test homes were built by a building partner, New Tradition Homes (NTH) of Vancouver, Washington.

The homes were two-story homes with a focus on crawlspaces ranging from 2,194 to 2,288 ft². The homes were built to ENERGY STAR® Homes Northwest Builder Option Package 1 (BOP) standards and exceed 40% savings relative to the BA Benchmark.

- Conditioned crawl with ducts in crawl
- Vented crawl with ducts in crawl
- Conditioned crawl with no ducts
- Vented crawl with no ducts

The study on the homes examined the comparative performance of vented and conditioned crawlspaces in the heating dominated marine climate of the Pacific Northwest.

Energy analysis performed on the prototypes shows energy savings of 44.1% compared to the BA Benchmark. Based on the energy cost savings from BEopt software and incremental costs estimated by NTH, it is estimated that the homeowner will see approximately \$1,276 savings per year versus the BA Benchmark with a net \$752 annual positive cash flow.

Detailed, analytical modeling was conducted on configurations of the prototype homes to examine the energy performance of the crawlspace variations using RemRate, EnergyGauge and SEEM software. The results indicate only small variations in energy use between vented and conditioned crawlspaces. Vented crawls with well insulated floors and well sealed duct work generally use less energy than conditioned crawls. Conditioned crawls use less energy only when they enclose leaky ducts.

Initial Communities

BIRA has fifteen community-level research and demonstration projects spanning the three climate zones predominate in the western States: Cold, Marine and Hot/Dry climates. BIRA's goal is to evaluate the performance of final production building designs through analyzing a community of homes, primarily for energy consumption.

Energy efficient home designs have been completed to achieve homes that are 40% more efficient in Cold, 50% more efficient in Hot/Dry and 50% more efficient in Marine climates. These designs will simplify prototyping and community scale construction efforts, BIRA will be looking for opportunities to be involved with projects that expect to perform beyond these levels or in other climates.



Phantom Loads



Miscellaneous Electric Loads (MELs), commonly referred to as phantom loads, were a major systems research area for BIRA in 2008. MELs are associated with unnecessary electrical consumption by appliances and consumer electronics. As loads are reduced in cooling, heating, lighting and water heating, MELs are becoming a more significant overall load, representing 25% of the total load of a 40% hot/dry BA benchmark home. BIRA is investigating the electrical savings potential from the introduction of controls and consumer education into BA homes, aimed at small appliance and consumer electronics.

BIRA researched two MELs reduction strategies: automated and manual control systems. This represents the two predominant system types currently available on the market. Automated systems represent solutions as simple as motion controlled light switches, and as complex as control systems for whole house lighting, security, outlets, thermostat, etc. The automated system evaluated was the Wattstopper IDP-3050. Manual control systems have

the ability to control a set of outlets from a centralized location. Power strips are the simplest manual control system, but they are usually unreachable. “Green switches” are the more complex systems using a master switch to control numerous objects in the house from one centralized location. The manual system evaluated was the Smart Control LCG3.

Both systems were successful at reducing phantom loads in both the home entertainment center and the home office. The following table shows the savings from the motion sensor controlled IDP-3050 and the LCG3 SmartStrip control power strip.

Gate 1B research for MELs will continue into 2009, expanding the test group and testing bigger and more sophisticated systems, as well as developing integrated MEL systems into projects like Home of the Future. BIRA is on track to make significant contributions to MELs research in the coming years.



System	Home Entertainment		Home Office	
	Total Reduction (kWh)	Phantom Load Reduction (W)	Total Reduction (kWh)	Phantom Load Reduction (W)
IDP-3050	4.40	57.550	19.40	33.156
LCG3	9.830	48.505	5.05	10.476

MELs Experts' Meeting

BIRA hosted the Miscellaneous Electric Loads (MELs) Experts' Meeting at the ACEEE Summer Study for Energy Efficiency in Buildings in Asilomar, CA in August of 2008. In a base case home, MELs represents 15% of the home's total consumption, while it jumps up to 25% in a Building America home which is 40% more efficient than the Benchmark.

- Existing research and practice aimed at MELs' reductions
- Short (<5 yrs) and long (>10 yrs) term solutions
- Opportunities and synergies between industries & technologies
- Barriers, challenges and necessary research toward consumer-friendly solutions

The Building America Program is on a collision course with MELs, and the 2 kW PV systems installed on homes is not an appropriate mitigation measure for MELs. A 2 kW system that produces roughly 2,500-3,000 kWh a year matches typical yearly MELs' use. Building America teams must coordinate future work with the industry, as well as with each other, to collaborate on tasks and to reduce the repetition of each other's work. The scope of the experts' meeting included identifying:

The Experts' Meeting exposed many gaps in the MELs area, but it also exposed the numerous possible solutions to combating the problem. Electronics are the biggest problem to MELs, but systems like power strip and house automation controls, feedback devices, and education for behavioral change can all be used to mitigate MELs impact. As the Building America Program progresses through its milestones, it will be increasingly important to find a way to mitigate MELs loads.

Building America's 40% Cold Prototype: Kennecott Land

BIRA's partnership with Kennecott Land to assist in the development of an energy efficient, master-planned community of 200,000 homes provides a significant opportunity to both BIRA and the BA Program. The home builders participating in this project are: Gold Medallion Homes, Liberty Homes, Rainey Homes, and Holmes Homes. These builders and Kennecott Land are committed to working with BIRA with the goal of building cost-effective and marketable communities that are energy efficient.

At the 40% level, all four homes have been built and have been tested to meet the proposed specifications. All four builders have committed to continued work with BIRA to complete research on the prototype homes.

The status of each home is as follows:

- **Liberty Homes and Holmes Homes** are currently for sale. BIRA has worked with both builders to coordinate agreements with future homeowners to monitor their utility bill's data. Post-construction cost neutrality analyses have been completed.
- **The Rainey Home** was sold in September 2008. BIRA is monitoring the performance of the Bosch tankless water heater and the Bosch solar water heating system. These systems will be part of Gate 1B research for 2009. In addition BIRA will be working with the homeowner to monitor utility bills to confirm actual performance.
- In the **Gold Medallion Home**, BIRA along with both NREL and Heliocentric, has installed monitoring equipment and will perform extensive monitoring and data evaluations on the photovoltaic thermal (PVT) and two-stage OAsys evaporative cooler, in BIRA will also monitor overall whole house energy savings (WHES). This home is scheduled to become a BIRA lab home beginning in February 2009 and BIRA will be conducting a cost-neutrality analysis in early 2009.



The Rainey Home with the solar water heating system

The four homes evaluated in this study all achieved the 40% Cold WHES level. As shown in the table below, all four builders increased their features from the current Kennecott guidelines to achieve the BA 40% Cold WHES requirements.

Features	Kennecott Sustainability Guidelines	40% WHES Cold BA Design
Insulation	R-19 Wall R-40 Ceiling	R-21 Batts, 2x6, 16" o.c. R-49 Ceiling
Windows	0.35 U-factor SHGC NR	0.318 U-value/0.302 SHGC
Cooling	SEER 13	SEER 15
Heating	0.90 AFUE	0.92 AFUE
Ducts	R-6 in Unconditioned Space	Ducts in Conditioned Spaces
DHW	0.60 EF Tankless	0.80 Tankless Water Heater
Lights	-	100% CFLs
Appliances	ENERGY STAR®	ENERGY STAR®



The Building Industry Research Alliance (BIRA), a U.S. Department of Energy Building America team led by ConSol, produces the quarterly BIRAmeter. BIRA works with over 80 partners to produce marketable energy efficient solar homes and communities aimed at net zero energy by 2020. For more information please visit www.bira.ws or email BIRA@ConSol.ws.

