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IN DEPTH

A Community Approach: Wisdom Way Solar Village

Extremely efficient homes are not only possible, but becoming more popular. What about expanding that idea to include a whole residential community? In 2010, Rural Development, Inc. (RDI) decided to seek not just one home, but a community of near-zero energy homes with a project in Greenfield, Massachusetts. Composed of 10 duplexes, a total of 20 residences, RDI created the Wisdom Way Solar Village community (see Figure 1). Steven Winter Associates Inc. (SWA), of the Consortium for Advanced Residential Buildings (CARB), partnered on the project, and is conducting data performance analyses to determine whether the planned community of homes reached near-zero energy levels. An upcoming report authored by Robb A. Aldrich, PE, SWA, is currently under review. The findings were prepared for the Building America, Building Technologies Program and the Office of Energy Efficiency & Renewable Energy (EERE). Aldrich shared and discussed some of the initial research findings, including home components, structure, and modeled and actual energy performance, with ***Energy Design Update***.

The Homes

In concert with CARB and architects at Austin Design, RDI started holding team meetings encompassing all professionals – from architects to finish trades – before land was acquired. "RDI got everyone on the same page with this," Aldrich commented. "The 20 home community was a big challenge and they got people on board from the beginning. Initial design meetings involved everyone so that everyone was tuned in to what the goals were from the start." Once the site was acquired, special attention was paid not only to building orientation, but also to the balance of development and open space. Site planning goals included:

Figure 1. Rural Development, Inc. desired a whole community of near-zero homes for Wisdom Way Solar Village. Image courtesy Steven Winter Associates.

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- Creating a "neighborhood," rather than a typical, suburban development;
- Providing open space for recreation, gardening, etc.;
- Incorporating utilities and roads efficiently;
- Providing a southern orientation for all homes to allow for passive and active solar;
- Incorporating functional landscaping that would not cause detrimental shading; and
- Making the community accessible to people with disabilities.

Building plans called for a mix of 2-bedroom, 3-bedroom, and 4-bedroom residences. Living spaces were oriented to the south, while bedrooms and bathrooms were located on the northern exposure of each duplex.

Figure 2. Double walls prior to insulation. Image courtesy Steven Winter Associates.

Due to RDI's stated goals for the development, and their previous experience in constructing near-zero energy homes, building specifications were rigorous. A key feature in the homes was the double-wall construction (refer to Figures 2 and 3). Each above-grade exterior wall is started with a 2x4 framed wall, load-bearing, with framing at 16" on center. Once the envelope is fully enclosed, carpenters return to frame an interior 2x4 wall 5" inside of the existing frame. Insulation netting is then stapled to the inner studs, and the new 12" wall cavity is filled with dry-blown cellulose insulation, with densities at a minimum of 3.4 to 4 lbm/ft^3. The design team sought and gained approval to leave out the reinforced polyethylene vapor barrier required by Massachusetts codes to allow the wall a better chance of drying in the case of moisture intrusion.

The roofs of the residences used manufactured, raised-heel trusses, and incorporated full soffit and ridge vents and full insulation baffles at each truss bay. Using

Figure 3. Double walls after cellulose insulation. Image courtesy Steven Winter Associates.

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loose-blown cellulose at 14", the attic achieves an R-value of close to 50 ft² hr°F/Btu.

Securing ideal window performance presented a major challenge for RDI. Heat Mirror™ membrane technology, a low-emissivity, polymer film suspended between two panes of glass, which was used on previous houses, was unavailable for this project. RDI had to walk the balance between ensuring enough passive heat gain and visible light transmittance (VT) from windows, while preventing excessive heat loss through the window itself (refer to Table 1). RDI selected vinyl windows from Paradigm tuned to the different orientations. Those windows facing north, east, or west received triple-pane glass with low-e coating on surfaces 2 and 5, for a final U-value of 0.18, solar heat gain coefficient (SHGC) of 0.23, and VT of 0.37. South facing windows were constructed with double-pane glass, and one coat of low-e on surface 3 to achieve higher SHGC and VT values.

For ventilation, the homes at Wisdom Way relied on an exhaust-only ventilation strategy. In the primary bathroom of each home, a Panasonic Whisper Green exhaust fan (model no. FV-08VKSL1) was installed and programmed to run continuously to meet the whole-building ventilation requirements of ASHRAE Standard 62.2-2007. An additional Panasonic fan was used via a simple air distribution system to move 20–25 CFM of air to each bedroom. The strategy offered affordability, low maintenance, and low power consumption in a northern climate, as compared to using HRV or ERV technology.

Finally, lighting in the home comes from compact fluorescent lamps (CFLs). All appliances in the homes are ENERGY STAR rated. Water heating uses solar thermal technology, collected from a flat-plate solar collector located on the southern roof. Auxiliary water heating comes from sealed-combustion natural gas-fired tankless water heaters. In addition to the solar collectors, each home boasts a roof-mounted solar electric system. Two-bedroom homes have 2.84-kWSTC PV systems; 3- and 4-bedroom homes have 3.42-kWSTC systems. All systems are installed flush on the roof (10/12 pitch, 40° tilt) and facing within 10° of true south. Each system has one inverter that is located in the basement of each home.

The Evaluation: Structure

The commitment to very low energy use lead to the establishment of the following key home features:

- Careful site plan so that all homes have solar access (for active and passive);
- Cellulose insulation providing R-40 walls, R-50 ceiling, and R-40 floors;
- Triple-pane windows;
- Air tight construction (~0.1 CFM_{50}/ft^2 enclosure area);
- Solar water heating systems with tankless, gas, auxiliary heaters; and
- PV systems (2.8 or 3.4 kW_{STC}); 2–4 bedrooms, 1,100–1,700 ft^2.

Aldrich commented on a stand-out feature of the homes at Wisdom Way: their double walls. "The double wall system worked really well for the envelope. There were some challenges with that. In design, homes were practically boxes; to break up that aesthetic monotony the architect incorporated various kinds of siding. The homes look great, but integrating the different siding systems resulted in some unforeseen challenges and expense. Overall, though, we are pretty happy with the outcome, and most owners seem to be, also." SWA found that the double-wall construction worked well for two key reasons: first, Austin Design designed the homes simply with double-wall construction in mind; and second, RDI used its own trained employees for construction, and did not have to train subcontracted framers. Because of the well insulated envelope, and the special attention paid to air sealing, homes had a leakage rate of 200–350 CFM when depressurized to 50 Pa. The tight envelope also meant design heat loads were very small, between 10,000 and 13,500 Btu/hr. Small loads enabled the selection of a simple heating system. RDI selected a sealed-combustion, natural gas-fired

Table 1 — Window Properties at Wisdom Way Solar Village

Orientation	Manufacturer	Description	U-Value	SHGC	VT
South	Paradigm	Double-pane, low-e on surface 3	0.26	0.37	0.53
North, East, West	Paradigm	Triple-pane, low-e on surfaces 2 and 5	0.18	0.23	0.37

Table 1. Selected window performance values. Data courtesy Steven Winter Associates.

Table 2 — Annual Site Energy Use

Benchmark			Prototype	
End Use	kWh	Therms	kWh	Therms
Space Heating	739	1024	212	258
Space Cooling	851	0	547	0
DHW	0	242	0	53
Fixed Lighting	1490		415	
Appliances	1056	98	937	98
Plug Load	2578	11	2578	11
Plug-in Lighting	309		86	
OA Ventilation	190		53	
Total Usage	7213	1375	4828	420
Site Generation			4060	
Net Energy Use	7213	1375	768	420

Table 2. Modeled site energy of three-bedroom home compared to the baseline home using Building America Benchmark procedures. Data courtesy Steven Winter Associates.

room heater located in the central area on the first floor of every unit. The specific unit used at Wisdom Way is a Monitor Products model GF1800; capacity is 10,200 Btu/h at low fire, 16,000 Btu/h on high fire, and the AFUE is 83%. Prior to Wisdom Way, RDI's standard heating system selection was an ENERGY STAR boiler (either gas or oil) fueling hydronic baseboard convectors. The heater system employed at Wisdom Way results in savings of approximately $4,000, and helps offset the significantly higher envelope costs.

Aldrich summed up the structural lessons from Wisdom Way Village. "From my perspective, the very simple heating system is the most interesting point of the project. It made the project doable. A slick, simple system. Minimal HVAC combined with super envelopes makes the whole thing more cost effective."

The Evaluation: Energy Performance and Energy Bills

CARB applied two different modeling methods to obtain a thorough picture of energy performance at the completed Wisdom Way Solar Village. Both Building America Benchmark Analyses and REM/Rate modeling were used, and data were looked at before and after occupancy. Aldrich explained why these rating systems were chosen. "REM/Rate is what raters use and is really a simple, quick, easy tool to use. REM analysis is very accurate in predicting heating energy use in homes. The big wild card

Table 3 — Annual Cost

Unit	Gas	Electricity	Total
2-1 A	$427	-$6	$421
2-2 A	$358	-$73	$285
2-2 B	$386	-$216	$171
2-2 C	$183	$68	$251
3 A	$390	-$6	$385
3 C	$422	$35	$458
3 D	$485	-$189	$297
4 A	$418	$12	$430
Average	$384	-$47	$337

Table 3. Average annual energy costs, including all utilities, for 8 occupied homes at Wisdom Way Solar Village. Data courtesy Steven Winter Associates.

Table 4 — Incremental Costs

Measure	Without subsidies	With subsidies	Notes
Double-wall construction	$3,776	$3,776	From builder calculations and estimates
R-50 attic insulation	$300	$300	Builder cost calculation
R-40 floor insulation	$540	$540	From BEOpt cost estimates
Triple-pane windows	$1,436	$1,436	Actual incremental window costs
Heating system	-$4,500	-$4,500	Plumber and builder estimates, including savings from the standard central boiler and baseboard
Water heating system	$0	$0	Cost of tankless comparable to indirect tank
Ventilation system	$600	$450	Cost estimates for distribution system; the electric utility provided the fan at no cost
100% CFL	$114	$0	BEOpt estimate of $3.79 per lamp; utility provided all CFLs at no cost
ENERGY STAR appliances	$190	$190	BEOpt incremental costs for ENERGY STAR refrigerator and dishwasher
Solar water heating system	$9,750	$0	Pricing from solar contractor plus additional RDI labor; RDI obtained DOE funding for solar thermal systems
3.4-kW Photovoltaic system	$24,827	$4,574	State incentives provide funding for PV systems
Total	$37,033	$6,766	

Table 4. Approximate costs for energy improvements to a 3-bedroom RDI home. Incremental costs are compared to Building America Benchmark specifications. Data courtesy Steven Winter Associates.

in any energy model is how the building is used and what occupants do. Really no model can account fully for that, which means energy bill information after occupancy offers a second analysis source. Heating is more predictable from a modeling standpoint, and is one of the least susceptible use elements to different occupants. Electric, lighting, and water use really hinge on occupants. You have to take any model with a grain of salt."

In the Benchmark Analysis, Wisdom Way home performance was compared to the Building America Research Benchmark, as defined December 20, 2007. The 3-bedroom home was selected for evaluation, as it is the most common model in the development. Using EnergyGauge USA v2.7.03 for hourly energy simulation, F-Chart software for solar thermal performance, and NREL's PVWatts tool for PV generation, a picture of the home's performance emerged. Analysis revealed that the homes required 57% less source energy to operate than the benchmark definition home. When PV generation is included, the savings jump to 77%. The Benchmark home calculated 1,024 therms for space heating, while the Wisdom Way home needed only 258 therms. Total Benchmark home kWh usage was estimated at 7,213 annually under the Building America Benchmark procedures, whereas the RDI home was estimated to have an annual need at 4,828 kWh, and only 768 kWh after site generation from solar systems was calculated (refer to Table 2). Aldrich noted that a big source of discrepancy between between the modeled and measured within the Benchmark modeling procedure is the requirement to include modeling of a minimally-efficient air-conditioning (AC) system, despite the fact that the actual home does not have an AC system.

Table 5 — Annual Energy Cost

Modeled - Benchmark Ref Home	$3,292
Modeled - EGUSA	$957
Modeled - REM/Rate	$365
Measured - Average Bills	$380

Table 5. Comparison of modeled and measured energy costs. Data courtesy Steven Winter Associates.

REM/Rate analysis was also conducted on the Wisdom Way homes, and assumed infiltration rates of 350 CFM50. The 3-bedroom model was predicted to use 185 gas therms annually for space heating, 24 therms for water heating, and 298 therms in total. Modeled annual energy costs were predicted to be $364 for the 3-bedroom home.

Home purchasers in Wisdom Way Solar Village agreed to allow RDI and SWA access to utility bill information. By comparing utility bills to model predictions, CARB received a full picture of home energy performance. Of 11 homes surveyed for electricity, 9 generated more energy than they consumed. Average annual electricity costs were $8. For the 13 homes with one year of gas consumption records, average annual consumption was 203 therms, and average annual gas costs were $377, including utility fees. As an interesting note, gas consumption in the two unoccupied homes was only 30% less than the average consumption seen in occupied homes. Actual annual energy costs from collected data were then calculated, and found in total to average $337 annually, or $28 per month (refer to Table 3).

Conclusions

After all of the numbers were crunched, actual energy costs proved to be even lower than predicted modeled costs. RDI was successful in realizing a high performance community. However, a major point of discussion for the project remains in weighing cost effectiveness of the upgrades. When asked how increased material costs were balanced, Aldrich weighed in: "RDI is a non-profit, affordable housing group, and they are driven to build really good houses and to do the right thing. RDI did a great job coordinating everything and balancing everything." However, can a larger, for-profit home builder be convinced by the data?

Total incremental costs for energy improvements in the 3-bedroom Wisdom Way home reached $37,033. RDI was able to access subsidies to decrease these costs to $6,766 (refer to Table 4). Modeled cost savings for the home were calculated at $2,335 per year (refer to Table 5). With subsidies included, energy savings of $2,335 annually translate to a rate of return of 35% on efficiency investments, calculated over a 30-year period. Without subsidies, the rate of return falls to 4.7%. When taken separately, what can the incremental costs tell us? Solar systems at the homes – both PV and solar thermal – took up 93% of the incremental cost. Including improvements and incremental costs to the envelope, HVAC, lighting, and appliances and associated savings, and deleting the solar system and its costs, a home realizes a 47% effective rate of return. Although solar consumed the lion's share of incremental costs, it also made up 50% of energy cost savings. Aldrich stressed that, at this point in time, a residential builder must carefully weigh planning, installation, and total costs before adding solar to a building's performance arsenal.

Aldrich summarized the key lessons from the Wisdom Way Village project for today's residential builder. "Really focus on the envelope. The better the envelope the less important how you heat and cool buildings becomes. You can really simplify things there." Beyond the envelope, Aldrich stressed the need for careful planning and buy-in from all project partners. RDI got everyone on the same page, and with the same goals, from the beginning. "Even code officials and the town were very receptive," Aldrich commented. "Planning is always important. Planning and coordination were key to realizing efforts in the end." Having a committed team also helped tremendously. "When challenges arose, everyone was willing to jump and to field engineer solutions."

As Aldrich and CARB researchers conclude, the cost savings from the simple HVAC systems made possible the tremendous investments in the homes' envelopes. Models predicted and data demonstrated that, because of efficient lights, appliances, and conscientious home occupants, the energy generated by the solar electric systems exceeded the electric energy used in most homes.

The final report, "A Building America Technical Report: Wisdom Way Solar Village: Analysis of Occupied Homes," is currently under review, and should be made available later this fall. Steven Winter Associates, Inc, may be contacted at 50 Washington Street, Norwalk, CT 06854.

IN BRIEF

Deloitte Looks to Consumer Actions in Forecasting Future Energy Trends

Deloitte Development LLC released its latest survey on energy and resources, entitled "Energy Trends: What Do Business and Consumer Actions Say About the Future?" The survey seeks to form a picture of the changing energy marketplace, based on the effects of consumer attitudes and the economic recession. Deloitte, in partnership with strategy and market research firm Harrison Group, collected the data

through the 2011 reSources Study. Held on July 20, 2011, presentation speakers included Marlene Motyka (Principal, Deloitte Financial Services LLP), Doug Harrison (Chairman and CEO, Harrison Group), and Gregory Aliff (Management Partner, Deloitte LLP).

In regard to electrical consumption, the study found that 68% of consumers surveyed stated they took extra steps to reduce electrical bills, as a result of the recession. A total of 95% reported that their spending in regard to electricity will remain at or near current levels, despite economic improvements. Yet, only 38% of total respondents felt that they understood the resources their electrical company used to generate electricity. Among respondents aged 21 to 34, 50% were unsure about electrical resources, while only 19% of those aged 66 to 74 reported uncertainty, indicating that younger generations are more poorly informed about electricity resources. The study also found that respondents were unsure of electrical company agendas, with 47% stating the agenda was to have households conserve electricity, while 35% were really not sure. Those surveyed reported coal, natural gas, and oil as what they believed to be dominant resources used to generate electricity. Data found a consumer eagerness for electrical companies to embrace renewables, as 65% and 64% voted for further investment in solar and wind energy.

With regard to overall energy trends, the study found high receptiveness toward changing current energy practices. A total of 69% of consumers surveyed were extremely/very motivated to develop alternative energy in the US, seeking to both reduce dependence on foreign oil and create more jobs domestically. Second in support from respondents (61%) was the idea to generate tax credits for investing in solutions – more efficient light bulbs, light sensors, smart home technology – to reduce electric bills. In all, 59% supported the statement that alternative energy will be an important aspect of future economic health, and were motivated to invest in alternatives, based on jobs and national security. The same percentage supported rebates directly from electrical companies to reward choosing more efficient light bulbs. Rounding out the top five ideas, respondents supported the application of smart meters to allow the management of energy consumption. Those aged 21 to 34 were more likely to purchase more expensive smart energy applications, with 28% of that cohort reporting that they would definitely make the purchase, as compared to 19% of those aged 35–44, 16% of those aged 45–65, and 13% of those aged 66–74. When asked to pay a small amount for a meter or timer control system, 25% of total respondents would definitely make the decision, and those aged 21 to 34 were again leading the pack, with 33% responding positively.

For access to the Deloitte Dbrief report slides, go to *http://www.deloitte.com/view/en_US/us/Insights/Browse-by-Content-Type/dbriefs-webcasts/Industries/Energy-Resources/index.htm*.

New Strategy Guidelines for Heating, Cooling Released by EERE

The US Department of Energy (DOE) Energy Efficiency & Renewable Energy (EERE) Building Technologies Program has released strategy guidelines for creating accurate heating and cooling load calculations. The guide, "Strategy Guideline: Accurate Heating and Cooling Load Calculations," released in June 2011, emphasizes potential risks from inaccurate adjustments, and focuses on critical inputs of load calculations. Referencing the methodologies of the Air Conditioning Contractors of America (ACCA) publication Manual J Residential Load Calculation Eighth Edition (ACCA MJ8), which in turn references information provided by the American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE), the publication offers real world examples and applications of calculations. Load components, risks associated with oversizing, and load dependencies are explored in depth. The guide concludes that seemingly small manipulations containing inaccuracies translate into exaggerated loads, and that combining several adjustments can lead to inaccuracy of calculation results. The publication counsels avoiding compounding of arbitrary safety factors to get a more accurate load calculation.

To access this document in full, go to *http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/hvac_load_calc.pdf*.

RECS 2009 Data Offers Detailed Profile of Household Energy Use

Compiling end use energy data collected from residential households every four years, the 2009 Residential Energy Consumption Survey (RECS) overview, data, and analysis and reports are now available through the US Energy Information Administration (EIA). For access to RECS, go to *http://www.eia.gov/consumption/residential/data/2009/#tabs-1*.

The 2009 data revealed that appliance and consumer electronic use has nearly doubled over the past 30 years, rising from a 17% to a 31% share of electricity consumption. Data gathered offered a detailed profile of fuels used and end uses in US homes. Among detached single-family homes, electricity was primarily used for "other" purposes, followed by air conditioning, cooking, and space heating. Electrical use in attached

single-family units and apartment buildings maintained a similar usage profile. Natural gas consumption data revealed households use the resource first for space heating and next for water heating, with apartment buildings holding five or more units contrasting that trend, consuming more natural gas for water heating than space heating. Propane and LPG uses were dominated by "other" applications, while wood, fuel oil, and kerosene contributed primarily to space heating. RECS data also showed that the dominant fuel for any use remains electricity, followed by natural gas.

When fuel use is analyzed by year of construction, RECS 2009 revealed that all homes, regardless of age, used electricity dominantly. Homes using solar energy were spread nearly evenly across homes built from 1950 to 2009; however, the homes built between 1980 and 1989 were found to use slightly more solar than the others in the group.

Analyzed through the lens of climate zones, the end use profiles of fuels altered slightly. While all five climate zones designated by RECS reported "other" as the dominant end use for electricity, in Mixed-Humid and Hot-Humid climate zones, air conditioning ran a close second in usage. Unusually, Very Cold/Cold climate reported air conditioning as the second most common end use for electricity. Natural gas end use was primarily for space heating in Very Cold/Cold and Mixed-Humid climate zones. Mixed Dry/Hot-Dry, Hot-Humid, and Marine climate zones principally used natural gas for water heating. The use of kerosene and fuel oil was restricted to the Very Cold/Cold and Mixed-Humid climate zones, and used primarily for space heating.

$15 Million From DOE Aimed at Facilitating New Energy – Efficient Lighting

On June 7, 2011, Energy Secretary Steven Chu announced $15 million in funding to foster the research and development of high-efficiency, solid-state lighting (SSL) technologies. This is the seventh round of funding for solid-state lighting technology. According to a Department of Energy (DOE) press release, projects were awarded in three areas: core technology research, product development, and SSL manufacturing. The Core technology research projects will focus on filling key technology gaps in LED and OLED development, improving scientific knowledge, and providing performance data for these technologies. Product development, which received $3.6 million in total funds, will help develop and improve cost-effective, high-performing, commercially viable solid-state lighting materials, devices, and systems. Finally, SSL manufacturing aims to realize significant cost reductions and enhanced quality by improving manufacturing equipment, processes, or monitoring techniques, and ultimately make new technology more competitive. Recipients of DOE funding for 2011 are:

- Arizona State University (Tempe, AZ) – $664,785.
- Research Triangle Institute (Research Triangle Park, NC) – $1,699,318.
- Soraa Inc. (Goleta, CA) – $678,257.
- University of Rochester (Rochester, NY) – $1,247,881.
- Cree, Inc. (Goleta, CA) – $1,610,681.
- Philips Lumileds Lighting Company, LLC (San Jose, CA) – $1,987,200.
- Moser Baer Technologies, Inc. (Canandaigua, NY) – $2,906,324.
- Veeco Instruments (Plainview, NY) – $4,000,000.

UK Magazine Study Casts Vote for Best in Green Home Heating

In a study comparing biomass boilers, ground source heat pumps, and solar hot water heating, the *Ethical Consumer* magazine cast its vote for solar hot water systems. The magazine sought to determine the best solution for homes that will both reduce carbon emissions and use green heating technology, and take advantage of the new Renewable Heat Incentive. The study found that solar thermal technologies offered the lowest upfront cost, and offered a £50 typical annual savings, when compared to a condensing gas boiler. While biomass boilers offer a larger carbon savings, annual energy costs and upfront investment were strong marks against biomass. Solar hot water heating yielded a 250-kg savings in carbon dioxide emissions over a typical condensing gas boiler, according to the study. Solar systems in the study used roof mounted solar collectors to heat water, and were found to be compatible with many existing home systems, another mark in the technology's favor. The study results are timely, as the United Kingdom launched the Renewable Heat Incentive in March 2011. The Renewable Heat Incentive offers both money toward the installation of renewable heat equipment, as well as payments for heat generated by the equipment. Editor Rob Harrison summarized the results of *Ethical Consumer's* study, stating that solar hot water heating makes the most sense for homeowner investment, as it is the easiest and cheapest technology to install.

The results were published in the July/August 2011 edition of Ethical Consumer. For access to the full study and report, go to *http://www.ethicalconsumer.org/Portals/0/Downloads/EthicalConsumer_Home_Heating_Report.pdf*. To read more, visit *http://www.energyefficiencynews.com/power-generation/i/4308/*.

Floating Building Aims at LEED Certification

A new construction project housing the operations office for Cottonwood Cove Resort, at Lake Mead National Recreation Area in Nevada, has registered for LEED certification, aiming to become the first floating structure to achieve a LEED rating. The building features both green construction materials and methods, and is anticipated to rate a LEED Gold certification. According to the *Sustainable Business* article, the building features decking made of recycled plastic and rice hulls, exterior stucco made from recycled tires, and the use of recycled and regionally made materials. Glass on the structure is insulated for high performance, and the building will be anchored to maximize daylighting potential and orientation. To read more about this project, go to *http://www.sustainablebusiness.com/index.cfm/go/news.display/id/22504*.

National BIM Conference Agenda Announced

The National BIM Conference educational program was announced on July 12, 2011. For the 2011 Conference, the agenda will focus on building information modeling (BIM) standards, objects, and software. Additionally, classes on green BIM, case studies, and standard updates will be offered. Published sessions include:

- Introduction to buildingSMART.
- Introduction to NBIMS-US.
- Using BIM at the Schematic Phase.
- How BIM Will Transform Education: A Series from Major Universities.
- BIM Interoperability: A Modern Story of the Tower of Babel.
- Building Smart BIMs.
- BIM in the DoD's Military Health System to Improve Facility Life Cycle Management.
- Modeling the Future of Education: The Multi-disciplinary BIM Project at WIT.
- Going Lean with BIM.
- A Research Framework for Building Information Modeling.
- 5 Years, 50 Projects: Lessons from Ongoing Private Sector BIM Implementation.
- Enhancing High-Performance Building by Integrating Green into BIM Tools.
- BIG BIM BANG.
- BIM and Comparative Structural Life Cycle Analysis.
- LEED Certification Facilitation: A BIM Server Approach.
- Knowledge Management in BIM.
- The Facility Maintenance and Operations Committee's Construction.
- Operations Building information exchange (COBie) CMMS/CAFM Challenge.
- Specifiers' Properties information exchange (SPie) Presentation.
- Life Cycle Model Demonstration (LCie).

The Conference will be held in conjunction with Ecobuild America (EBA) in Washington, DC, from December 5–9, 2011, and is sponsored by the buildingSMART alliance and AEC Science and Technology. To access the entire EBA conference Web site, visit *http://aececobuild.com/conference-exhibits*.

IN PRACTICE

Perspectives on Design

From northeast Texas to northwest Wyoming, a home's performance can hinge not only on leading edge equipment, construction methods, and technology, but also on how that equipment, and ultimately, the home itself, interfaces with the environment. ***Energy Design Update*** interviewed two separate firms with award-winning, energy efficient residences located in very different environments to explore what differences and similarities arose in the design phase. While located in drastically different climate zones, both homes paid homage to local historic aesthetics and materials. The realization of each home reflects a shared commitment to efficiency, sustainability, and reuse, while embracing the importance of relationship to place in ensuring home performance.

Figure 4. The home aesthetic recalled much older buildings, while the energy features are cutting edge. Window and roof materials mirror the historic look, while capturing superior performance ratings. Image courtesy Travis Laminack Photography.

Builder's Perspective: Beating the Heat

Ferrier Custom Homes' 2011 EHVA Home

Built in the hot climate of northeast Texas, the exterior of the weathered and rustic home ensconced on a bluff by Eagle Mountain Lake belies the remarkable standard of energy performance and efficiency within (see Figure 4). Built by Don Ferrier of Ferrier Builders, Inc., and Ferrier Custom Homes, this home, named the Zero Energy Casita, is the recipient of the 2011 Energy Value Housing Award® (EHVA) in recognition of its incorporation of energy efficiency in both design and construction. In their evaluations, EHVA judges reported that the home was both "excellently crafted" and "a blueprint for best practices." (Visit *http://www.nahbrc.com/evha/* for access to the EHVA site.) Integrating cutting edge technologies with historical aesthetics, the Zero Energy Casita's mission was to reclaim, reduce, and renew from the start.

The EHVA report card for the Zero Energy Casita recorded the following performance values:

- Wall Insulation: R-25.
- Ceiling Insulation: R-41.
- Windows: Low-e, gas-filled, wood-framed; U-0.29; SHGC 0.19.
- HVAC: 9 HSPF, 18 SEER air source heat pump; Energy recovery ventilation.
- Ducts: Manual D design; all in conditioned space; minimized duct design with registers at interior walls.
- Water Heating: 0.99 EF Seisco tankless electric water heater with PEX distribution.
- Lighting: 100% LED and CFL lighting with advanced lighting controls.
- Appliances: ENERGY STAR refrigerator and dishwasher.

Figure 5. The porch and window positioning allow for strategic passive solar gain in the winter, while minimizing direct heat gain in the summer. Image courtesy Travis Laminack Photography.

- Onsite Energy Generation: 3.7-kW wind turbine.
- Duct Leakage Test: 12 cfm total at 25 Pa.
- Blower Door Test: 581 cfm at 50 Pa; 2.12 ACH50.
- HERS Index: 56 (without renewable energy); 30 (with 3.7-kW wind turbine).
- Innovative Features: The Energy Detective energy monitoring device.

Green building is nothing new for Ferrier; it is all that they do. Ferrier homes are certified under third-party rating systems like Leadership in Energy and Environmental Design™ (LEED) for Homes, the NAHB Green Building Standard, the Department of Energy (DOE) Builders Challenge, Green Built Texas, and ENERGY STAR. For more on Ferrier Builders and Don Ferrier, refer to Sidebar 1.

Sidebar 1: Don Ferrier and Ferrier Builders, Inc

In 1982 Don Ferrier used earth-shelter building strategies and built his first super energy-efficient home. Recognized repeatedly by the US Green Building Council (USGBC) and the National Association of Homebuilders (NAHB) for his green methods and techniques, Ferrier is in demand as both a speaker and instructor. Ferrier became the first home-builder in Texas to earn a LEED Platinum rating, and was in the inaugural class of 20 national builders participating in the Department of Energy "Builders Challenge."

Ferrier began Ferrier Builders in 1984. Not a newcomer to the green home scene, Ferrier Builders and Ferrier Custom Homes has been building high performance homes since the early 1980's all across North Texas. Passionate about what they do, Ferrier oversees a variety of sustainable projects ranging in design, function and size. Affiliations include National Association of Home Builders (NAHB) Green Building Subcommittee Board Member, Structural Insulated Panel Association Member, Founding Member of Green Built North Texas, Certified Green Professional (CGP), and Certified Graduate Builder (CGB). Of their many awards and recognitions, Ferrier has won an EHVA in 2005, 2006, 2007, 2008, 2009, 2010 and 2011, was the NAHB 2007 Green Builder Advocate of the Year, a 2008 Department of Energy Builder Challenge Honoree, and had the honor of building the first home rated under the American Lung Association Health House Guidelines. Ferrier was awarded "Godfather of Green" status from the Dallas Builder Association.

Hallmarks of every Ferrier project include: energy efficiency, water efficiency, resource efficiency, indoor air quality, and long-term durability. Being big believers in a team approach, Ferrier believes that the right balance of these elements is different for every project and treats no two the same.

Don Ferrier gave ***Energy Design Update*** an interview to discuss the building approach and unique features of the Zero Energy Casita.

Congratulations on winning the EHVA Gold Award on this project. What was the approach that you and the owners took going in?

In the face of rising energy costs, these homeowners wanted their second home's carrying costs to be minimized as much as possible. The homeowners desired a rustic design that incorporated a variety of reclaimed materials as well as efficiency measures. They wanted to achieve net-zero or near-zero energy. The Casita is proving that sustainability and cost effectiveness are not mutually exclusive concepts.

What is your philosophy regarding the approach to home design?

My number one rule in an energy efficient home is that you keep the hot Texas sun out. To accomplish this, we carefully site the house, and incorporate all principles of passive solar design. Trees, overhangs, porches, and exterior shutters need to be designed to work with the house, preventing direct heating in the summer and allowing for passive gain in the winter (refer to Figure 5). In the design, we like to see no or very minimal west-facing windows, and when present, shade them with large trees or tall shrubs. Southern windows are necessary to allow winter sun in a passive fashion.

Tell us a little bit about the Zero Energy Casita. What were the goals and challenges you faced?

The owners had originally approached us wanting to explore a near- or true net-zero energy home and to explore all the elements that go with that strategy. This was always going to be a lake cabin, not their primary residence. As this was and will be a part-time residence, the owners wanted to consume minimal energy.

Based on the site for the home, the view of the lake was to the west, so that was a challenge. We also had to keep in mind the fact that the owners planned to sell their main house within a few years and have us build them a new residence on this property. The Zero Energy Casita had to be designed and cognizant of pending construction. Given these parameters, we decided to site the house mid-lot. The Casita sits near a bluff above the lake, where there had been an existing home years ago that was removed. We placed the new house where the old house was. The siting choice took advantage of the existing 50′ oak trees, 30′ shrubs, and other existing vegetation. The trees actually enabled us to solve our lake-view dilemma, as the preponderance of vegetation was on the west side, so that the trees provided shading naturally.

Did anything unusual or notable occur during the design phase?

In the original meetings, the owner came to us wanting the home to look aged. At that point, we planned on using a mix of James Hardie siding and painting to give the home a weathered appearance. The stock market crash put the project on hold for a year. When the project resumed, the client had decided to reuse old barnwood for the exterior, rather than siding or painting. After evaluating a variety of potential sources, we settled on 85-year-old barnwood that still had some of the original red paint. We also incorporated 150-year-old timber frame sections, and a 100-year-old chicken coop subfloor (refer to Figure 6). After the delay, the owner's dream became reality as we recycled and reused actual weathered wood for the home.

What specific design construction practices did you apply with this home?

Our starting point, and our first priority, is recognizing that you are always better off and more cost effective to get the energy consumption of the structure as low as you can before you add renewables. This is standard practice on every house we build. While some houses you can expand renewables use further due to budget, every house can be designed to minimize consumption structurally. To secure structural performance, our first step is then to keep the hot summer sun out of the house as best as possible, while still allowing winter sun in for passive gain. Second, we must get the envelope as tight as possible. I put tightness ahead of

Figure 6. Cabinets at the Casita are certified formaldehyde-free, and flooring and interior wood beams are sourced from reclaimed lumber. Image courtesy Travis Laminack Photography.

insulation because, if a home is well insulated but leaks air, you really haven't gained anything. On the Zero Energy Casita, we had three blower door tests done. Our final test showed less than one air change per hour. Of course, when you do accomplish such a tight house, the next vital task is to ventilate it. We installed an energy recovery ventilation (ERV) system at the Casita, and use this strategy in most of our homes. Third, after obtaining a truly tight envelope for a home, we want great insulation. On the Casita, we accomplished these second and third steps primarily by structural insulated panels (SIPs). When Oak Ridge National Laboratory compared SIP wall properties to a stud and fiberglass wall, SIPs were found to be eight times more air tight than the stud fiberglass wall.

We don't get to such a high performing home by doing just one thing, but rather by numerous things. We try to apply a variety of different things to achieve the desired level of energy consumption. If we can secure a 10% reduction in energy consumption, then that means 10% less renewables are needed, which also translates into less cost for the homeowner. In the Casita, instead of using a typical 4 ½" SIP, we went with a 6 ½" SIP. For the roof, we also upgraded the insulation level and selected a 10 ¼" SIP roof. According to studies from Florida, insulation in the roof is four times more important than insulation in walls for our hot climate. For the Casita, we increased roof insulation above and beyond typical performance standards.

Figure 7. The wind turbine allows for energy generation onsite. Image courtesy Travis Laminack Photography.

As in any home, the biggest piece of energy consumption is heating and cooling. For the Casita, we went with a high efficiency 18 seasonal energy efficiency ratio (SEER) rated variable speed fan and compressor. For hot water, we considered a solar thermal system, but the owners decided ultimately on a tankless unit, which avoids needless heating 24/7 of a tank of water. At the roof, we selected a galvalume colored roof. Not only did the roof reflect the historical aesthetic, it also re-reflects 73% to 76% of the sun's hot radiant heat, forming a great radiant barrier. The owner selected a corrugated style roof, again for historical aesthetic. The corrugation also gave us a place to vent, so we located a ridge vent on top of the roof to create a vented roof. Windows were, of course, another big piece of the performance puzzle. The windows we selected were a Weather Shield® wood window, which we faux painted to maintain the home's aesthetic. We selected the Zoe-5 glazing system, which incorporates a non-conductive spacer, instead of metal, uses soft coat low-e in a double or triple coat, and the space between panes is filled with an inert gas and sealed for maximum energy efficiency. The windows allowed for both the desired look and level of efficiency. Finally, we selected ENERGY STAR appliances rated at the very top of their categories, as well as low-flow faucets and fixtures, and dual flush toilets.

In summary, what specific products and strategies were selected for the Casita?

- SkyStream Wind Turbine (see Figure 7).
- Fischer SIPs Structural Insulated Panels Wall and Roof.
- Termimesh chemical-free termite barrier system.
- Weather Shield Zoe-5 Low-E ENERGY STAR Windows.
- Reclaimed Barn Siding, Fascia, and Beams.
- Reflective Metal Roof with Vent Space Underneath.
- Seisco Tankless Water Heater.
- PEX Plumbing with a compact distribution system.
- Reclaimed Wood Flooring.
- Formaldehyde-free knotty alder cabinets.
- Low and No VOC Paints, Stains, and Adhesives.
- Indoor Air Quality strategies: variable speed air handlers, fresh air intake, HEPA air filtration system, central dehumidification, Tyvek HomeWrap.
- High Performance Carrier AC.
- Enhanced Fresh Air Ventilation.
- All Ducts Located within Conditioned Space.
- Passive Solar Orientation.
- Native Landscaping.

- Construction Debris Reuse and Recycling.
- Certifying under LEED-H, NAHB Standard, ENERGY STAR, Builders Challenge, and Green Built Texas.
- Tree Protection to Ensure Survival of all Existing Trees and Shrubs.

Did you use any unusual combinations of either products or building strategies to reach your goals?

Window technology really continues to change and advance, so you constantly see new technologies and product combinations incorporated in homes. We really embraced the strategy of a high performance glazing system. In terms of unusual features, it was the aesthetics of the home that was the most unique project feature.

What lessons can the Casita hold for other builders?

While using high performance windows as a strategy is becoming more common, unfortunately, no one pays attention to siting homes on lots. Siting a home correctly is a key step in guaranteeing lower energy consumption levels and ensuring correct levels of passive solar gain in the cold months.

To visit the Web site for the Zero Energy Casita, go to *http://www.zeroenergycasita.com/site/*. For access to the EHVA report on the home, go to *http://www.nahbrc.com/evha/winners.aspx*. To visit Ferrier Custom Homes, go to *http://www.ferriercustomhomes.com/home/*, or contact them at 11255 Camp Bowie West, Suite 115, Fort Worth, Texas 76008-3692, 817-237-6262, info@ferriercustomhomes.com.

Architect's Perspective: Creating Comfort in the Cold

Carney Logan Burke Architects' John Dodge Compound

Located alongside the Snake River in Wilson, Wyoming, the John Dodge Compound exemplifies an historic aesthetic, an integral relationship to place, and an energy performance attuned to the mountain climate. The Compound stands out for study both for its design balance of vernacular architecture, and for its aggressive application of reused and resourced materials and energy efficient strategies.

Completed in 2009, this project was designed by Carney Logan Burke Architects in Jackson, Wyoming. Known for embracing relevant, innovative, and responsible design, Carney Logan Burke practices an architecture that is simple and direct, expressive of structure and purpose, and committed to both human utility and environmental sustainability. In response to place, the firm proposes architectural solutions that are respectful of the past, but speak to the present through new applications of technology and materials. Notably, Carney Logan Burke Architects designed the first LEED Platinum status National Park Service building, the Laurance S. Rockefeller Preserve in Grand Teton National Park, which went on to receive the 2009 Citation Award, Wood Design & Building Awards; 2008 Merit Award, AIA Western Mountain Region Chapter; 2008 Excellence Award, AIA Wyoming Chapter; and the 2008 Engineering Excellence Award, American Council of Engineering Companies of Colorado. More recently, the firm has earned a 2011 LEED Silver for the Jackson Hole Airport Expansion; the 2011 Merit Award, Custom Home Design Awards, for the Peaks View Residence; and the 2010 Merit Award of the AIA Denver Chapter and AIA Colorado Chapter for the Jackson Hole Airport Expansion.

Figure 8. The John Dodge Compound groups around a southern courtyard to maximize warmth and natural light. Native landscaping incorporates into the shading and seasonal solar heat gain scheme. Image courtesy Roger Wade.

Eric Logan, AIA and Principal at Carney Logan Burke Architects, spoke with ***Energy Design Update*** about the project. Logan serves as the Chairman for the Town of Jackson Design Review Committee, and has been recognized by the National American Institute of Architects (AIA) as a "Citizen Architect" for his contributions to his local community.

Tell us a little bit about how the John Dodge Compound project began. What were the owner requirements and requests you had to balance?

Our client was a Jackson Hole native, and had a serious commitment to doing something here in Jackson. In addition, her husband, who was a native of France, brought a desire to express European sensibilities of permanence. We sought a design that balanced both of these desires. Additionally, our client really had a desire to explore the site and make sure the proposed residence would interact correctly with it. She had purchased the site, which runs adjacent to the Snake River, with an existing "McMansion" house and three-hole golf course already present. These were unsuitable for her. Our client was very interested in being green, and was one of our first really dedicated clients. When the existing house was demolished, the client offered whatever elements were reusable or salvageable to the local Habitat for Humanity chapter. The three-hole course also went away and the site returned to its natural state.

Talk to us about the home's design, performance, sustainability, and efficiencies.

The new home is broken into individual pieces – the main house, master bedroom suite, and garage and laundry area, for three buildings in total (refer to Figure 8). There is an additional guest house separate from the main house. Dividing the home into smaller, individual buildings not only met the client's desire for comfortable and intimate spaces, but made the spaces much easier to heat and condition (refer to Figure 9). These buildings are grouped in the landscape around a south facing courtyard. South facing orientation is a big deal in our mountain environment due to climate. Orienting a home to take advantage of southern exposures is a strategy we use quite often.

Figure 9. Dividing the home into smaller buildings meant more comfortable, easier to heat spaces. Bridges between the home's elements contribute to aesthetics and offer integrated overhangs. Image courtesy Roger Wade.

The south courtyard creates a warm outdoor space, landscape opportunities, and generates solar heat gain for the building's interior.

In terms of energy aspects and sustainable elements, they appear across the board in this home. We heat the house with geothermal heat pumps and radiant flooring. This site was particularly suited for a geothermal system due to its close location to the river. Creative Energies, the sustainable consultant for this project, recommended the system. The geothermal wells were very minimal, as the resources needed were very near the surface. All units are Hydron Modules, manufactured by Enertech Manufacturing. The system itself consists of three forced air heat pumps: one 5-ton, two 3-tons, with forced air heat pumps providing mostly cooling and some auxiliary heating. The home also has three water to water heat pumps: two 10-tons, one 6-ton, with the 10-ton providing heating for the radiant floor, and the 6-ton providing domestic hot water. The system is an open loop system, also known as pump and dump. The system includes a second water well separate from their domestic water well, and a drain field that was existing to the property. The water flows through the units and they strip heat energy off it as it passes through. Btu's are never created, they are simply moved from the ground into the house, or are rejected into the ground in cooling. The geothermal system, in this case, is roughly 2/3 more efficient than a high-efficiency natural gas alternative. Our estimated pay-back period on the system – the time it will take to offset the additional cost of the geothermal specific components – is five to seven years.

All of the timber and wood product for framing is either reclaimed or responsibly harvested (see Figure 10). Exposed beams in the home came from trestles removed from the Great Salt Lake. Wood siding on the home's exterior is reclaimed snow fence. We chose high performance windows from Albertini (*http://www.albertini.com/default.aspx*), and windows were intentionally located on the home to maximize beneficial solar heat gain. While the exterior of the building is a combination of wood and stone, the structure itself was built first with insulated concrete forms (ICFs) to create a very efficient system. ICFs enhance our ability to add insulation, increase sound deadening, and boost structural capacity all within one system.

The majority of our residential work has been thought about conceptually as super-insulated structures. We don't do vented roofs anymore, as we've found them to be very expensive and, in practice, they don't always work. Yet, we have had great success bringing

our enclosures up to an R-60+ with spray foam or a combination of spray foam with foam board to create a super-insulated enclosure. Our plans very deliberately keep plumbing and electricity penetrations out of the envelope.

One interesting note on this particular home was the client's desire to be mindful of where Romex runs in the walls. We intentionally went through the house and evaluated, within code, the placement of outlets and their relationship to heavily occupied spaces – bedrooms, and the family room, for example. Those places where people would be in close proximity for extended periods of time, we employed shielded conduits to protect inhabited spaces.

How did you use existing trees and landscape in the home's design?

The site has a mature forest of 60 ft tall pine trees bordering one side, and has the Snake River, with a levee, framing the other side. We wanted to preserve all of these elements, and make the home in keeping with the existing aesthetic. Our first move was to lift the building slightly so the homeowners could hear and view the river. The land ascends toward the home site, and descends from it, so a flow was established to and from the site. The garage wing of the house reaches out toward the base of the existing forest, and grounds the house visually. From there back to the river, the building appears naturally "pulled apart" in pieces connected by bridges, with the master bedroom suite closest to the river. The middle ground in the site offers views back to the Tetons. Again, the home is grouped and oriented to the south, to maximize natural light and heat. Hershberger Design created the landscape plan, and kept it as natural as possible, in contrast to what had existed on the site. In the foreground, the garden piece leading to the front door is all native plants: an aspen grove and a series of wildflower plantings. Natural water elements are incorporated that run around the buildings and between where cars park and the front door. In total, the home's landscape offers a very natural feeling, with nothing designed on a grid. It feels natural and comfortable. The aspen trees, a key element on the southern exposure, flourish in their native environment, and offer shading in summer when leafed out, generating a natural canopy for the home. The lower sun angles of winter pass through the bare aspens, allowing sunlight into the house for natural heating gain. The aspens offered a natural device to encourage solar gain. The continued series of wildflowers surrounding the home terraces back to the rest of the site, which is left in a natural state of predominantly rye grass growth, to encourage wildlife population.

The compound reinterprets historic Western structures. How did this design strategy lend itself towards sustainability?

We quite often reference archetypes of western classic structures – hay sheds and barns with simple gable roofs appear natural and complimentary to our landscape. By pulling this house apart into three separate sections, each of the buildings is rendered with that simple roof form and some combination of locally quarried stone and reclaimed barn and fence wood. The flow between the buildings mimics the natural solid/void relationship. The main section of the home, on its south face, has a heroic-scaled opening that is an effort to open up to the benefits of the southern exposure, and to create a lantern to light, and heat, that whole space. The division of space makes conditioning the home much easier.

What lessons would you pass on from the construction phase of this home?

It is easy to say we're going to do a super-insulated building, but hard in reality to pull it off. Kurt Wimberg Construction Inc. (KWC) was an excellent partner for us on this project. KWC has been practicing in the Jackson valley 30+ years. Not only do they bring local expertise, but Kurt has been out on the leading edge of building science. A builder that is on the forefront of the team effort to bring

Figure 10. In unison with the native landscape, exterior home elements include reclaimed snow fence and locally quarried stone. Image courtesy Roger Wade.

technical knowledge and to install the way we need to do will mean performance success or failure for the project. A high performing home needs a whole team with practice, experience, and great collaboration. Another practice we use is to get the cost crisis out of the way first, before we're even done with drawings.

To visit the Web site for the John Dodge Compound, go to *http://www.clbarchitects.com/projects/houses/john-dodge-compound-1/*. To visit Carney Logan Burke Architects, go to *http://www.clbarchitects.com/* or contact them at 215 South King Street, Jackson, Wyoming 83001, 307-733-4000, design@clbarchitects.com.

IN REFERENCE

Snapshots From Building America's Summer Residential Energy Efficiency Technical Update Meeting

Held August 9–11, 2011 in Denver, Colorado, and hosted by the US Department of Energy (DOE) Building America program, the Residential Energy Efficiency Technical Update Meeting examined the latest in research and products for energy efficient residential building technologies and practices. Three attendance tracks were offered, covering System Performance Improvements, Speed and Scale, and Engaging Stakeholders. To access a full meeting agenda and available summaries, go to *http://www1.eere.energy.gov/buildings/building_america/meetings.html*.

Track A presentations, which focused on System Performance Improvements, included presentations and discussions on air sealing, ventilation, distribution, foundation insulation, high-R enclosures, hydronic systems, and sheathing and moisture.

Among the notable presentations and research was Lois Arena of the Consortium for Advanced Residential Buildings' (CARB) proposal to conduct moisture research in the unstudied wall assemblies of brick rehab, high-R walls (R-40, R-60), and code walls, or those walls with hybrid insulation, spray foam, and fiberglass, to evaluate 2009 IRC prescriptive foam levels. Proposed research will focus on wall performance in cold, moist climates.

During the Ventilation session, Iain Walker, of Lawrence Berkeley National Laboratory, discussed his organization's ongoing research aimed at producing a residential integrated ventilation controller. The future integration system would not only control the ventilation system to ensure American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 62.2 compliance, but would also seek to minimize energy consumption of the system by avoiding peak energy times and accounting for unoccupied periods in the home. Lawrence Berkeley research also proposes inclusion of an algorithm in the system, allowing the system to automatically calculate for pollution in the home to know when to vent.

The High-R Enclosure session revealed several upcoming research projects of note, including Vladimir Kochkin of the National Association of Home Builders Research Center (NAHB) project to wind pressure test walls with exterior rigid foam. Testing will evaluate how walls with foam attached directly to framing perform and resist wind pressures, and aims to provide definitive answers on capacities and how the systems behave. The results of the NAHB research will be used for International Residential Code (IRC) development and Foam Sheathing Coalition (FSC) standards for attachment guidelines. Under the same High-R session, Joseph Lstiburek, with the Building Science Corporation, unveiled an interim report on hybrid wall assemblies as his organization seeks to find the best combination of practical, high performance components that will compose the winning technology for future new home construction.

Under Foundation Insulation, Patrick Huelman of NSTAR reported on three separate research projects underway for Building America that are focused on obstacles and opportunities presented by high-R value foundations. While opportunities exist for energy savings, the foundation is also arguably the most challenging component of the building enclosure, as it experiences damp and cold, and occupancy and expectations have changed dramatically. Research will evaluate performance on basement foundations in climate zones with cold winters and hot, humid summers.