Net-Zero Solution

Reskinning the exterior on a suburban energy retrofit.

By Clayton DeKorne

The Accessibly Green Home's energy performance team, led by Bill Zoeller of Steven Winter Associates, opted for an inversion of the gut rehab: Reskinning the exterior in order to spray the wall (and roof) cavities with closed cell spray foam.

A winding cul-de-sac in the old Stardust Country Club, which first opened for play in 1961, provides the unexpected backdrop for the Accessibly Green Home—a zero-energy, high-performance research home. But this decidedly suburban setting in southeastern Las Vegas was a deliberate attempt to prove the green remodeling concept.

"Suburban housing of the 1960s was about expanding wealth opportunities for the middle-class, not about energy conservation, or 'ecology' as we used to say instead of 'green,'" explains project manager Craig Savage. "These ideas didn't really register with the public until the oil crisis of the 1970s, and it's taken another 30 years for them to have any real significance."

Rewinding to a 1960s suburban home, Savage believes, takes a vital step forward in the evolution of green housing. Rather than abandon all the existing housing stock and build from scratch, Savage has set his sights on ways to transform all those leaky, energy-intensive homes that most Americans live in. "We can reduce a lot of waste, and stem the production of tons of new materials by making do with what we have," he explains. "Trouble is, the number one green priority is energy. And in this day and age, it's not enough to just reduce energy; the bar is set at zero energy."

Deep Energy Retrofit

For a leaky, old suburban home, the net-zero solution centered on three tasks: improving the building enclosure, installing efficient mechanicals, and tapping the abundant Nevada sun to produce hot water and electricity.

The most challenging of these proves to be the enclosure, says Bill Zoeller, senior project manager for Steven Winters Associates, a partner in the Accessibly Green Home. As in any energy retrofit, the performance of the

Photo courtesy of BASF

ELECTRIC LOADS	EXISTING	PROPOSED w/ SHW*	PROPOSED w/o SHW *
Total cooling (kWh)	8691	1626	1626
Total Heating(kWh)		1448	1448
Lighting (kWh)	1971	551	551
Appliances (kWh)	2078	2018	2018
MEL's (kWh)	2631	2631	2632
TOTAL ELECTRIC (kWh)	15371	8274	8275
GAS LOADS	**EXISTING**	**PROPOSED w/ SHW**	**PROPOSED w/o SHW**
Total Heating	302 Therms/ 8878.8 kWh	n/a	n/a
Hot Water	166 Therms/ 4880.4 kWh	28 Therms/823.2 kWh	105 Therms/3087 kWh
TOTAL GAS	478 Therms/14053.2 kWh	28 Therms/823.2 kWh	105 Therms/3087 kWh
TOTAL LOADS (GAS+ELECTRIC) (kWh)	**29130.2**	**9097.2**	**11362**
PV Production (kWh)	n/a	9621	9621
Net Energy	n/a	523.8	-1741
HERS Index	123	4	10

*SHW=Solar Hot Water

This table shows the existing and proposed load distribution for the Accessibly Green Home. Ultimately, a true net zero solution is not possible without muscling Nevada's chief energy resource – the sun – for the production of hot water.

walls is principally limited by inaccessibility to the existing building cavities. "Most deep energy retrofits require a gut rehab," Zoeller says. "Instead, we are attacking this project from the outside." This approach, he notes, will narrow the window of time that the house is uninhabitable from a few weeks to just a couple days.

Zoeller's attack on the exterior involves ripping off the skin (cracked stucco) and pulling off the lid (spent asphalt shingles and existing roof sheathing) to allow the building cavities to be filled with closed-cell spray foam. The opaque walls will be upgraded from R-10 to R-21.25 using 3 ½" of BASF Comfort Foam. This will be enclosed by structural sheathing (where there hadn't been any previously), followed by a 2" layer of EPS rigid foam and Dryvit synthetic stucco.

The roof gets 8 ½" of ComfortFoam before it's redecked, providing a hefty R-55.25 insulation value. This super-insulated roof assembly will then be covered with a radiant barrier, 1x strapping and a standing-seam metal "cool roof," which is designed to reject better than 80% of the sun's radiation to reduce cooling loads. Finally, the existing single-pane metal windows (U-factor of 1.11 and SHGC of 0.86) will be replaced with high-performance triple-pane windows (U-factor and SHGC of about 0.2).

Efficient Mechanicals and PV Production

With such a robust enclosure, the chance for actually getting to net zero energy becomes possible, but it needs the help of an efficient HVAC and water heating system.

Zoeller and company replaced the grossly oversized package-unit heat pumps that used to sit on the roof with a high-efficiency Trane heat pump. This tiny unit will hide in a hall closet and reduce the cooling capacity to 2½ tons, down significantly from the previous 6 tons. Combined with a tankless water heater with an energy factor of .80, a balanced ERV for ventilation, and the usual energy-efficient lighting, the total energy load drops to a third of what it was previously (see table above).

By marshalling the resources of the sun to produce electricity, the total energy load drops to a meager 524 kilowatt hours. Additional solar muscle to produce hot water will be necessary to shimmy below a zero-energy margin. GB

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Table courtesy of SWA