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**GREEN LINE ARCHITECTS COMPLETES NET-ZERO ENERGY HOME IN ROARING FORK VALLEY**



A small home with optimal efficiency, a LEED-H Gold rating, and -5 HERS Index!

**June 1, 2011 (Carbondale, CO)** -- The Green Line Architects team has achieved the Holy Grail of energy-efficient home design: a small, off-grid home in Lenado, CO with Net-Zero Energy (NZE) use. An NZE home produces the same amount of energy it uses on a yearly basis. At only 2000 square feet, this home represents an efficiency of scale that could help to shape the future of the American home.

"NZE consumption for homes in our cold climate is a lofty goal, and we've finally done it." said Steve Novy, Green Line's principal. "In fact, this home is situated at 8600 feet in elevation where there are only 4 and a half hours of sun per day in the dead of winter."

The home was built for Branden Cohen of True Nature Healing Arts who bought the property at the top of Woody Creek from "Lumber Jack" Hogue. "I came to Steve with an vision for a beautiful, ultra-efficient, off-grid home. I had been living off the grid for some time in Jack's old cabin, which I renovated and maintained. So, I knew exactly what needed improvement," said Cohen. Novy assembled a team of experts to address this unique design challenge: an optimized, high-performance, off-grid home.

The team met in several charrette sessions to design the home. Cohen asked the team to move the house up the hill, where it could get more sun. The solar hot water system was taken off the roof in the new design for easier access and maintenance. It was Cohen's desire to make all of the home's systems more reliable and more efficient; and to make living off the grid a little more comfortable. For example, because the bathhouse had been separate from Lumber Jack's cabin, Cohen requested that the bathroom be put *inside* the new home.

Re-use and recycling have become important considerations in green building design, and none more so than in this home. Many of the materials from Lumber

Jack's original cabin, bathhouse and garage were deconstructed for use in the construction of the new home, such as the cotton insulation, bronze door hardware and exterior compact fluorescent (CFL) lighting fixtures, to name just a few.

The majority of the wood materials in the home is Forest Stewardship Council certified or "FSC" wood. The FSC certification shows that the wood was produced from responsibly managed forests.

All of the finishes are low toxicity and natural products. Structural Insulated Panels (SIPs) were used, which are delivered on-site pre-cut. This dramatically reduces the waste on the site. "This is the lowest waste home we have seen," said Megan Gilman from Active Energies, the project energy consultant.

Gilman emphasized the importance of energy performance in building design. "Lowering energy consumption is the most important design consideration in new homes. The long-term impacts of this exercise are great, so get the energy equation right!" she said. The home has received a HERS Index of -5. (minus 5). That means that it is 105% more efficient than a standard home.

Although the Residential Energy Services Network ([RESNET](#)) has only recently started to track HERS index scoring, **but it is believed that there is only one other home in the state with a lower Home Energy Rating System (HERS) index than the Cohen home.**

The HERS Index, also known as the [EnergySmart Home Scale](#) by the US Department of Energy's Building Technologies Program, shows the energy efficiency of the home. For example, a score of 100 is a code-compliant home, based on the 2006 International Energy Conservation Code; a score of 50 would be a home that is 50% more energy-efficient than the baseline home; a score of zero is considered a Net-Zero Home, one that produces the same amount of energy on a net yearly basis as it uses. The home is also registered with the U.S. Green Building Council's [LEED for Homes](#) program and anticipated to receive a LEED-H Gold rating.

The use of SIPs allows for a very high level of continuous insulation, which makes all the difference in the Cohen. The walls are R-40 and the roof is R-60. The insulation, combined with extremely low air infiltration -- 0.10 natural air changes per hour -- makes for an ideal building "shell." According to most architects, getting the shell designed and built properly is the most critical part of the entire design and construction process. "Once the shell is super-insulated and airtight, that's when we start thinking about the other systems," said Dennis Powell, former project manager at Green Line Architects.

Modern building science is at the heart of these new super-homes. "We have learned from the best," said Novy of his experience working with Joe Lstiburek and Betsy Pettit, FAIA of [Building Science Corporation](#). "Joe and Betsy always remind us of the simple things, like the mantra: 'You cannot make a building too airtight, you can only under-ventilate it.'"

With that advice in mind, Dave Houghton and August Hasz of Resource Engineering Group incorporated two Heat Recovery Ventilator units (HRV's) into the home design that provide heat exchange, ventilation, and filtration. More than just an air delivery system, the heat exchange component allows cold outside air that is being brought in to be heated by the warm, stale air that is being exhausted. "Although this house is literally built like a refrigerator, you could leave the house for months, and come

back to a home that will smell fresh and clean," said Houghton.

Houghton and Hasz also designed the extremely efficient solar thermal system, which uses eight large solar hot water panels and interfaces seamlessly with the high-efficiency boiler. On the structural side of the design, the two contributed greatly to reducing the material use in the home by "right-sizing" all of the structural members.

Windows are a key shell component when going for great energy performance. Here, the team chose triple-pane windows with a very high insulation value -- a U-Value of 0.117 and R-Value of 8.54. Keeping in mind that the rest of the wall is R-40, Novy reminds us that an R-Value of 8.54 window still has less than ¼ the insulation value of the wall. "Windows are where we are seeing some of the fastest technological developments. In fact, just a few years after we specified this glazing, we have new products available that have twice the insulation value," Novy said.

The GLA Team also took advantage of the newest available lighting products by incorporating LED-compatible fixtures into the home design. Aaron Humphrey, of Alpenglow, Inc., the lighting design firm, has only good things to say about LEDs. "The low electricity demands, paired with excellent light quality, make LEDs an obvious choice," extolled Humphrey. Over 90 percent of the light fixtures in the Cohen home are LEDs, and the remainder are compact and linear fluorescents, which creates a very low electricity demand: an extremely low 1 watt per square foot!

As with most off-grid homes, renewable energy systems provide the primary heat and electricity for this home. An array of eight 4 foot x 10 foot solar hot water panels provides space heating and heating for domestic water. These are paired with a storage tank, and a high-efficiency boiler as backup. "Having redundancy of systems is absolutely necessary in this type of off-grid setting," said Novy.

The photovoltaic (PV) system provides all of the necessary electricity, except for extended periods of clouds, rain or snow. For these times, there is a back-up generator.

One aspect of the PV arrays that distinguishes this home from others is the tracking function. "The trackers allow the PV panels to follow the sun throughout the course of the day," explained Novy. "They increase the efficiency of the PV arrays by roughly 25 percent." Cohen had used two existing PV arrays on trackers successfully while living in the cabin, so another array on a tracker was added for the new house.

Building integration of renewable systems is the buzzword these days in the design community. Architects are tasked with making the solar panels and other renewable systems a part of the design of the home, not an afterthought. Unfortunately, many of the solar homes and earth ships of the 1960's and 1970's created something of a stigma for solar homes. Since then, architects have made great efforts to erode that stigma. There has been a strong movement to design aesthetically pleasing green homes that fit into their surroundings. Green Line Architects set out with that intent: to design a home that fit into the rustic character of the historic mining and logging town of Lenado. "We tried about 20 different roof designs before we got it right. The design had to be fairly simple and work well with all of the historic homes and sheds in the area," said Novy.

The aesthetic is that of a finely detailed mountain cabin. The interior finishes are durable and beautiful. The slab black walnut benches, and door and window finishes were designed and crafted by local furniture maker David Rasmussen of David Rasmussen Design. Laura Bartells, of GreenWeaver, Inc., a local straw-bale and plaster

expert, worked up 20 to 30 plaster samples before the color was selected. She installed a dark, almost chocolate-colored natural earthen clay plaster on much of the interior walls.

As with most of the Woody Creek area, there is a good story that goes with the location of the Cohen home. Jack Hogue, also known as "Lumber Jack," was rumored to be a cranky mountain man who always carried a gun. Hogue squatted on this piece of land at the top of Woody Creek for 17 years, built a cabin and a bathhouse there, and in the 90s finally received title to it through adverse possession (essentially squatting on it for 17 years).

Finally, Novy, who has a degree from the University of Colorado, College of Environmental Design, suggests that there is always more to learn in the creation of efficient buildings. This year, the 5th semi-annual Solar Decathlon competition will be in Washington, DC where university teams compete to design and build ultra-efficient small homes. The CU Team won the first two of these competitions in 2002 and 2005. Novy attended in 2005 and came away with a wealth of knowledge, inspiration and creative energy to design even better, small homes. His hope is that the Cohen Net-Zero Energy home will inspire architects, builders and homeowners to strive for the next level of efficiency in home design, and use this home as a model for creating high-quality high performance housing in the US and beyond. "If we were to start producing this kind of home in a factory, as an engineered product like we do with automobiles, we would see even better, more reliable home designs and get even higher energy performance," Novy forecasted. "This is how I would like to see our good old American ingenuity put to its best use, toward beautiful buildings that help create a secure energy future."

Green Line Architects – Beautiful, Sustainable, Functional Architecture

For photos, go to: <http://greenlinearchitects.blogspot.com/2011/06/green-line-architects-completes-net.html>

For more information about NZE homes, contact Steve Novy at Green Line Architects: 970-963-6689, [snovy@greenlinearchitects.com](mailto:snovy@greenlinearchitects.com), [www.greenlinearchitects.com](http://www.greenlinearchitects.com).

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**Basic Info:**

- Main messages: This is a product of good old American Ingenuity! (Let's help ourselves by promoting the construction of this type of home in the future)
- Off-the-Grid, Net-Zero Energy home at 8650 feet in elevation, in Lenado, CO where there are only 4 and a half hours of sun per day in the dead of winter. HERS Index score of **Minus 5**: a score of 100 is a code-compliant home; a score of 50 would be a home that is 50 percent more energy-efficient than the baseline code-compliant home; a score of zero is considered a Net-Zero Home, one that produces the same amount of energy on a net yearly basis as it uses. The Cohen home is one of the most energy-efficient homes in the state, and on target to receive LEED-H Gold certification.
- The Cohen home is a great example of a small home - only 2000 square feet, smaller than the average American home.
- Located in Lenado, above Woody Creek in local favorite, George Stranahan's territory, and up the road from the old haunts of Hunter S. Thompson, the land was bought from Jack Hogue,

aka "Lumber Jack" who was extremely cranky and who always carried a gun. Hogue got title to the land from squatting on it (adverse possession) for 17 years.

- Low-waste design, limits burdens of hauling from remote site, and limits burdens on landfills.
- The Cohen home is built in the Colorado cabin vernacular style, old Lenado cabins and sheds were the inspiration.
- Much of the materials from "Lumber Jack's" existing cabin, bath house and garage were used in construction of the new home.
- Located only 5 minutes as the crow flies from Aspen,CO , but worlds apart.
- Constructed of Structural Insulated Panels, or SIPs, which create an extremely tight building shell with very little air infiltration. Literally, built like a refrigerator.
- The home utilizes a solar hot water system and solar electric system for power with a back-up generator for long periods of cloudy days.
- 95 percent of the lighting uses LEDs, the best new technology with great light quality and very low energy consumption.
- High-performance window glazing – Center of glazing U-value of 0.117 (R-Value of 8.54)
- Re-used, natural, recycled, and local materials were used including Forest Stewardship Council certified or "FSC" wood was used throughout the project.
- Interior plasterwork was done by Laura Bartels, of GreenWeaver, Inc.
- Unique, custom built-ins, furniture and wood finishes by David of David Rasmussen Design.

**Team:**

Owner - Branden Cohen and Deva Shantay, [True Nature Healing Arts](#)

Architect of Record- Steven A. Novy, AIA, [Green Line Architects](#)

Project Manager – Jeff Dahl (now with [Carbondale Beerworks](#))

Project Manager - Dennis Powell (now with [DK Architects](#))

Architectural Design / Furniture / Wood Finishes – David Rasmussen, [David Rasmussen Design](#)

Mechanical and Structural Engineers - [Resource Engineering Group](#),

Dave Houghton, PE and August Hasz, PE

Energy Consultant / Rater - Megan Gilman, [Active Energies, Inc.](#)

Photovoltaic Expert - Scott Ely, [Sunsense Solar Electric and Renewable Energy](#)

Solar Hot Water / HVAC Expert - Patrick Johnson, [Solar Flair Thermal Systems, Inc.](#)

Interior Plaster - Laura Bartels, [GreenWeaver, Inc.](#)

Lighting Consultant – Aaron Humphrey, [Alpenglow Lighting Design, Inc.](#)

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