

An amazing NET-PLUS home in Prescott, Arizona.

What is a "Net-Plus" home? *It is a home that provides more energy and water than needed. The result... energy returned to the grid (for a profit) and water returned to the earth to replenish local aquifers. This well-constructed and highly insulated building meets European standards that are at least 20 years ahead of those in the United States. It also exceeds most LEED standards.*

Living Systems Building Group broke ground on this project in June 2012. The project took 15 months to complete -- from initial groundwork to native landscaping -- due to the highly innovative, state of the art technologies including in this remarkable home:

- High efficiency (R-32) mass walls with a low carbon footprint
- High R-value roof: R-50
- Tri-door insulating system that raise all doors to total R-10.5
- All windows R-7
- 18,000 gallon water harvesting storage system
- Night sky radiation (NSR) cooling system
- Light reflector decks
- Super high efficient insulation
- Heat recovery ventilators
- Graywater recycling to flush toilets
- Water sequestering landscape avoids run-off and recharges aquifer

The following are photos of the progression of the build.



BEGIN FOUNDATION: AC Block (aerated auto-claved concrete) has been placed inside the foundation to insulate the home from the ground up creating an R-value of 10 for the underslab and a perimeter slab of R-15. The footings used high volume flyash concrete which reduced the use of Portland cement by 50% creating a more carbon neutral product. The insulation of the slab is critical to creating high energy efficiency but most builders, today, use minimal foundation insulation.



IN-FLOOR HEATING LAYOUT: Before the foundation is poured, the piping for the in-floor heat and cooling system is laid out. This system is the back up heat source for ultra cold, cloudy days and the means for delivering cooled water provided by night sky radiation during the summer -- an inexpensive means of "air conditioning." This system will be zoned throughout the house for full efficiency.



FOUNDATION POURED: The foundation is poured.... again using high volume flyash concrete that reduces the use of Portland cement by 50%. It will later be color etched. Along with the Poured Earth walls, these concrete floors add to the mass to store heat during the day in the winter and cool during the night in the summer.



POURED EARTH WALLS: These beautifully colored Poured Earth walls are the first to make use of MgO (magnesium oxide) along with flyash to reduce the use of Portland cement by 50%. Because MgO sequesters more carbon than is used to make it, it moves Poured Earth technology one-step closer to becoming carbon neutral!



FRAMING: Wood trim is kept to a minimum in this house; used mainly in the interior due to the harsh Arizona sun that quickly deteriorates exposed exterior wood. Where it is used on the exterior, good design has assured that it is in areas that will either be shaded (e.g., the soffit) or will have metal trim applied.



INSTALLATION OF ROOF: The metal roof is applied to the roof sheathing. However, before it is fully installed, the Night Sky Radiation (NSR) system is integrated into the roof frame (see photos below). This system is composed of pex pipes (used in radiant flooring) that are installed just below, but in contact with, the metal roof above it. Although most cooling of the building during the summer is due to nighttime venting, there are times when extra cooling is needed. Instead of an air conditioner, the NSR system steps in. During summer nights, the metal roof is cooled by night sky radiation that, in turn, cools the water in the pipes. This cooled water is ultimately pumped through the in-floor radiant heating/cooling tubes under the concrete floors throughout the house. Throughout the night, the chilled water cools the concrete which, in turn, absorbs radiant heat that has been conducted into the building envelope during a hot summer day. It is a highly efficient, ecological – and inexpensive -- alternative to the high bills of commonplace air conditioning.



NIGHT SKY RADIATION SYSTEM: The photo on the left shows the installation of the NSR cooling tube system. The photo on the right shows the tubes covered. The metal roof goes on top of this covering allowing the transfer of cool from the metal roof during the night to the water in the tubes.



READY TO MOVE IN!: The house is just about finished. Native plants are carefully planted around the whole building in order to join with the natural surroundings of boulders and native Arizona plants.



WATER HARVESTING/CATCHMENT SYSTEM: The water harvesting system holds 18,000 gallons. There are 8 of these 3 piece conical metal “sculptures” located around the home that are part of the water harvesting system collecting water from the roof via the gutters. The largest cone is for a “first flush” to eliminate dirt and particles. This overflows into the second cone that flows by gravity to three 6,000 gallon water cistern storage tanks located below the garage (see photos below). When the tanks are full, the third cone receives the extra water that is then distributed to the landscape for surface water retention and absorption. The conical sculptures are located so that they can be seen and enjoyed from within the house.



The upper left photo shows the excavation and foundation for the garage. The photo on the upper right shows the steel substructure required for the extra weight of parked cars. The bottom two photos show the steel deck covering the substructure. Concrete was then poured on top of the steel decking with access to the water storage area maintained.



LIGHT REFLECTOR DECK SYSTEM: The interior solar reflector deck (copyright design by LSSA) is located on the interior side of clerestory windows. Made of punched steel sheets, it is used for passive solar heating by allowing 30% of sunlight to penetrate through to the floor area while reflecting 70% up onto the ceiling. The curvature of the deck diffuses the light to avoid glare on the ceiling and throwing light 30’ deep into the building. This allows the light to help heat the mass walls and floor while also providing a delightful, well-lit living space without glare.

On the outside of the building, there is an exterior reflector deck (invented by the Owner) along with two motorized sun and shade screens that drop by remote control from the edge of the outside reflector deck. Due to the southwestern passive solar orientation, the shades are necessary to block 80% of the sun and wind without losing major views. It also enhances outside living during summer afternoons and evenings. The exterior reflector deck increases solar input to the home by 40% in the winter. During the summer, it is positioned to reflect direct sun (and, thus, heat) away from the windows.



NANO-WALL EXTERIOR SLIDING DOORS: These bi-folding doors open the south wall dramatically to connect interior spaces to the natural landscape. They are certified to have very low air infiltration with a high R-value glazing.



TRI-DOORS: All exterior doors have been fitted with Tri-doors (copyright design by LSSA) to augment the R-value. They serve 3 purposes: to insulate the doors during the winter through the insertion of polycarbonate panels thus raising the R-value from 3.5 to at least 10.5. During the summer, the insulating panels are removed exposing the steel "skeleton" plates (a reuse of industrial "waste") and fitted with screens. During the summer they provide security when the doors are fully opened for full nighttime ventilation that cools the mass walls and floors.