



# Exploring New Horizons 2015 Sustainable Building Tour



*Part of Flagstaff Festival of Science and  
the ASES National Solar Tour*



11th  
Annual!!!

September 26  
10am-2pm



**Tour Features:** ~Rainwater Harvesting ~Greywater ~Solar PV ~Solar Thermal ~Straw-bale Construction ~Passive Solar ~Local Materials ~ICF & SIPs Construction ~Advanced Framing ~Air Sealing & Advanced Insulation Methods ~New and Innovative Materials and Methods ~Retrofitting and Historic Preservation ~Urban Infill ~Rural Development ~Indoor Health

# Willow Bend Environmental Education Center

703 E Sawmill Road,  
Flagstaff, AZ 86001



Willow Bend Environmental Education Center's mission is to provide education outreach services that build environmental awareness and an ethic of responsible stewardship of our natural and cultural resources. This non-profit center was founded in 1978 by the Coconino Natural Resource Conservation District. Built in 2002, this building provides the public with an example & resource for sustainable building and living. Willow Bend leads by example, with their passive-solar, straw-bale education center, as well as by their low-water native gardens, on-demand water heater, energy star office equipment, energy-efficient lighting, composting, and more.

In addition to serving as a center that practices sustainability, Willow Bend offers environmental education for kids and adults, such as hands-on learning, workshops, field trips, and events for the community. For more information about Willow Bend, visit their website at [www.willowbendcenter.org](http://www.willowbendcenter.org)

## Sustainable Features:

- Straw-bale building, energy efficient, renewable and high source of insulation value, straw bale is also a waste by-product from grain harvesting
- Passive solar design: south facing windows, Trombe walls: passive solar heat collection, heat stored and radiated at night
- Native plants and xeriscaping to help reduce watering demands supporting healthy ecosystems
- Solar PV panels: grid tied 6.2 kWh per day, donated by Prometheus Renewables, Inc.
- Rainwater harvesting system collects and distributes to low-water garden
- Energy efficient: blown-in fiberglass at ceiling (R-50) & CFL lighting with natural day lighting

*Award Certification Level: Advanced*

*Architect/Designer: PWM Architecture*

*Builder: Solar Design and Construction*

# Cabin Haus by Ezra Builders

2367 Chof Trail,  
Flagstaff, AZ 86005



This spec house was designed with sustainability in mind for its future owners. Inspired by Passivhaus house design and construction, the home employs passive solar design which works with the sun's heat energy to warm the building during the cold season. Above code insulation and complete air sealing of the home makes heating in the winter extremely efficient and keeps warmer air out in the summer months. The home includes a passive radon ventilations system and an outdoor fresh air supply was installed with the HVAC system for optimal indoor air quality. These qualities not only make the home safe and efficient, but adds to long-term comfort and durability of the house. The Cabin Haus utilizes advanced framing which reduces the amount of lumber and other materials as well as cuts down on the total waste of a project. These factors combined with low-flow toilets and energy star appliances throughout make this home an example for others to follow when building new homes. The Cabin Haus is solar ready so that future occupants can easily employ the use of solar panels to power their home.

## Sustainable Features:

- Passive solar design
- Blown-in cellulose in walls for a R-21
- Low flow toilets and fixtures throughout
- Complete air sealing
- Trussed roof with 14" of cellulose (R49)
- Performance testing for envelope and duct tightness
- Passive radon ventilation system
- Energy star appliances
- Advanced framing
- Pre-project HERS rating = 60
- Recycling on-site during construction
- Solar ready
- HVAC has fresh air supply for optimal air quality
- Outdoor living space and trail connectivity
- Working towards Energy Star certification

**Award Certification Level: Pending**

**Builder: Ezra Builders, LLC**

**Architect/Designer: Tom and Serena Elsass**

# Fagan Cordwood & Straw-Bale Residence

2020 N Westview Trail,  
Flagstaff, AZ 86001



This home is still in the construction phase but it is easy to see that it will be beautiful and sustainable. The cordwood garage uses small diameter trees, something we have an abundance of here in Coconino County. The house is post and beam construction with straw-bale infill for natural and efficient thermal mass insulation. Much of the wood in the home comes from the Ponderosa Pine that was removed on site. The Fagan's plan to install a solar PV system on a 30 degree pitch roof for their energy needs. The home also features rainwater collection and durable metal roofing on the garage and house. The Fagan's made it their goal to use local, recycled, and salvaged materials wherever possible.

## Sustainable Features.

- Straw-bale construction
- Insulated slab with radiant floor heating
- Outdoor wood fired boiler
- Cord wood garage using small diameter wood
- Earth and lime plaster interior
- Rainwater harvesting with possible future storage
- Solar PV system- 30 degrees pitch roof
- Trees were removed from site with horses-Minimizing impact on site, and wood is being used in the project, including some posts and cordwood
- Energy STAR appliances
- High efficiency insulation with low/zero VOC materials
- Recycled and salvaged materials used

**Award Certification Level: Pending**

**Owner/Builder: John & Beth Fagan**

**Building Support: Beyond Adobe**

**Architect/Designer: Solar Design and Construction**

# Hahn ICF & SIPs Net-Zero Residence

1201 N La Costa Ln.,  
Flagstaff, AZ 86001



## Sustainable Features.

- ICF and SIPs Construction
- Universal design, multi-generational use
- Energy efficiency and solar PV makes home Net-Zero energy
- Outdoor living space
- Hydronic in-floor heating
- Sunprime translucent solar PV system
- Indirect lighting from sun shelf
- South orientation for passive solar design
- Extensive rainwater harvesting system for landscaping
- Innovative design incorporates house into site and low impact development
- Proper summer & winter shading feature for south window
- Use of durable finishes throughout including metal roof, cement and stucco
- Formaldehyde-free insulation
- Day-lighting strategy implemented in all conditioned rooms

**Award Certification Level: Advanced Plus**

**Owner: Martha Hahn**

**Architect/Designer: Smith Architects**

**Builder: Hope Construction**

The Hahn residence is truly the first home of its kind in its surrounding area providing a wonderful example of functional, beautiful, sustainable, and Net-Zero housing. The home is integrated into the site and employed Low-Impact Development and has an extensive rainwater harvesting system. The Hahn residence showcases durable and low-maintenance materials and design methods, including Universal Design, providing accessibility for those with, or without disabilities. The home is a hybrid construction with Insulated Concrete Form (ICF) walls and Structurally Insulated Panels (SIPs) roof, making the entire home envelope extremely efficient and durable. The passive solar design supplies most of the home's heating needs, and the radiant floor heating is tied to an electric hot water system that also provides the domestic hot water. All the home's appliances and systems are electric and the translucent solar PV system provides 100% of the home's energy needs-making the home Net-Zero energy-meaning none of the home's energy is coming from fossil fuels.

# Four Square Historic Project

Corner of N. Bonito and  
W. Aspen, Flagstaff, AZ 86001



The Four Square Historic Project is an innovative approach to historic preservation in which the project owner, Alphabet Trees, LLC and partners, are retrofitting four historic houses to be more efficient, durable, healthy, and sustainable. They also created a community land trust called Flagstaff Townsite Historic Properties Community Land Trust (TCLT) to insure the houses are permanently affordable—increasing the houses sustainability for at least another century. The four small houses have a shared site that includes a community garden to be watered by rainwater collected from the roofs. The homes feature new passive radon ventilation systems, new and efficient space and hot-water heating systems—creating healthy homes and the efficiency aspects support the long-term affordability goals. Reuse and recycling is another goal, and the houses are all being insulated and refurbished while maintaining and reusing as much of the original as possible.

## Sustainable Features:

- Historic preservation project—retrofitting 4 small houses— 2 wooden houses (built pre-1916) & 2 stone houses (built late 1920's)
- Houses sited on Flagstaff Townsite Historic Properties Community Land Trust (TCLT) ensuring the long-term affordability into perpetuity.
- Shared garden & rainwater harvesting cistern
- Passive radon ventilation systems
- Reused materials such as bathtub, light fixtures, cabinet, shutters and wood floors
- Asbestos & lead paint removed
- Preserving as much of the original houses as possible
- Blown in cellulose for wood framed houses
- Spray foam in attic of stone houses
- Community enhancement by increasing the proportion of owner-occupied homes in the neighborhood.

**Award Certification: Pending**

**Owner: Alphabet Trees LLC**

**Builder: Good Oak Enterprises, Inc.**

**Architect/Designer: Architectural Design Studio, LLC**

# Mars Hill ICF Passive Solar House

1508 W Lower Coconino Ave,  
Flagstaff, AZ 86001



## Sustainable Features:

- Live dashboard system that provides ongoing energy, water and resource impact data on a website for the community to access and learn from
- Integrated local materials
- Passive solar, solar thermal system, and solar PV ready
- Rammed earth wall for additional thermal mass storage
- Water catchment systems including a 10,000 gallon cistern built into attached greenhouse for on-site food production
- Complete graywater system for outdoor landscaping
- Working towards Living Building Challenge and Net-Zero Energy Certification

The Mars Hill House utilizes ICF construction and local materials, including sand, clay, and aggregate from the site for the rammed earth wall that creates additional thermal mass for heat storage. The house has optimal passive solar design, energy and water efficient appliance and systems, and a solar thermal hot-water system for the homes heating and hot water needs. An attached greenhouse provides an additional heating source for the home, as well as stores 10,000 gallons of collected rain in an underground cistern. This water is used for their food production, gardens and landscape. Alan designed their family home as part of his master's thesis, and as an NAU Construction Management instructor, has used his home as a teaching tool for his students and the community. Alan also created a website that community members can visit to see how much energy and water their home is using, as well as how much it is producing or harvesting. You can follow their home at [buildingdashboard.com/clients/marshellhouse/](http://buildingdashboard.com/clients/marshellhouse/)

**Award Certification Level: Advanced Plus**  
**Owner/Designer: Alan Francis and Birgit Buss**  
**Builder: Stilley-Tullos Design Build Group**

# Double Efficiency Residences

433 Kiowa St.,  
Flagstaff, AZ 86005



## Sustainable Features:

- Insulation under slab and on stem walls
- Smaller house design - 2 stories, 3 bedroom, 2 bath - 1,400 sq. ft.
- Passive radon ventilation and Spot energy recovery ventilators for healthy indoor air quality
- Energy Star qualifying
- Durable materials used throughout
- Rigid insulation exterior wrap on walls and roof for a complete thermal break throughout the building envelope for maximum energy efficiency
- Performance tested
- Low waste during construction
- House backs forest service land and is close to trails providing easy accessibility to the outdoors
- Complete air sealing and blown-in cellulose for comfort and efficiency

**Award Certification Level: Pending**

**Owner/Designer/Builder: Green Mountain Construction Inc. and Jirsa Construction**

This project is another great example of the growing interest and sustainability of smaller house design. Green Mountain Construction and Jirsa Construction have teamed up on this Mountaineer project with the goal of creating efficient, durable and lower cost housing for the community. The homes feature maximum energy efficiency with insulation on slab, rigid insulation exterior wrap on walls and roof, blown-in cellulose insulation in the walls, and complete air sealing, as well as high efficiency heating systems for water and space heating. Durable and low-toxic materials, passive radon ventilation and spot energy recover ventilators create a healthy indoor air quality. These homes are going through performance testing to ensure the comfort and efficiency of the homes. A huge perk of this site is its location backing forest service land providing easy accessibility to the outdoors. With beautiful examples like these, efficient and smaller house design may start to become the norm!

# Passive Solar House on Ash

800 S Ash Lane,  
Flagstaff, AZ 86004



The House on Ash is a custom designed passive solar residence with a focus on long-term operation and maintenance, and durability of finishes. The skin is a combination of steel panels, metal roofing and glass and is tucked discreetly into the site. Located in the City Limits and in the Wildland Urban Interface, the design and material choices exceed the requirements for the most extreme fire hazard zone designation. Additional sustainable features include: Non-combustible, durable exterior materials with little to no maintenance requirements; 10,000 gallon rainwater harvesting tank with a 500 gallon first flush tank with filtration and UV disinfection for domestic use; dual commercial electrical panel for future PV system; and indoor/outdoor living spaces.

## Sustainable Features:

- Passive solar design, optimized for winter gain and summer shading using orientation, roof overhangs and tailored glazing specs
- Vented roof assembly with rigid insulation for thermal break.
- High performance roof system with mechanically seamed metal panels.
- Rainscreen system for exterior walls with rigid insulation for performance and thermal break.
- Fully insulated stem and slab.
- Roxul rigid and batt insulation (stone and slag, non-combustible, water-repellant, environmentally friendly, will not support mold or fungal growth, no off-gassing)
- Active (mechanical) radon mitigation system.
- High efficiency electric boiler for hydronic in-slab heating and domestic hot water.
- Heat recovery system.

**Award Certification Level: Pending**  
**Owner: Jeff and Julie Leid**  
**Builder: Jirsa Construction**  
**Architect/Designer: Lightvox Studio**

# Lancey & Bruce Solar PV Residence

4710 E. Monroe St.,  
Flagstaff, AZ 86004



The Lancey and Bruce residence is nestled away in the forest and has direct access to forest trails and open space. This home boasts many sustainable features like energy and water efficient fixtures and appliances used throughout, making it easier for the homeowners to meet 100% of their electricity consumption through their solar PV system. Their hot-water heater is an electric system, providing hot water for their domestic needs, as well as for their radiant floor heating-and because it is electric-this is being done through their solar PV system. The homeowners have also installed 15,000 gallon cistern for wildfire protection, and have installed gutters and infrastructure for future rainwater harvesting. This residence has a detached guest house that is tied to their septic system, driveway, and well-this provides additional income, and rental property.

## Sustainable Features:

- 100% Electricity from Solar PV system
- Radiant floor heating
- Spray foam insulation
- Solar tubes for natural lighting
- ADA accessible
- Gutters and infrastructure for future rainwater harvesting
- 15,000 gallon cistern w/stand pipe for wildfire protection
- South facing passive solar design
- Durable materials including Hardy Plank exterior paneling
- Local malapai rock
- SFI Sierra Pacific Windows
- Backs forest service and trails
- High-efficiency propane gas fireplace

**Award Certification Level: Advanced Plus**

**Owner: Beth Lancey & Peter Bruce**

# Dunn Greenmodel Residence

21 W. Pine Ave,  
Flagstaff, AZ 86001



There are over 100 million existing homes in the US. Less than 20 million of those have been built since . Increasingly, more new homes are becoming energy efficient as more localities adopt newer building codes that incorporate high energy efficiency standards. What this means is that far over 95% of homes in the US are consuming too much energy. If we are to turn climate change around, we need to do something about existing housing. This home is a 1977, stick framed, spec home. When the Dunn's bought it in 1988, it was very uncomfortable in both deep winter and summer. By making by making the home tighter and better insulated along with adding a Trombe wall for thermal mass storage from southern sun-providing an additional winter heating source, they now are very comfortable and have cut gas use by 44% since 2002. Another sustainable aspect of the Dunn home is its central location, allowing for biking, public transportation options and less driving,

## Sustainable Features:

- Re-graded lot so that no rainfall runs off property
- Xeriscape with an efficient watering system
- Energy and water efficient appliances.
- 2" rigid board insulation on most exterior walls, over 40'
- Removed all drywall from interior walls/added insulation to where it was missing/compressed too much.
- Expanded foam in attic to create a conditioned attic
- Re-ran hot water lines in attic and insulated them
- Insulated stem wall to R10
- Programmable thermostat on efficient gas heater
- Tankless water heater
- Most lights are LED
- Retrofitted trombe wall in two southern facing walls
- Replaced existing windows with Low-E and triple pane windows

**Award Certification Level: Advanced Plus**  
**Owner/Retrofitter: Dunn Family**

# 2015 Sustainable Building Tour

Exploring New Horizons with Sustainable Building



**Northern Arizona Intergovernmental Public Transportation Authority**

Free bus fare pass to be used only on:

**Saturday, September 26, 2015**

Present this pass to the bus driver to get free transportation to and from tour locations.

Thank you to NAIPTA for your generosity and for providing sustainable transportation for our community!