



2019 Sustainable Building Tour

A Moonshot* Approach: From Inspiration to Installation

*Moonshot = ambitious. exploratory, ground-breaking



As part of the 2019 Flagstaff Festival of Science and the ASES National Solar Tour



Saturday | September 28th | 10 am to 2 pm

9 am Pre-tour Panel Discussion on the Innovative Materials and Systems Pilot Program!



Tour Features: ~Net Zero Water ~Rainwater Harvesting ~Greywater ~Net Zero Energy ~Solar Thermal ~Solar PV ~Passive Solar ~Trombe Walls ~ICF Construction ~Local Materials ~Advanced Insulation

Willow Bend Environmental Education Center

703 E. Sawmill Road



Sustainable features:

+ Strawbale building: energy efficient, renewable and high source of insulation value, straw 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

+ Solar PV panels: grid tied 6.2 kWh per day, donated by Prometheus Solar

+ Rainwater harvesting system collects and distributes to low-water garden

+ Energy efficient: blown-in fiberglass in ceiling (R-50) & LED lighting with natural day lighting

Award Certification Level: *Advanced Architect/Designer: PWMA, LLC*

Builder:

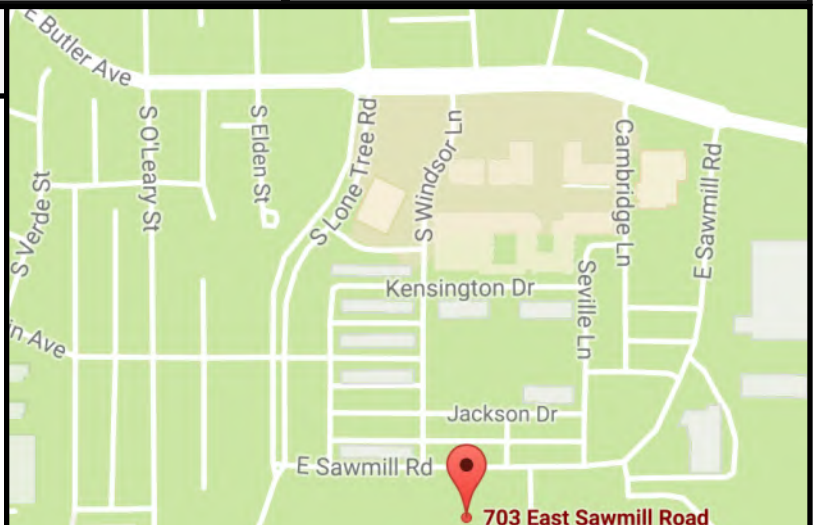
Solar Design & Construction

Willow Bend Environmental Education Center's mission is to provide educational outreach services that build environmental awareness and an ethic of responsible stewardship of our natural and cultural resources. The non-profit organization was founded in 1978 by the Coconino Natural Resource Conservation District and found a permanent home in 2002 when this building was constructed. The building provides the public with an example and resource for sustainable building and living. Willow Bend leads by example, with their passive solar, strawbale education center, as well as by their solar PV, 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.

Directions to Willow Bend

Willow Bend is off of **Butler Ave** in the vicinity of Aspen Place behind the Sawmill shopping center. Go south on **E Sawmill Rd.**, past the County Jail. Willow Bend will be on your left. Or go south on **S Lone Tree Rd.**, take a left on **E Sawmill Rd.** Destination will be on your right.



Imagine Tiny House from TinyCamp™ 703 Sawmill Road



Sustainable features:

- +208 square foot tiny home = reduced material and energy use
- + Full bathroom
- + 2 X 6 construction
- + closed-cell spray foam insulation
- + Mini-split heating and cooling
- + Solar PV for all electrical needs
- + LED lighting
- + Built by technical training program students
- + Bamboo flooring

Owner: Darin Dinsmore

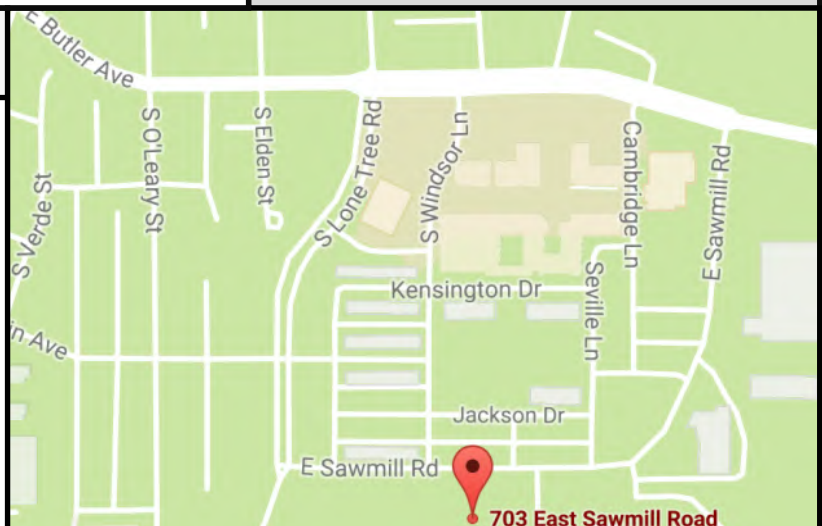
Designer/Builder: TinyCamp™

TinyCamp™ is a development of 5 tiny homes in Oak Creek Canyon. Four of the houses are available on Airbnb, giving the public the opportunity to try out tiny house living. Built by Construction Careers Academy, a magnet high school in San Antonio TX, designs for three of the units are from Tumbleweed Tiny Houses. Their small size reduces material and energy use, which is further minimized through efficiency measures.

Imagine Tiny House boasts of a New York modern country flair. As you walk through the double doors of this home you can't help but feel the openness of this tiny home. The home has an open floor plan with the living area open to the kitchen. The home has high end bamboo flooring, craftsman cabinetry, granite counter tops, stainless steel appliances and a washer/dryer combo. The home also has a tub/shower combo in a large separate bathroom. The single sleeping loft is roomy and open.

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Cooperrider Residence



Our home started as an idea to create an energy efficient home that reflected our lifestyle and interests. Three things were most important to us as we designed our house - 1) that we could afford it, 2) that it was as energy efficient as possible, and 3) that it was comfortable and opened up to the outdoors so we could enjoy the beauty of Northern Arizona even while inside our home. To achieve our financial goal we designed and built the house by ourselves. Bryan did the manual labor, hiring others as needed, and Beth did most of the research and planning. The home features passive solar orientation, solar energy, heated floors, and lots of natural light. The design is very simple making it easier to execute, but includes thoughtful details. The result is a comfortable and beautiful home that is net-zero energy and required no loans to build.

Sustainable Features:

- + Net zero energy home
- + Solar PV
- + Passive solar design
- + Rainwater harvesting system
- + Complete greywater irrigation system
- + Attached greenhouse
- + ICF stemwall
- + R-49 spray foam in lid, R-24 blown-in cellulose with exterior rigid insulation wrap
- + Heat Recovery Ventilator (HRV)
- + Masonry heater for efficient space heating from wood burning
- + Xeriscape landscaping
- + Energy Star appliances

Certification Level: Advanced (at time of certification)

Owner-Builders: Bryan & Beth Cooperrider

Architect/Designer: Owners with support from SolarTerra Design LLC

Flagstaff Family Farm



“When the winds of change blow, some people build walls and others build windmills.” –Chinese Proverb

The Flagstaff Family Farm implemented many sustainable systems such as solar power, water collection, fire safe materials and water wise practices. We believe the innovation comes from the exchange of resources between the home and the garden. One could not succeed without the other.

Our process began when we chose the perfect piece of raw land for the farm and took on the challenge of creating a successful relationship between the built and the unbuilt. We drew on our combined expertise of both architecture and horticulture. We approached our project in phases, beginning with constructing the farm buildings, then we created the garden, followed by building a small farmhouse, and then bringing the sustainable systems online. The entire project has taken 4 years of planning and execution to date and continues to evolve, strengthening the symbiosis between the natural and man-made.

Sustainable Features:

- + Family farm with Community Supported Agriculture (CSA)
- + Soil building with spent grains, coffee and wood waste
- + Small home
- + Rain water harvesting
- + Complete greywater system
- + Solar PV
- + Bidet
- + In-floor radiant heat with combination Energy Star boiler
- + Outdoor bathtub
- + Energy Star appliances
- + WaterSense fixtures
- + Zero VOC paints and finishes
- + Dark Sky LED shielded lighting
- + Xeriscape landscaping

Award Certification Level: Platinum

Owners: Patty and Tyler Allenbaugh

Designer: Patty Allenbaugh

Builder: RPM Masonry & General Contracting Inc.

Rain Valley Ranch



Our project had been a dream we shared for many years. Silas grew up in a family of contractors and was familiar with various building practices and Jana studied architectural design and drafting by taking classes at CCC. We were both interested in sustainable building options and passive solar design. The land in Rain Valley had been in Jana's family since the '90s and was converted farm fields. This influenced our contemporary farmhouse style. Blending together concrete and wood gave our house a feeling of permanence and place. Incorporating our local wood products from our sawmill business gave us a chance to explore different techniques and styles from post and timber construction to custom shiplap paneling and shou sugi ban exterior finishes. The concrete work was also an experiment for us with new products and finishes. The stem and first floor walls are poured concrete utilizing ICFs and the interior concrete slab was ground and polished then finished with a clear sealer. Our design and our knowledge evolved over the years as we planned our dream home. We were not exactly sure where we would end up when we started this journey pulling together all the different ideas, designs, and materials but we love our new home and are happy to share it with others!

Sustainable features:

- + Fox Block Insulated Concrete Forms construction
- + Use of local wood milled by AP Sawmill (owned by project owner): pine, fir and spruce for structural and non-structural elements
- + Shou Sugi Ban burning technique on siding
- + Reclaimed sub-slab rigid insulation from the Hub
- + Passive solar design
- + 25% fly ash added to concrete
- + Plywood used instead of OSB for durability and reduced off-gassing
- + Future rainwater system planned
- + Passive radon ventilation system
- + Zero VOC finishes
- + 115% solar PV system to be installed in December

Certification Level: Gold

Owners: Silas Page & Jana Aukon

Builder: Bristlecone Builders

Architect/Designer: Owners with help from Architectural Design Studio

Engineer: Core Structure Group

Ramsey Platinum Residence



The Ramsey "Platinum" U. S Green Building Council (USGBC) rated home was designed by Architect Carl Ramsey AIA, owner of Architectural & Environmental Associates Inc. (AEA). The house was also built by AEA. It was the first "Platinum" USGBC house in the State of Arizona and was used by the USGBC to help set the building standards for "green" sustainable homes. Many professional hours and trips to Phoenix were spent by Mr. Ramsey and the AEA staff to help the Phoenix USBBC Management team research and document what sustainable design and construction items should be given points. It was well worth the time to help set the standard for future home design and construction.

More than 2000 visitors have toured the Ramsey Home, including a group of former Soviet Union architects and home builders, sent by the U. S, Commerce Department, International Trade Relations Department. AEA was named the "Green Builder of the Year" by Green Builder Magazine in 2008, the year the home was completed.

Sustainable features:

- + LEED Platinum certified
- + Constructed on previously developed land- preserves green space
- + Permeable walkways and driveways
- + South orientated for passive solar gain
- + 12 KW solar photovoltaic power system
- + 1.8 KW wind turbine
- + Construction waste recycling for metal, wood, concrete plastic and cardboard
- + High insulation values, R-36, 8" SIPS panels
- + Two pipe drain system for future gray-water recovery system
- + Rainwater collection and storage system for all water needs
- + Xeriscape yard with irrigation control
- + Low VOC sealants and finishes
- + Participated and passed the Energy 10 Energy Performance Analysis
- + Passive radon system
- + Finishes: American Clay wall finishes, recycled car tire paver bricks, cork flooring, concrete counter tops, Ponderosa pine cabinets and trim
- + Recycled wood furniture

Certification Level: Advanced Plus

Owner: Carl Ramsey

Architect and Builder: Architectural and Environmental Associates, Inc.

Ryan Historic Retrofit



We purchased the house 30 years ago; now a 105 year old rock house that had the east wall moving further east, widely spaced floor joists that made the floor boards bouncy, and a slope toward the east of around 3". The Townsite neighborhood is one of the best in Flagstaff for us, so we knew we had to save the home. After living out of the country for ten years and saving money, we were able to finance the project. We envisioned a sturdy sustainable home and wanted it to look like it always did on the outside, but with a more modern use of space inside. We planned to build the cabinets and finish and install all of the trim (locally milled pine from fallen ponderosa) - very ambitious! Getting from inspiration to installation took a team of friends (one an architect) and a contractor who loved challenges!

Sustainable Features:

- +Restoration of 103 year old malapai rock home
- +R-49 insulation added to lid
- +Crawl-space filled with cinders and R-10 insulation added
- +95% efficient boiler for hot water and radiant floor heating
- +New above-code windows (with historic look)
- +Walls stabilized with helical piers
- +Solar tube
- +Local ponderosa pine trim from AP Sawmill
- +Energy Star appliances
- +Reuse: El Tovar light fixture, doors made into fence, oak flooring stored for later use, rock reused in neighborhood (for Wheeler Park sign!)
- +Xeriscape landscaping, pollinator garden
- +Low flow fixtures

Certification Level: Gold

Owners: Dave & Ellen Ryan

Architect/Designer: PWMA

Builder: Good Oak Enterprises

Tears of Joy



Beautiful, natural, recycled, resourceful, healthy, and innovative were some of the goals with Tears of Joy; these shaped the vision and construction of our home. We wanted to build using strawbale construction because it is a by-product of grain harvesting, and its natural insulative properties help to keep our home cozy and healthy. We had to remove several trees prior to construction, and we minimized the impact of this by using horses instead of heavy machinery. We decided to use the trees we cut down by building the first cordwood construction garage in Flagstaff. We also built a passive solar kiln to speed up the drying process of the wood. Our home was used as a teaching tool with Coconino Community College students, and they helped to design our solar PV system and our rainwater harvesting system that we use for all our water needs.

Sustainable Features:

- + Strawbale construction
- + Insulated slab with radiant floor heating
- + Outdoor wood-fired boiler for walkway snow melt and pizza!
- + Earth plaster exterior with lime
- + Solar kiln- cord wood greenhouse
- + Rainwater harvesting
- + Solar PV system
- + Home heated with hybrid electric water heater that cools pantry
- + Energy Star appliances
- + Regional materials
- + Zero-/Low VOC materials used inside
- + Cord wood garage construction
- + Trees from site used in construction
- + Many recycled materials used

Award Certification Level: Platinum

Owners: John and Beth Fagan

Designer: Solar Design and Construction

Builder: John Fagan and Patrick Beatty

Resource Page

Government Programs:

Coconino County Sustainable Building Program

The mission of the CCSBP is to educate, encourage, support and help develop sustainable and energy efficient building practices throughout northern Arizona: www.coconino.az.gov/sustainablebuilding

City of Flagstaff Sustainability Program

The Sustainability Program is dedicated to promoting sustainable living and providing practical solutions to the Flagstaff community. <http://flagstaff.az.gov/sustainable>

City of Flagstaff Water Conservation Program

The City of Flagstaff Water Conservation Program promotes using the City's water resources wisely and implements educational opportunities for the community. <http://www.flagstaff.az.gov/waterconservation>

Educational Organizations/Programs:

Willow Bend Environmental Education Center

The nonprofit 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. www.willowbendcenter.org

Coconino Community College Alternative Energy Technology Degree

<http://www.coconino.edu/academics/curriculum/collegecatalog/Pages/AASAlternativeEnergyTechnology.aspx>

Coconino Community College Sustainable Green Building AAS Degree

http://www.coconino.edu/academics/curriculum/collegecatalog/Pages/AAS_SustainableGreenBuilding.aspx

Northern Arizona University Master of Arts in Sustainable Communities: <http://nau.edu/sbs/sus/>

Northern Arizona University Office of Sustainability: <http://home.nau.edu/sustain>

Northern Arizona University Sustainable Energy Solutions: <http://ses.cefns.nau.edu>

Northern Arizona University Construction Management: <https://nau.edu/cefns/engineering/construction-management/>

Tax Incentives-Utility Rebate Programs:

Listing of State and Federal Tax Incentives: <http://www.dsireusa.org>

Residential and non-residential rebate and incentive programs exist through utility providers such as Arizona Public Service (APS), Salt River Project (SRP), Unisource Energy Services (UES) and the City of Flagstaff. Please refer to their websites for information.

APS: <https://www.aps.com/en/residential/accountservices/serviceplans/Pages/green-choice-plan-options.aspx>

SRP: <http://www.srpnet.com/environment/earthwise/solar/Default.aspx>

UES: <https://www.uesaz.com/>

City of Flagstaff: <http://www.flagstaff.az.gov/index.aspx?nid=1030>

Organizations:

American Solar Energy Society: <http://ases.org/>

American Wind Energy Association: <http://www.awea.org>

Arizona Solar Center: www.azsolarcenter.org

Coconino Plateau Watershed Partnership: www.cpwac.org

Coconino County Sustainable Building Program

Consultation • Pre-Submittal Plan Review • Field Support
Sustainable Building Awards Program • Resources
• Educational Opportunities



The mission of the Coconino County Sustainable Building Program (CCSBP) is to encourage, support, educate, and develop sustainable building practices for the communities within Coconino County.

The CCSBP offers the following services for free:

Consultation: on sustainable building methods- plan review before you submit for a building permit, learn ways to make your new or existing home more energy/resource efficient or get code support for your alternative building design.

Award Program: through meeting at least the minimum requirements of the Program checklist, your home/building can receive a Sustainable Building Award Plaque and be able to participate in local tours and events. Use the regionally focused checklist as a guide during your planning and building process.

Resources: on sustainable building products, methods, practices, a resource directory of businesses that provide local sustainable building services and supplies as well as a comprehensive listing of tax incentives for sustainable development and renewable energy.

Educational Opportunities: lectures, solar/sustainable home/building tours, workshops, seminars and information on sustainable building classes that are offered at CCC or NAU. The Program also provides educational presentations to groups, conferences and schools.

2019 Sustainable Building Tour



Free bus fare pass to be used only on:

Saturday, September 28th, 2019

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

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