

# Living With the Sun Arizona Style



Arizona is a land of physical and climatic diversity. From the San Francisco Peaks to the Sonoran desert, Arizonans past and present have adapted to this diversity and to conditions of climatic intensity. The heat of the desert summer sun and the cold of a mountain winter have direct impact on the form and shape of our buildings, and the patterns of our behavior.

Living with the sun is the characteristic of a truly Arizona architecture, not rooted in national stylistic trends but in environmental conditions, local resources and climatic appropriateness. Living with the Sun Arizona Style uses on-site environmental conditions to meet needs and comfort, while minimizing resource depletion, and economic waste.

Through time there are examples of Arizonans Living With the Sun. The early cliff dwelling of Montezuma's Castle, often romanticized as Arizona's first solar building, has passive solar attributes including south orientation; deep eaves (cave roof) which shade in the summer and allow low winter sun penetration for warmth; and thermal mass (solar heat storing capabilities of the stone building materials).

Passive solar water heaters were used on buildings like the historic Ellis-Shackelford house and the Tempe Bakery. Historic buildings responded to the need for shade and cross ventilation. Phoenix hotels had large sleeping porches where rolls of burlap were unfurled and wet down for evaporative cooling .

The cooking porch, and even the cooking ramada provided to "keep the kitchen heat out of the house in the summer". Materials of masonry and adobe provided thermal mass in conditions where heat retention was a benefit, The Aeneas solar pump was installed to irrigate the agricultural lands in the Tempe area. Northern Arizona ranch houses incorporated large screened porches, open as cool places for evening use as well as sleeping.

## Living with the Sun - Arizona Style continues today -

In every corner of Arizona there are solar buildings. Some constructed twenty years ago, continue to function today. Newer buildings, incorporate current knowledge of passive solar design integrated with effective solar equipment of solar photovoltaic panels.

Projects like Tucson's Civano subdivision and the Milagro co-housing development are appearing, and the variety of solar strategies used provide a growing richness in solar building form and shape and architectural language.

Today, Living With the Sun - Arizona Style can be seen throughout the State every October during the annual tour of solar and renewable energy buildings, put on by the Arizona Solar Energy Association (ASEA) in association with the Arizona Solar Center. Local building tours are mounted on consecutive weekends at different locations around the State, throughout the month as solar homeowners open their doors to the public and share their knowledge and experiences in Living With the Sun..

## TAYLOR



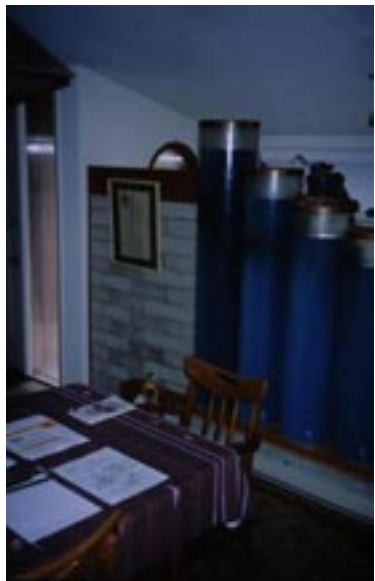
This Taylor "earthship" solar residence has a structure of interlaced tires packed with earth for both the structure and the heating and cooling system. This wall mass, coupled with earth integration into the site and extensive south face glazing allows for passive direct solar gain for natural heating. Recycled materials and the earth of the site provide effective mass as both a barrier to intense cold as well as summer heat, and is a wonderful medium for both warmth and coolth. . Renewable energy equipment include solar water heating system, wind generator, and photovoltaic panels

The Kerr residence in Taylor, is a simple thermal mass structure with south facing windows for direct solar gain for heating and a dedicated solar green space for both plant production and heat. Solar ovens are built into the south face and accessible from within the kitchen. Barbara Kerr is a long time common sense solar and resource conserving advocate and is internationally known for her work in solar cooking and resource independence. The structure is the headquarters for an institute, which teaches people from around the globe the ease and wisdom of Living With the Sun.



## SEDONA

Charles and Mary's place, a passive solar house built over 20 years ago, has direct solar windows, clerestory windows with penetrated interior walls to allow for capture of the sun's deep into the structure; a sunspace with thermal water tubes for heating and cooling; earth integration; high value insulation; an energy efficient pellet fireplace; and batch water heaters which have fully met their needs.



Another Sedona 20+ year old house, the Searle passive solar residence, uses direct solar gain and thermal mass for heating and cooling, and includes an isolated gain green space for plants and additional heat collection. South facing windows coupled with clerestory windows (for deeper penetration of the sun's rays), provide for heating as well as the illumination benefits of sunlight.

Building eaves are designed for protection from summer sun and access to the low winter sun. Additional temperature buffering comes from a raised planter against the north side. Cooling is attained by the structure's thermal mass, effective cross-ventilation design, and the operable clerestory windows. The energy design includes site strategies of exterior trellises, and surrounding vegetation, which creates a zone of coolness. Immediately adjacent to the house.



## VERDE VALLEY/COTTONWOOD

The Radoccia complex has evolved over time, with a variety of structures and activities. South face glazing, direct solar gain, structural thermal mass – all contribute to the building's heating, and strategic landscaping, thermal mass and effective cross

ventilation provide for cooling. Powered by electricity from on-site photovoltaic panels, the solar attributes provide a comfortable environment for both the living and working areas of the complex.



Sarah's Place, a simple structure integrating direct solar gain and thermal mass in the structure's walls and floor to provide heat comfort for the occupants. South facing windows, minimal east and west exposures, and strong mitigation of north side winter heat loss by means space planning, and a recessed entry and entry hall add to the efficiencies of this building.



## PAYSON

A custom solar and low resource consuming home integrated into the site, with south facing "clearview" collector windows, thermal mass, earth integration and berming, and extensive cross ventilation for cooling. The Clearview collector system - a double window area containing operable blinds and a plenum with room vents, allows for direct gain heating as well as convective heating. Additionally the blinds are used to mitigate the impact the sun.



## PRESCOTT AREA

A Buddhist temple and learning center remote from any available utility grid, this off-grid facility generates its' own power with a bank of photovoltaic panels mounted on the structure housing the system equipment and storage batteries. The energy stored within the batteries is used during the nights and during times when there is insufficient sun.



The Prescott College experimental Wolfberry Farm, looking into the agricultural benefits of indigenous crops, contains a number of solar applications - a student built straw bale structure with a photovoltaic installation, experimental solar crop dryers, and solar cookers for meal preparation



A Prescott professional building incorporating a Trombe wall for heating. The system, a dark masonry wall with upper (system hot air outlet) and lower vents (room air inlet to the system) and faced by windows., captures the sun's heat, and warm air rises and vents into the adjacent space by natural convection.



Ben's Place combines passive and active systems in a multi-level home. with south facing direct solar gain windows and clerestory, thermal mass walls and floors; penetrated interior walls, stacking of living spaces for more southern exposure;

cross ventilation coupled with thermal mass for cooling; and integration of photovoltaics for power generation, and a solar water heating system for hot water.



### FLAGSTAFF

An energy efficient residence incorporating ground mounted photovoltaic panels and a wind generator for power production.



### TUCSON

An energy efficient straw bale residence responds to the intense desert heat in its compact form and highly insulating building material, coupled with the thermal mass floors that assist in keeping the living environment cool in an efficient manner when coupled with high efficiency, low energy equipment and early/late season cross ventilation.

Reflective white roof and light color adds to the energy efficient attributes of the building. The residence has a permanent solar oven installed as a basic feature of the house' Living With the Sun approach.



Civano, one of Arizona's first environmental subdivisions, shows that good solar, environmental, and natural resource design and construction is successful in the open market. Homes range in construction from adobe to contemporary, energy efficient materials and all must meet Civano standards, which are some of the most stringent in the country.



The Weiner earthen materials and environmental common sense, high thermal mass, earth integrated rammed earth residence has solar assisted hydronic heating. Recycled materials for interior framing integrates with environmentally tempering design elements of porches, natural ventilation, and permaculture strategies to provide comfort.



### PHOENIX

The Arizona National Guard Eco-Building is burrowed into the site to gain the thermal benefit and barrier attributes of the earth. The "Earthship" construction of interlaced tires filled with compacted earth provides structure and a barrier to summer heat. A central landscaped atrium, coupled with an earth tube cooling system, are components for summer comfort. Active solar systems include photovoltaic panels and solar water heaters. coupled with high efficiency, low resource demand equipment and fixtures.



## SCOTTSDALE

The Edwards straw bale residence, part of Scottsdale's Green Building Program, incorporates Living With the Sun strategies including orientation, highly insulated building shell, energy efficient windows, structure shading wing walls, thermal mass plenum floors for heating and cooling, cross ventilation, a cool tower (gravity driven evaporative cooling system), direct gain heating, and an energy efficient fireplace.



## FOUNTAIN HILLS

Tierra y Sol, a compact, solar residence integrated into a north-facing slope, has high thermal mass walls with "out-sulation", summer and winter courts, and a raised thermal core for natural lighting and thermal chimney cooling. Equipment includes solar water heating, solar spa heating, resource efficient fixtures, and a centralized utility plenum for air distribution..



## PHOENIX

Built over 20 years ago, this DOE demonstration for roof pond heating and cooling in desert conditions. The benefits of roof ponds were proven and the inherent benefits of the buildings' passive design elements enhance any building. High thermal mass and thermal barrier walls, solar orientation, building proportions, an energy efficient Rumford fireplace, highly textured finish, recessed entries and windows, solar water heater, and energy efficient spatial arrangement provide the basis for comfort in the desert.



Formerly the APS Environmental Showcase House, this demonstration of "Green", energy efficient and solar applications includes orientation, thermal mass, placement and sizing of glazing, natural lighting, cross ventilation, courtyards, landscaping, resource efficient fixtures and equipment, "green" materials and finishes, and photovoltaic and solar water heater panels.



## TEMPE

The first straw bale building in Tempe this compact, energy efficient structure has highly insulating walls of mud plastered load bearing straw bale and a highly insulated roof structure, coupled with the thermal mass of the stone fireplace and exposed concrete floors, providing a condition where a minimum of mechanical energy is required for heating or cooling during the day.



Arizona is a land of extremes and variation. Arizonans have adapted to, and adopted the natural conditions and resources of Arizona sites and climate to create habitations that are energy efficient and resource appropriate. Throughout Arizona there are a variety of actions that have been and are continuing to be taken by Arizonans who are incorporating the elements of nature - the sun, wind, earth, and water, simply and directly to meet their needs. These actions are the basis of **Living With the Sun - Arizona Style.**



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