Off-Grid Ideas Competition
by Blair Seibert, AIA, LEED AP

Living and working independently of oil is not a dream. Joining as a team, owners, architects, engineers and environmental consultants can make it a reality.

I had a chance to take part in creating a prototype of genuine sustainable living during the "Off-Grid Ideas Competition" sponsored by the California Architectural Foundation through its William Turnbull Jr. Environmental Education program. It was fun seeing how the synergies of the systems worked together to make this community and those around it more sustainable.

The goal of the competition was to look at the ways we, as architects of the built environment, can create physical and social fabrics that go beyond doing less harm to explore ways we can regenerate the environment. Entries were displayed at the California Council's Monterey Design Conference held October 19-21, 2007.

The Carbon Footprint (the measurement of greenhouse gas produced by burning fossil fuels) and Ecological Footprint (the impact on water and sewer) were issues that most interested the jurors of the competition.

Although participants could modify the contest guidelines, with justification, the 60-acre site straddling San Francisco and San Mateo was expected to house 50 occupants per acre. The site characteristics included a 40-foot topography change across the site's width, a low water table, contaminated soils from previous manufacturing, strong westerly and southern winds and less fog and more sunshine than the typical San Francisco area.

Getting little encouragement from engineers and seeing a requirement for electronic drawings (preferring to do my work with hand-drawn plans), I was originally hesitant to enter the competition. One highly respected electrical engineer, hearing my thoughts of entering, responded, "Why would anyone want to go off grid?" I started to give up on the competition until meeting Jim Peterson, P.E., M.B.A., just two weeks prior to the submittal deadline. Jim is a brilliant, visionary, enigmatic mechanical engineer. He has substantial experience working with renewable energy technologies and was ready to get involved when I told him about the competition. Finally, a comrade.

Once we started sharing ideas it was clear he knew how to "rule the world" with photovoltaic panels, wind turbines, cooling and evaporative ponds. He explained how a small town on the site could exist free of the grid and void of carbon emissions by using the 600-degree water provided by the solar concentrator collectors along with adequate battery storage. In fact the power generated on site would support the buildings, all the residents' and commuters' electric cars and would generate enough energy to provide power back to the grid, reducing the surrounding community's carbon footprint.

As Jim and I spoke, the disconnection of our society from the climate and our environment really came into focus. Once we recognize that disengagement, our first active response for improving energy efficiency and independence is reducing the demands. Remaining comfortable in environmentally sensitive buildings means occupants become more aware of the weather and understand the climate in which they live. In that way they can adjust living and working patterns. As an example, an office building in this location would only need perimeter heating. As soon as people begin to inhabit the building and their computers are running, there will be enough heat generation in the core of the building to support the space. Office workers should come in prepared to "peel off clothing layers" as the space heats up.

Our vision of a small town off grid is as follows:

Carbon Footprint Reduction

The design of the building envelope reduces solar radiation, and conduction, and uses non-electric means (both passive and active), to shade and naturally ventilate the buildings. Cool natural daylighting from north- facing clerestory windows will be exploited. East, west and south glazing will be protected with deep overhangs (six feet on the east and west, eight feet on the south) and high performance quadruple layer glazing.

External blinds activated by solar cells would deploy to block direct sunlight. High R value insulation along with heat sink floor slabs reduce daytime internal heating loads which cuts cooling needs from the average 350 s.f. per ton to 700-800 s.f. per ton of cooling.

All lights, motors, computers, elevator motors and appliances operates on low voltage DC power, the electrical current made by solar panels, reducing energy demand and loss in transmission. Low voltage lighting reduces demand from 3 watts per s.f. to 1.5 watts per s.f. or less.

The residential towers have wind turbine electric generators and reversible hot water-photovoltaic panels which track the sun and rotate to the proper angle to maximize solar radiation absorption. In winter a computer analyzes the batteries, heating and domestic hot water tanks and determines how many panels need to be exposed to sunlight as photovoltaic, and how many need to be exposed as solar in order to maintain battery storage and hot water and levels.

The corridors in the residential towers have full-height operable windows at each end to allow for cross-ventilation in the north-south axis. The apartments have operable windows with ventilation shafts over the corridor to allow pressurization or cross-ventilation in the east-west axis. One fire damper per pair of units picks up attic heat and provides fresh air to the spaces. A four-pipe cooling/ heating unit located on the exterior wall of the apartment building allows 100% fresh air intake through outdoor louvers immediately connected to the fan coil closet.

Spot heating, cooling and lighting round out the energy reducing systems.

Ecological Footprint Reduction

Reducing the demand for potable water means relying on a number of other systems. All rainwater is collected and treated for potable water. Water from sinks and showers is treated and recirculated for toilet flushing and irrigation. All blackwater (water from toilets) is treated by a "Living Machine" (http://www.worrellwater.com/products_lm.html) and returned to the groundwater system. Wherever possible, composting toilets reduce the need for waste conveyance and production of blackwater.

Much of the contaminated soil is removed during excavation of underground garages. Remaining soil is treated naturally by mushrooms. (http://www.theremediators.com/index.htm)

Shared Efficiencies

Systems and uses are combined to reduce costs and increase usability. Chilled water and hot water storage in high rise buildings also serve fire water needs. The underground parking garages double as the utility levels and as places to locate evaporative ponds for vertical thermal chimneies through the buildings. These allow warm air to rise, pulling cooled evaporative pond air up through the buildings.

The on-site movie theatre serves as worship and auditorium space for the community, school and businesses. During inclement weather, the school's physical education students use the health club's basketball court. Residential towers with second-story "hotel" rooms provide accommodations for business travelers and out of town guests. The gym, billiards room, community room, dry cleaning and coffee/café services are used by residents and hotel guests. The community park acts as a playground for school children and a place for a weekend farmer's market.

It was fun participating in the competition, and though results had not been announced by submittal of this article, our entry can be viewed at www.verdearchitects.com/off-grid.html. If the AIA California Council uploads the other entries, I'll place a link on my website: www.verdearchitects.com.

Blair Seibert, AIA, LEEP AP is a member of the San Fernando Valley and Los Angeles AIA. It you have any questions or comments about this article or would like to be notified of local "green building" events, contact her at: 310-422-2417 or blair@verdearchitects.com.