

Design a Home That Keeps You Cool,

Let in the breeze, keep out the sun, and stay comfortable when things heat up outside

BY WILLIAM S. HOFFMAN



Passive cooling never looked so good. The house's design and materials were chosen for their ability to keep the interior cool and to protect the house from strong Florida storms. Broadleaf trees shade the entry from the sun's radiant heat. Photo taken at A on floor plan.

Just north of Miami, on a barrier island between the Indian River and the Atlantic Ocean, is a haven for fishermen, surfers, and nature lovers. Sebastian Inlet is a hot spot, literally. Along with the sand, sun, and fun comes the heat. Those of us who live in this area appreciate the value of a cool retreat at the end of the day.

Air-conditioning is one way to chill out in any house, but it brings along a higher electric bill. Alternatively, you can design a passively cooled home that uses the landscape, the wind, and the right materials to keep you cool. The home featured here is a perfect example of passive cooling. An ocean breeze, a wooded site, and a willing homeowner allowed me to incorporate all the principles of passive cooling into one home.

Design starts with the site

Long before the time of ceiling fans and air-conditioning, the Seminole Indians lived in chickee huts in southern Florida. The huts were long, narrow structures built on elevated platforms with open sides and palmetto-frond thatched roofs. It turns out that the Seminoles were on to something. The huts' form minimizes solar-heat gain, the open sides and elevated floors promote airflow, and the thatched roof offers protection from the elements.

The goal for this project was to design a home that keeps the owners cool without relying heavily on air-conditioning. The technique is called passive cooling, and it is accomplished by lowering the temperature and increasing airflow in and around a house. Designing a passively cooled house starts with the site and includes every aspect of the house right down to the color of the paint. Even with all the modern designs and materials for hot climates, though, this house is still surprisingly reminiscent of the Seminoles' chickee huts. The house is a long, elevated rectangle with open walls and a durable, reflective roof.

Wind and shade are your friends

There are three things to consider before deciding how a passively cooled house will sit on a site. Because the best remedy for hot weather is positive airflow, the first consideration is wind direction. In this case, the breeze comes from the south. So it was important to have one of the long sides of the house, with plenty of doors and windows, facing south. If the breeze had come from the east, I would have turned

Naturally



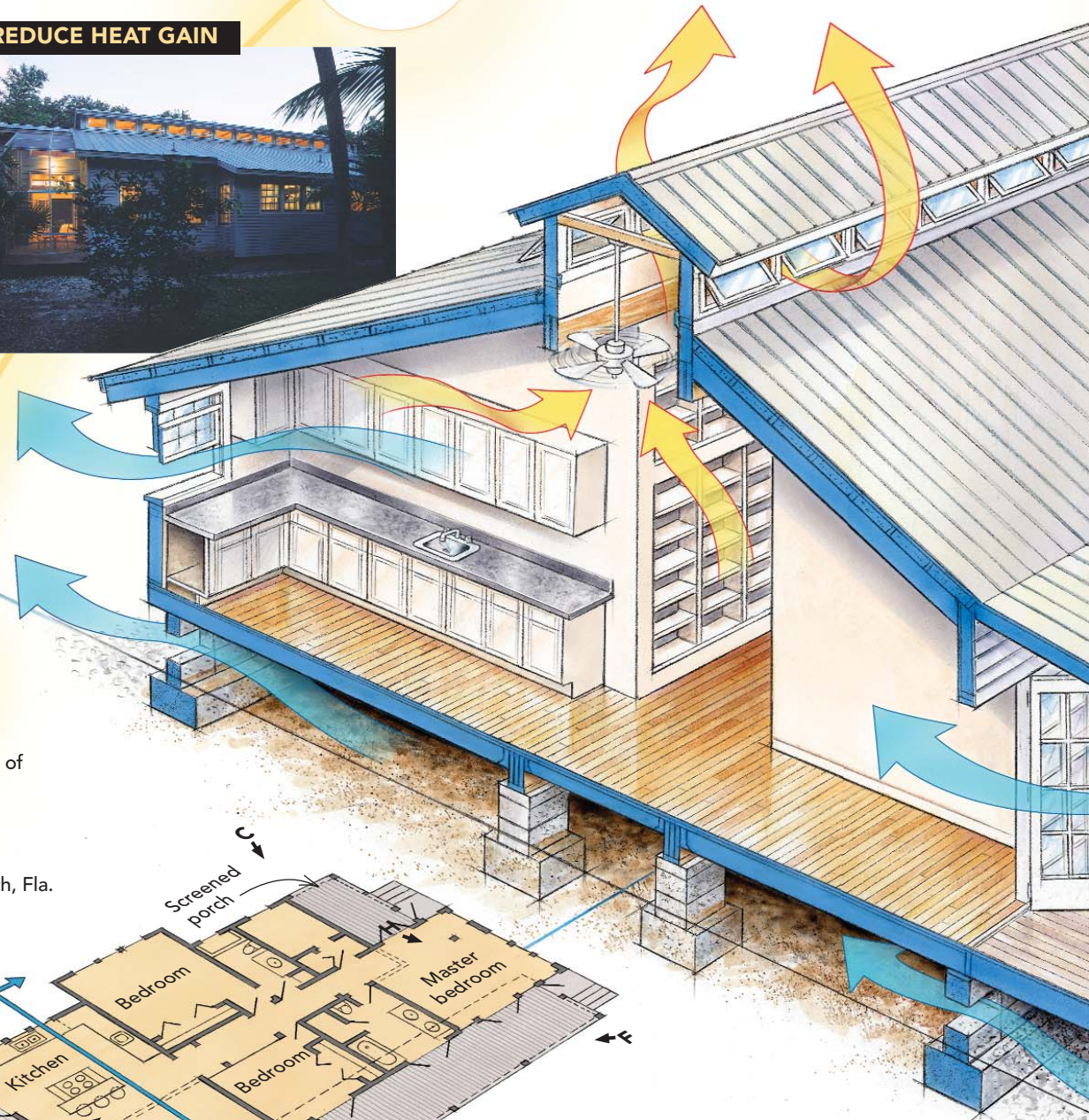
One more reason to use an open floor plan. Open floor plans complement today's lifestyles, make small spaces feel larger, and in this case, keep fresh air flowing through the house. The open kitchen, dining room, and living room connect to outdoor areas through French doors and allow the breeze to cool the interior of the house. Photo taken at B on floor plan.

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To remain cool without air-conditioning, this house is designed to promote the circulation of cool air and to keep the sun from turning the interior into an oven. Siting the house to take advantage of the prevailing breeze is the first step toward better airflow. Shade, light colors, and reflective materials keep the sun’s radiant heat where it belongs: outside.

REFLECTIVE MATERIALS REDUCE HEAT GAIN

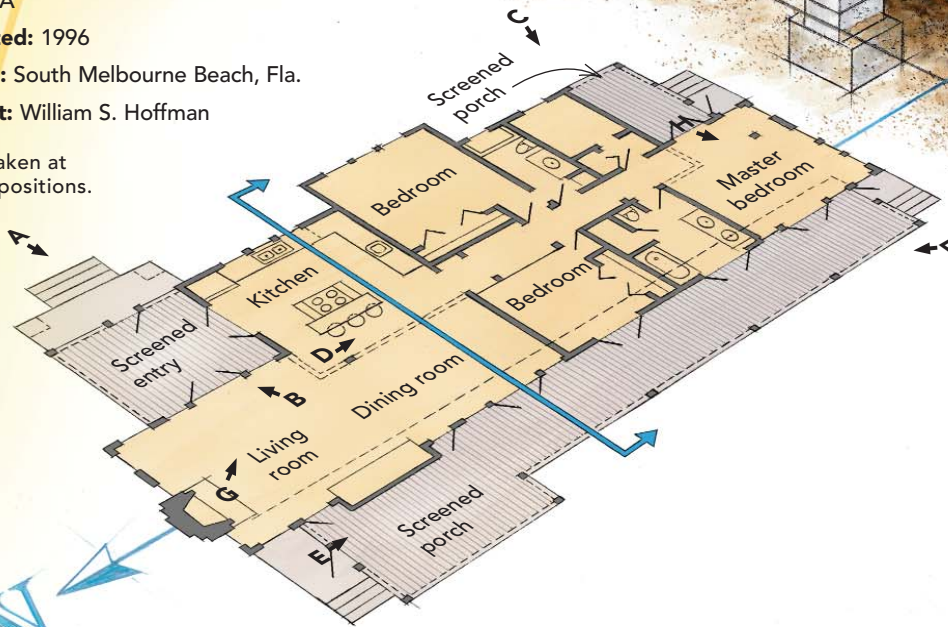
The metal roof and light-gray cypress siding reflect the sun’s radiant heat, while vegetation shades the east- and west-facing walls from early- and late-day sun. Combined with the cupola and various styles of windows and doors, the exterior finishes make an attractive house for any climate. Photo taken at C on floor plan.



SPECS

- Bedrooms:** 3
- Bathrooms:** 2
- Size:** 1800 sq. ft., plus 780 sq. ft. of screened porches
- Cost:** N/A
- Completed:** 1996
- Location:** South Melbourne Beach, Fla.
- Architect:** William S. Hoffman

Photos taken at lettered positions.



HOT AIR EXITS THE CUPOLA

In the center of the house where bedroom walls inhibit cross ventilation, warm air that rises to the ceiling escapes through the cupola's windows. When the forces of thermal dynamics aren't enough, reversible-blade ceiling fans give the warm air a push. Louvered vents above the doors also help to keep air flowing. Photo taken at D on floor plan.



the house slightly to the east, just enough to capture the breeze without exposing too much of the house's long wall to the strong, low sun early and late in the day.

The second thing to consider is the sun's orientation throughout the day because solar-heat gain along the house's walls and roof raises the temperature inside. Here, the midday sun is so high in the sky that a small overhang is enough to keep the south wall shaded. The overhang also allows the homeowners to keep the windows and doors open during rainstorms.

Then there's the third site consideration: vegetation. The site is dense with sable palms, water oaks, and gumbo limbos. Before locating the house, I mapped out the existing vegetation. Then I found a spot for the house where I could save existing trees to maximize the amount of shade around the house. Shade not only blocks sunlight from getting to the house, but it also cools the air flowing into the house. It is a good idea to keep as much vegetation as possible, especially high-branching broadleaf trees.

Keeping the sun at bay

In Florida, the sun is brutal. Building a long, slender house with the smaller sides facing east and west minimizes the amount of time that exterior walls are exposed to direct sunlight. Shading the exterior walls helps, but inevitably the sun will beat on some part of the house, especially the roof. Using the right materials becomes important.

The roof must be watertight, insulated, and reflective. A simple gable is the best roof form in an area where strong rainstorms are common. I used a V-5 metal Gal-

COOL AIR ENTERS FROM THE SOUTH

A full-length screened porch on the southern side offers an outdoor space accessible from every room on that side of house. French doors allow the ocean breeze to enter the house, and a vented block foundation wall allows the breeze to flow beneath the floors. Photo taken at E on floor plan.



More than just a porch. During the day, the long screened porch shades the south-facing wall. At night, it offers a great place to relax. More than one-third of the house's total square footage is made up of outdoor spaces. Photo right taken at F on floor plan.



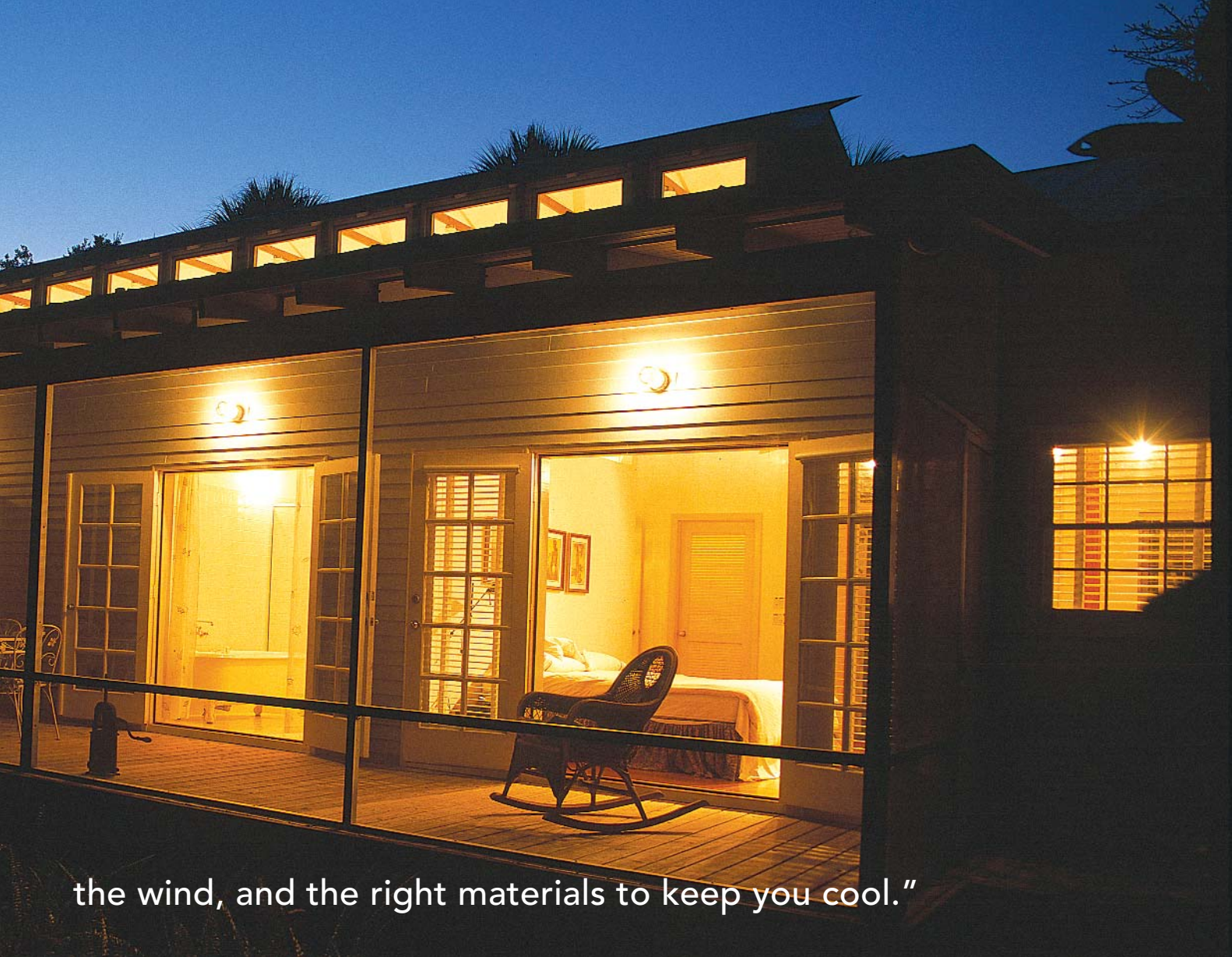
A sunlit interior comes with the territory. Passive-cooling strategies call for lots of windows and doors, and short distances to keep air flowing through the house. Long views and pleasant daylighting are a bonus. Photo taken at G on floor plan.

The coolest bedroom in Florida. Flanked by screened porches, shaded from the morning sun by nearby vegetation, and supplemented with a ceiling fan, this bedroom makes it easy to get a good night's sleep even on hot Florida nights. Photo taken at H on floor plan.



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valume roof (www.steelroofing.com) for two reasons. Metal roofs reflect radiant heat, and metal outperforms other roofing material in strong storms and wind-driven rains. Rigid-foam insulation prevents radiant heat from transferring to the tongue-and-groove cypress ceiling inside.

The most important function of exterior walls in Florida is to keep critters and intense weather out of the house. However, the walls are still insulated with fiberglass batts to absorb radiant heat that gets past the cypress siding. Cypress doesn't have any inherently reflective qualities, though, so the house is painted a light gray to reflect the sunlight rather than absorb it the way a darker color would.

Cool air comes in; hot air goes out

For passive cooling to work, there needs to be a constant exchange of cooler fresh air. The first step to maximizing airflow is to elevate the house off the ground. Building the house 2 ft. 6 in. off the ground on stacked blocks with vents allows air to flow beneath the floor, although the doors and windows capture the majority of the breeze.

The southern side of the house faces the prevailing breeze. In this case, the stars lined up: The prevailing breeze is out of the south and is cooled additionally by the Atlantic Ocean. Every room on the south

side of the house opens through French doors to a screened porch that extends the length of the house. The southern breeze crosses the house's shorter dimension to exchange fresh air out the northern doors and windows.

Covered screened entries at the front and rear of the house let air flow in but keep sun, rain, and critters out. One screened porch on the north side of the house is adjacent to the living room, and another is off the master bedroom. In most areas of the house, the breeze can blow in and out with little restriction. To keep air flowing where walls were unavoidable, I used built-in louvered vents.

The house has an elongated cupola with mechanical windows that creates a stack effect to induce airflow thermally. The stack effect is another passive strategy for circulating air through a house. Warm air rises, exits through the cupola windows, and then pulls fresh air into the house. Ceiling fans with reversible blades are used to aid the convection of hot air out the cupola windows. This process works a lot like the smokestack effect that sucks smoke up a chimney and sends it out of the house. □

William S. Hoffman (www.hoffmanarchitecture.com) is an architect in Fort Lauderdale, Fla. Photos by Bill Sanders.