INFORMATION RESOURCES

The Sun-Inspired House

The Sun-Inspired House, a 247-page book by architect Debra Rucker Coleman, may be the best available introduction to passive solar design (see Figure 11). Coleman's book is much more useful than three better-known books on the topic: James Kachadorian's *Passive Solar House Book* (see ***EDU***, December 1997), Dan Chiras's *The Solar House* (see ***EDU***, May 2003), and Steven Winters' *Passive Solar Design and Construction Handbook* (see ***EDU***, July 2003).

Builders who glance at Coleman's book may hastily identify three strikes against it: it is written by an architect; it is written for homeowners; and it promotes the sale of the author's house plans.

As it turns out, however, none of these apparent defects detract from the book's usefulness. Coleman is a rare architect: at once eminently practical and willing to share trade secrets. Although she writes with homeowners in mind, Coleman assumes her readership to be curious, knowledgeable, and technically inclined. Finally, the self-promotional aspects of the book — Coleman's touting of her house plans — do not detract from the value of the advice she provides on passive house design.

Consider Hiring a Home Energy Rater

Coleman's common-sense advice is based on years of design experience. For example, she writes, "Few builders will say 'no' when asked if they build energy-efficient houses, so talk to previous clients about comfort, quality, and energy consumption. Consider employing a third party such as a home energy rater that has been certified under the Energy Star program."

Coleman advises readers looking for more information on building performance issues to consult the Web site and books produced by the Building Science Corporation in Westford, Massachusetts.

EDU salutes Coleman for the first two items she chose for her list of green building principles: "building small" and "renovating instead of building new." Appropriately, she returns to the theme of "building small" throughout the book.

Readers of *The Sun-Inspired House* will occasionally be distracted by Coleman's disjointed writing style and erratic sense of organization. However, these minor flaws do not significantly undermine the value of her book.

Unimplemented Principles

The Sun-Inspired House ably covers the basics of passive solar design. Solar veterans may assume these principles to be well-known; but since the principles are almost never implemented in the US, they bear repeating:

- "South-facing windows allow sun to enter in cold months, while the correct placement of south window overhangs and awnings keeps the sun out during hot months."
- "Orient the longest wall of the house [to face] close to true south. … A design that requires two walls to be oriented at 45 degrees angles to true south is not optimum from an energy standpoint."
- "By choosing a fairly rectangular plan over one with many wings, additions, and roof forms, homeowners can save from 10 to 50 percent on heating and cooling energy consumption."
- "South windows should have a high solar heat gain coefficient (SHGC) to maximize the amount of the sun's heat that passes through the glass. … It can be hard to locate glass other than clear with a high SHGC in southern climates."
- "A two-story rectangle is the easiest shape to maximize south glass in relation to the floor area. It is also easiest to maximize the south glass to floor area ratio in smaller houses."
- "Limit the use of skylights because it can be difficult to control summer heat."
- "Shading with porches works well for east and west windows."
- "Prefabricated sunrooms seem to have so much glass that it would be nearly impossible to add enough thermal mass to balance out the temperature swings. The room would most likely be too hot in summer and too cold in winter."

Rules of Thumb

To design a high-performance passive solar house, a builder needs more than general principles; what's needed are formulas and rules of thumb. Fortunately, Coleman fulfills this need:

- "The low winter sun angle … varies with latitude: 67 degrees minus a given latitude = noon sun angle on 21 December."

- "Place a minimum of 5% and a maximum of 12% (of the conditioned area of the house) of glass on the south wall of the house. … If south glass exceeds 7% of the floor area, install heat-absorbing materials (thermal mass) inside the house."
- "Keep east-facing glass to less than 4% of the conditioned floor area."
- "Limit west-facing glass to less than 2% of the conditioned floor area."
- "North-facing glass should not exceed 4% of the conditioned floor area unless the site is in a warm climate."
- "For 8 and 9 foot wall heights, a 2-foot [roof] overhang or awning can be sufficient to many roof and wall construction details with 5′ to 6′ windows. The overhang criteria should be refined according to the latitude, exact orientation of the south wall, and climate."
- "Strive for a minimum of 2 inches of thermal mass, but limit mass to 4 inches thick."
- "13 degrees F is the maximum recommended temperature swing for most people's comfort range. For instance, a room could reach a peak temperature of 80 degrees during the late afternoon, but be back down to 67 degrees in the early morning hours without assistance from backup heating systems."

Maybe Not 30 Percent

The Sun-Inspired House contains only one glaring technical error — namely, Coleman's assertion that "Radiant barriers have been shown by the Florida Solar Energy Center [FSEC] to reduce cooling costs in hot climates by approximately 30 percent."

In fact, FSEC research has shown that an attic radiant barrier can reduce *heat gain through an R-19 insulated ceiling by 30% to 40%*. A report from Oak Ridge National Laboratory concluded, "Since the ceiling heat gains represent about 15 to 25 percent of the total cooling load on the house, a radiant barrier would be expected to reduce the space cooling portion of summer utility bills by less than 15 to 25 percent. Multiplying this percentage (15 to 25 percent) by the percentage reduction in ceiling heat flow (16 to 42 percent) would result in a 2 to 10 percent reduction in the cooling portion of summer utility bills."

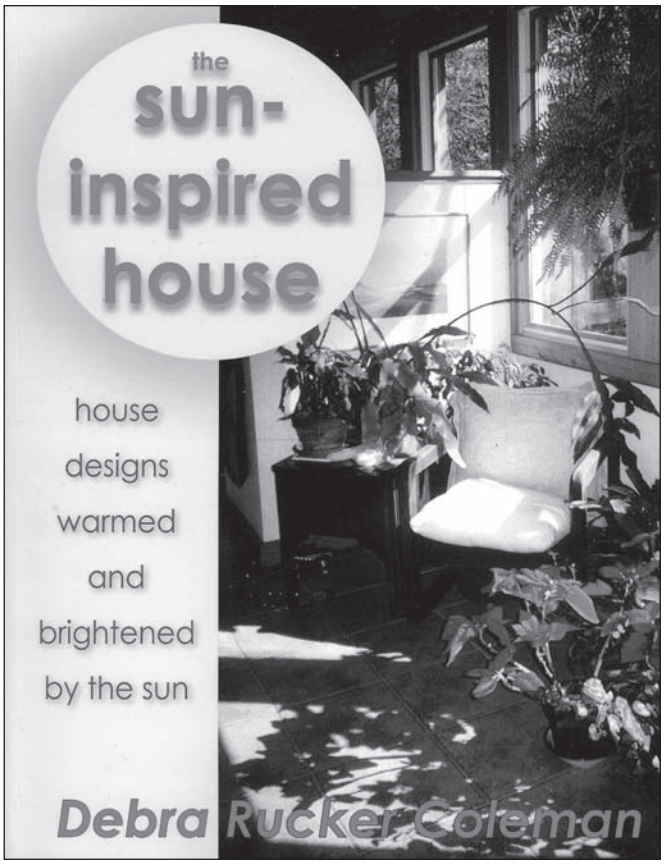

Figure 11. *The Sun-Inspired House* is an excellent introduction to the principles of passive solar design.

According to a fact sheet produced by the DOE's Office of Energy Efficiency and Renewable Energy, cold-climate builders who install an attic radiant barrier can expect even smaller reductions in energy bills: "Two field tests, one in Minnesota and one in Canada, both found that a radiant barrier placed over R-19 attic floor insulation (which is less than half the DOE minimum recommendation for those climates) found that the radiant barrier contributed to less than a 1% reduction in energy consumption for heating and cooling."

The Sun-Inspired House: House Designs Warmed and Brightened By the Sun (ISBN 978-0-9767318-0-1) by Debra Rucker Coleman ~~is available for $29.95 from Sun Plans, 18250 Tanner Road, Citronelle, AL 36522. Tel: (251) 866-2574; Fax: (251) 866-2576; E-mail: info@sunplans.com;~~ Web site: *www.sunplans.com*.