Can it be green, if it isn t solar?

It’s during the design phase of building a home that solar potential needs to be considered

By Anthony and Victoria Stoppiello

For a “green” building to be considered bright green, not merely olive, the critical criterion is whether it is sun-tempered – passive solar heated and cooled – and naturally day lit. In this era of “peak oil” and a “post carbon economy,” the importance of passive solar design becomes clear.

Fifty percent of a home’s total energy use is for space heating…most of which in our temperate Pacific Northwest climate can be provided by passive solar design, with very little, if any, increase in up-front construction costs.

Orientation is the least technical and yet most critical aspect of creating a building that uses the sun. Orienting your building toward “true south” (as opposed to magnetic south) will allow you to maximize solar gain. Even if site constraints require your building to be oriented 20 degrees east or west of true south, you will still capture 90 percent of the sun’s energy in your building.

Anthony Stoppiello

The best building plans stretch east-west, with living room, kitchen, dining, and bathing on the south, southeast and southwest, and “cool” spaces (bedrooms, storage, laundry, entry, and garage or carport) on the north side. This approach puts the active “living” areas of the home on the sunny side of the house, maximizing the effectiveness of solar gain, and areas that are used less, or for sleeping, on the side of the house away from the sun.

A “sun-tempered” house will still save you 25 percent of your energy costs, heating up when the sun is out, but quickly cooling down after sunset. That’s because a sun-tempered house may be oriented well to capture the sun’s energy, but has no storage capacity to hold heat into the evening.

A passive solar house can provide 65 percent of your heating in our climate. In a passive solar building, thermal mass is installed (concrete, water, masonry) that absorbs heat when the sun strikes it and slowly re-radiates that heat when the sun is down, keeping the home’s internal temperature constant. Adding nighttime insulation will increase the effectiveness of solar heating applications; it stops heat from re-radiating through windows to the outside atmosphere.

There are three types of passive heating systems – direct gain, where thermal mass is part of the floor or interior walls; storage wall, where a thermal mass is built quite close to south facing glass; and solar greenhouse, where a sunroom captures heat which in turn is transferred into the main building. In all cases, there is a straightforward formula for calculating and designing your solar system – the size of the space to be heated tells your designer how much glass is required, which in turn impacts the amount of thermal storage mass.

The principles involved have been well developed over the last 30 years as solar architects and engineers fine-tuned them, using their own sometimes amusing experimental homes. Houses with way too much glass became unbearably hot in winter, no matter how much storage mass was included. On the other hand, there have been designers who went to the other extreme, thinking if a little mass is good, a lot must be better… and ended up with a building that never got warm because there was just too much mass to be heated, creating a literal heat sink.

Any “solar” home that uses mechanical air conditioning has a design mistake. A passive solar heating system also provides cooling, what most people think of as “air conditioning.” East of the Cascades, where summer temperatures can soar, the thermal mass has a cooling effect, absorbing ambient heat during the day to keep the house cooler; opening windows in the evening flushes residual heat, cooling the house overnight. West of the Cascades, natural ventilation—better known as opening windows on opposite sides of the house—is usually sufficient.

The first law of air conditioning is to keep the sun out. The greenhouse effect works on a simple principle: light rays, once they’ve passed through glass and strike an object, become heat, which is trapped in the building. Therefore, window orientation needs to be considered carefully. West-facing windows have the potential for overheating the building even on the wet side of the Cascades, and the problem is more severe in Southern Oregon and east of the mountains where both east and west windows can “over contribute” solar heat. If you’ve ever stayed on the ocean front, or in a space with expansive western views, you’ve experienced the problem: When the sun is moving toward sunset and is low on the horizon, rays come directly through the glass, into the building…at the most efficient angle. You get eye-piercing glare and the space becomes uncomfortably hot during daylight hours.

Don’t underestimate the impact of well-designed natural daylighting. While it will save roughly 10 percent of your electricity costs, the major benefit of natural light is its quality, which surpasses that of any other light source. As we grow older, the quality of natural light allows us to read fine print without additional lighting.

Our climate in the Pacific Northwest, with substantial cloud cover, creates perfect diffused light. The goal of good daylighting design is this – when the sun is above the horizon, regardless of the weather, no electrical lights are necessary to move around your building or do most tasks. Electric lighting for specific tasks, e.g. cooking, office work, or reading can supplement natural light.

As you tour Oregon’s green and solar buildings, you might assume you can’t get a solar house, a properly oriented house, or a well day-lit house unless you start from scratch…but that isn’t true. Except in the rare cases where a steep hillside, a mature forest or an adjacent building blocks all the solar access, a thoughtful solar architect or designer can retrofit an existing house to maximize its solar potential. Careful placement of additional windows and solar mass, adding insulation to meet current energy codes, or shifting space uses to put active living areas in the sunshine are not only possible, but from one perspective, are the best of “green” building—utilizing a site and materials in a new, more energy and resource efficient way.

Anthony Stoppiello is an architect licensed in Oregon and Washington doing solar and green buildings for the last 30 years in the Pacific Northwest.

Victoria Stoppiello is a freelance writer and general manager of the Astoria Cooperative natural foods grocery.

The Stoppiellos retrofitted their 1895 Ilwaco home, reducing their electricity use by two-thirds while adding space and livability.