CONSTRUCTION & DESIGN CONSIDERATIONS IN Warmer Climates

It's generally accepted that homes use more energy in climates that require more heating than cooling. Wisconsin is a good example of a heating-dominated climate, while Florida is clearly cooling dominated. (You can find the heating and cooling dominance of your state here.) Homes in colder climates use more energy for heating than those in warmer climates use for air-conditioning. There two main reasons.

First, there are generally fewer degrees of difference between indoor and outdoor conditions in warmer climates. In Florida, cooling a building from 95 degrees to 75 degrees requires only 20 degrees of change. Warming a home in Wisconsin from 25 degrees to 70 degrees means increasing the temperature by 45 degrees. This relationship is reflected by using metrics called heating degree days (HDDs) and cooling degree days (CDDs). These metrics reflect the amount of effort required to make homes comfortable by comparing the average outdoor temperatures each day to the indoor temperature setting. Madison, Wisconsin, has 7,333 heating degree days, while Miami has only 2,562 cooling degree days. You can find average heating degree days for any city in the U.S. here.

There is a second reason that cooling takes less energy than heating. Cooling is always done with a refrigeration cycle. Air-conditioners have compressors that operate very efficiently. While heating is almost always done with some sort of combustion that is inherently less efficient. Of course, space heating heat pumps also use refrigeration, but they must work harder to warm air in cold climates than to cool air in warm climates.

Given the fact that it takes less energy to achieve indoor comfort in cooling-dominated climates, such as Miami, it's also true that it's easier to build a zero energy home. Much of the attention received by zero energy homes in heating-dominated climates revolves around reducing the large space heating demand. In Wisconsin, 56% of household energy use goes to space heating and 1% to cooling. In Florida, 9% goes to heating and 27% to cooling. While thick layers of insulation get most of the attention in cold climates, insulation needs less emphasis in warm climates.

Guidelines for Warmer Climates

Here are several issues that would be treated differently in warm climates:

Energy Modeling

Use energy modeling to optimize insulation, air sealing, and equipment selection.

Home Orientation

Orient the house with the long axis east-west to minimize exposure to rising and setting sunlight. Design living spaces to face cooler facades. Place patios and decks on the north side in the shade of the building.

Thermal Mass

Concrete, brick, tile and thick plaster will absorb large quantities of heat and release it slowly. This "thermal mass effect" helps even out daily temperature swings. In hot climates, heat is absorbed during the day and released at night when outdoor temperatures are lower. Thermal mass is most effective in desert climates that experience large temperature swings from day to night. Heat is absorbed by these high-mass materials during the daytime and, if nights are cool enough, opening the home at night can help vent the heat outside.

Insulation

Floor and wall insulation can be reduced in warmer climates. For wall insulation, though rigid foam board rated at R-10 could be sufficient, in some cases, optimum insulation levels are best determined with an energy model. If the walls are concrete-block, rigid foam should be installed on the exterior. A slab foundation should not have insulation below the slab, as omitting it will reduce the home's cooling load. Slab perimeter insulation is recommended where termites can be controlled. Where termites are a problem, consider rockwool boards, such as Roxul Comfortboard, which can be used below grade and will deter insects. Ceramic tile floors are best for flooring as they will help transfer cool, while carpeting should be avoided. Ceilings or roofs should be insulated to at least R-30 depending on energy modeling.

Reflective Roofing

Use highly reflective roofing. White metal roofing or white concrete tile roofing is preferable. If the house has an unconditioned attic, radiant barrier roof sheathing is recommended.

Natural Shade

Select the building site for natural shade or design landscaping to create it.

Window Shading

Every window should be shaded, whether with natural shading, by window overhangs of 3' or more, by being recessed in thick walls, by wide porches on the east and west, or by using a combination of these techniques.

Window Orientation

The majority of windows should face north or south. Windows on the east and west should be minimized because they are more exposed to low angles of the sun and lead to overheating more than windows on the north or south.

Window Efficiency

Energy efficient windows are important. A solar heat-gain coefficient (SHGC) below 0.25, and preferably as low as 0.20, should be specified.

Air Sealing

Carefully seal the home's thermal envelope because air sealing is just as important in warmer climates as it is in cold climates. In warmer climates air leaks increase the home's cooling load and allow humidity to enter the conditioned space, so air conditioners have to work harder. In humid climates, airborne water vapor from outdoors presents a threat of mold and rot that will be reduced by air sealing.

Ducts Inside

It is very important that the home's cooling and ventilation ducts are inside the conditioned space and duct joints are carefully sealed. If ducts can't be placed within the living space, locate them inside air-tight insulated chases, inside soffits or in a sealed and insulated attic.

Water Heating

Warmer climates are well-suited to heat pump water heaters. They should be placed in a buffered space, such as a garage, where they would cool and dehumidify the space while heating water.

Moisture Control

Since moisture makes a home feel hotter and makes air conditioning more expensive, the following strategies should be used to prevent it entering the home: wrap the house with an effective moisture barrier including proper flashing; make the home as airtight as possible to keep moisture out; and install a properly sized energy recovery ventilation (ERV) system with vents in the bathrooms, laundry and kitchen to expel moisture, while retaining the home's cool air. Take care to properly size the central air conditioning system, as an oversized system will not effectively remove water vapor. For very humid climates consider installing a dehumidifying heat pipe in conjunction with the air conditioner. Another option is a supply ventilation system with integrated dehumidifier.

Internal Heat Gains

Waste heat from lights and appliances are especially harmful to the performance of hot-climate houses in summer. Use LED lighting and select the most energy efficient appliances available, including energy efficient electronics, to minimize heat gains. Many of these concepts are detailed by Martin Holladay of Green Building Advisor.