



Which windows are preferred for a passive solar home, double- or triple-pane? With or without coatings? Which coatings? What type of glass? Assuming standard building insulation, what is the sweet spot for percentage of glass area?

The idea for a passive solar home is a good one, but offers some significant challenges in our climate. Based on a 1970s study by University of Alaska researchers in Fairbanks, for every month of the year besides December, a net energy gain with south-facing windows is possible, but only when the sun is out. Given that our winters are very cold and have much longer periods of darkness, the heat losses through windows during the dark periods are much greater than the gains made when the sun is shining. A solution could be a system of insulated exterior shutters. Then, even in Fairbanks, your house can benefit from net solar gain for 11 months.

Unfortunately, a perfect heavily-insulated shutter system has yet to be invented. But people have built their own shutter systems in typical Alaskan style— anything from putting on a piece of two-inch blue foam to a raise-able shutter that can be engaged with a hand crank from the inside. Keep in mind that, as with all sources of energy, you will make the most of solar gain if you have an extremely well-insulated building shell. If you have an under-insulated, leaky house, you won't get the same results.

In a cold climate, we want a window with a low u-value. The u-value represents the rate of heat transfer through the glass. The U-value is usually listed on a sticker on the window, or is available from the dealer. Currently, Alaska Housing Finance Corporation requires a "5-Star Plus" home in Fairbanks to have a window with a u-value of .25 or lower, which typically means a triple-pane window.

When it comes to glass and coatings, because we are primarily interested in optimum thermal performance, nearly all windows geared toward our climate will have some variation of low emissivity (low-e) coating designed to reflect radiant heat. Low-e glass usually has some type of metallic film bonded to one of the faces. For a window with good insulating value, we want a coating that allows some of the short-wave infrared energy from the sun to enter the house while minimizing how much of the long-wave infrared radiation escapes from the heated space through the glass. This is a balancing act that depends on the type of coatings used, and which side of the panes of glass they are on. Coating technology is improving steadily, and it is worth the time to research the performance for any type of window line you are considering.

When it comes to finding the sweet spot of how much surface area should be glass, it varies depending on what you are trying to achieve. In order to comply with the Alaska Housing Finance Corporation "5-star Plus" home requirements, the total window surface area should not exceed 15% of the above-grade wall area. The Fairbanks City Building Department uses the same standard. If you go over 15%, you will have to make up for those energy losses somewhere else. Often this means adding more insulation to another part of the building. The location of the glass should also be factored in: south-facing works best while north-facing should be minimized.

There is much more information on the subject than covered here, but an excellent resource is "A Solar Design Manual for Alaska" written by Rich Seifert from the UAF Cooperative Extension Service.