MINNESOTA
GREEN
AFFORDABLE
HOUSING GUIDE
www.greenhousing.umn.edu

FACT SHEET

HOUSE: WINDOW AREA 2 STORY

Description

The number of window has a direct impact on energy consumption and on the quality of life of the home owner. This section examines the impact of window area on the cost and energy consumption of a two-story house. It is important to keep in mind the "non-economic" factors such as view and daylight that can greatly impact the quality of the space. For additional information on window technology see Assemblies: Window. For information on the impact of window orientation see House: Window Orientation 2 Story.

Recommendations

A window-to-floor area ratio of 15% to 18% is recommended for conventional construction. This window-to-floor area ratio balances energy, first cost, and indoor environmental quality. Houses implementing passive solar strategies using thermal mass and south orientation must be evaluated on an individual basis and may require a different overall window-to-floor area ratio to achieve maximum benefit. While energy use increases with window area, the penalty is not significant when high performance windows (such as triple-glazed low-E options) are used. See Assembly: Window.

Window Area Alternatives

alternatives	cost/sf-habitable	energy cost/sf-habitable	material/sf-habitable
10%	$4.62	$1.05	glass (s.f.) 172
15%	$6.93	$1.09	glass (s.f.) 260
20%	$9.24	$1.14	glass (s.f.) 344
30%	$13.87	$1.24	glass (s.f.) 517

The cost and energy model is a Minnesota code base zone 2, 2-story 1728 s.f. house, with wood siding, window area as noted, double low-E argon glazing, equally distributed on all for orientations, 80 AFUE furnace, and 10 EER air conditioning. Cost information is based on Means Cost Works 2004. Energy modeling was conducted on Visual DOE 3.1. Windows: U-Value = 0.36, SHGC = 0.52, VT = 0.53.

Criteria Summaries

Cost: First cost rises sharply as the number of windows increases. A 15% window-to-floor area ratio represents 8% of the overall budget for the two-story base house, and 15% of the budget for a 30% window-to-floor area ratio. From a purely economic viewpoint ,lower window area ratios lower the first cost. Window-to-floor area ratios above 18% for standard construction require increased envelope performance ratings and mechanical equipment efficiencies to meet code. This can increase costs without the benefit of lowering operating cost normally associated with such improvements.

alternatives	whole house cost	percent of budget	cost/sf-habitable	energy cost/sf-habitable	yearly energy cost
10%	$141,398	6	$4.62	$1.05	$1,810.32
15%	$145,382	8	$6.93	$1.09	$1,882.60
20%	$149,366	11	$9.24	$1.14	$1,963.09
30%	$157,334	15	$13.87	$1.24	$2,140.70
The cost and energy model is a Minnesota code base zone 2, 2-story 1728 s.f. house, with wood siding, window area as noted, double low-E argon glazing, equally distributed on all for orientations, 80 AFUE furnace, and 10 EER air conditioning. Cost information is based on Means Cost Works 2004. Energy modeling was conducted on Visual DOE 3.1. Windows: U-Value = 0.36, SHGC = 0.52, VT = 0.53.					

Energy: The two-story base house shows an increase in energy cost as window area increases. Doubling the window area from 10% to 20% increases whole house operating cost by 9% or $153 a year. An increase from 15% to 30% results in an annual energy cost increase of $258. Window orientation can decrease the negative impacts of large glazing areas; particularly in passive solar homes. Triple glazing and/or low gain windows can also be effective as a means of decreasing negative impacts in passive solar homes. (See House: Window Orientation 2 Story).

Material: Increased window area results not only in increased material resources required for the construction of the window, but also in an increase in materials associated with installation. These unseen material increases include a net increase in the amount of lumber used for conventional framing. Advanced framing techniques can minimize this increased use of lumber and can in some instances result in a net savings of lumber.