MINNESOTA
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HOUSING GUIDE
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FACT SHEET

HOUSE: WINDOW AREA 1 STORY

Description

The number and size of windows in a house has a direct impact on energy consumption and indoor environment. Smaller houses are more sensitive to changes in envelope performance than larger houses, therefore factors which impact envelope performance, including window area, should be carefully considered with regard to energy and comfort. The following comparative analysis identifies the relative economic, energy, and environmental implications of window area in a single-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, and therefore the quality of life of the home owner. For additional information on window technology see Assemblies: Window. For information on the impact of window orientation see House: Window Orientation 1 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	$1.41	glass (s.f.) 86
15%	$6.93	$1.45	glass (s.f.) 130
20%	$9.24	$1.49	glass (s.f.) 172
30%	$13.87	$1.58	glass (s.f.) 260

The cost and energy model is a Minnesota code base zone 2, 1-story 864 sf house, with wood siding, window area as noted, high gain 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 7% of the overall budget for the single story base house, and a 30% window-to-floor area ratio brings it up to 13% of the budget. 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 costs normally associated with such improvements.

alternatives	whole house cost	percent of budget	cost/sf-habitable	energy cost/sf-habitable	yearly energy cost
10%	$84,238	5	$4.62	$1.41	$1,216.59
15%	$86,235	7	$6.93	$1.45	$1,250.15
20%	$88,231	9	$9.24	$1.49	$1,286.03
30%	$92,225	13	$13.87	$1.58	$1,364.89

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Energy: The one-story base house demonstrates that modest changes in window area do affect energy consumption. Doubling the window area from 10% to 20% increases operating cost by roughly 5% or $0.04/s.f.-year ($60), and from 15% to 30% increases energy cost by $0.27/s.f-year ($114) or nearly 9%. The negative impacts of large glazing areas can be offset in part by consideration of window orientation and shading; 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 1 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.