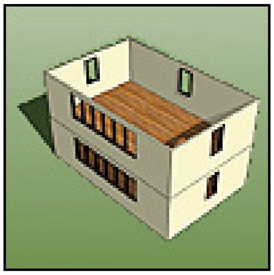

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FACT SHEET

HOUSE: WINDOW ORIENTATION 2 STORY

Description

Window orientation has a direct impact on energy consumption. This section examines the impact of window orientation on a two-story house. The window used is a double glazed low-E high-solar-gain unit. To maximize the energy savings potential of high performance windows, the orientation of windows for optimal solar gain and energy conservation should be considered. In situations where factors, such as view and site constraints limit the use of the best orientation, advances in glazing technology can limit energy loss due to windows, see Assemblies: Window for information on different types of windows.

Recommendations

On a relatively small, unshaded house using conventional low-mass, frame construction, orientation is not a significant factor in energy use. This occurs because passive solar gains which lower heating energy use in winter are offset by higher cooling energy use in summer. To optimize for passive solar gains in cold climates, locate the majority of glazing on the south orientation. Shading through the use of awning, overhangs, and deciduous trees is necessary to avoid unwanted heat gain during the summer months (from June to August), which if left unchecked can negate energy savings. This analysis utilized high solar gain Low-E windows to maximize passive solar gain. Low solar gain Low-E windows make orientation less of a factor. See Assembly: Window.

Citations

Residential Windows, A Guide to New Technologies and Energy Performance, 2nd Edition. John Carmody, Stephen Selkowitz, Dariush Arasteh, and Lisa Heschong. W.W.Norton & Company 2000

Efficient Windows. The Efficient Windows Web Site is sponsored by the U.S. Department of Energy's Windows and Glazings Program in collaboration with members of the Efficient Window Collaborative (EWC). EWC members have made a commitment towards manufacturing and promoting energy efficient windows. http://www.efficientwindows.org/

Window Orientation Alternatives

alternatives	cost/sf-habitable	energy cost/sf-habitable	material/sf-habitable
equal	$6.93	$1.09	glass (s.f.) 260
north	$6.93	$1.09	glass (s.f.) 260
east	$6.93	$1.15	glass (s.f.) 260
south	$6.93	$1.10	glass (s.f.) 260
west	$6.93	$1.16	glass (s.f.) 260

The cost and energy model is a Minnesota code base zone 2, 2-story 1728 s.f. house, with wood siding, 260 s.f. of unshaded windows with double low-E argon glazing, distributed as noted, 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 costs of glazing systems are not directly by window orientation.

alternatives	whole house cost	percent of budget	cost/sf-habitable	energy cost/sf-habitable	yearly energy cost
equal	$145,382	8	$6.93	$1.09	$1,882.60
north	$145,382	8	$6.93	$1.09	$1,890.94
east	$145,382	8	$6.93	$1.15	$1,988.14
south	$145,382	8	$6.93	$1.10	$1,896.80
west	$145,382	8	$6.93	$1.16	$2,008.76
The cost and energy model is a Minnesota code base zone 2, 2-story 1728 s.f. house, with wood siding, 260 s.f. of unshaded windows with double low-E argon glazing, distributed as noted, 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: Energy modeling shows equal and north orientations result in the least energy expenditure. This simple bottom line does not reveal the whole energy story however. Examination of the electricity and natural gas charges separately shows the higher electricity charges on the south hide a natural gas savings of 9% over the north. The increased heating load on the south offsets the cooling savings due to passive solar heat gain. Substantial reduction in south orientation electricity costs could be achieved by use of overhangs, trees, or awnings. The west and east orientation have the greatest energy use due to the increased cooling loads in the summer with only modest winter solar gain. These increases can be countered by shading but this is more difficult to do on the east and west. Energy costs change over time, a rise in natural gas prices would amplify the benefits of south glazing.

alternatives	electric cost/sf-habitable	natural gas cost/sf-habitable	energy cost/sf-habitable
equal	$0.46	$0.63	$1.09
north	$0.43	$0.67	$1.09
east	$0.49	$0.66	$1.15
south	$0.49	$0.61	$1.10
west	$0.50	$0.66	$1.16
The cost and energy model is a Minnesota code base zone 2, 2-story 1728 s.f. house, with wood siding, 260 s.f. of unshaded windows with double low-E argon glazing, distributed as noted, 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.			

Material: Window orientation alone does not have a direct bearing on material use. However, the need for additional means of solar control to further reduce heat gain and glare on the east, south and west sides can increase material consumption. Material consumption can also be increased through necessary improvements to the envelope to meet code and comfort requirements.