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Summer Shading Performance of Awnings

by Marianne Armstrong, John Gusdorf and Aziz Laouadi

This article presents results of a study on the use of awnings to reduce energy use and increase comfort levels in houses.

Controlling solar gains in all seasons is important for minimizing the amount of energy used for space heating and cooling and for ensuring occupant comfort. During the heating season, maximizing solar gains reduces energy use, but it can result in occasional overheating and thermal discomfort, especially in highly energy-efficient houses with large areas of south- or west-facing windows. During the cooling season, solar gains should be minimized to reduce cooling loads.

A recent shading experiment at the Canadian Centre for Housing Technology (CCHT) examined the use of retractable awnings as a means for reducing house energy consumption. In the summer of 2010, Canada Mortgage and Housing Corporation, Natural Resources Canada and the National Research Council's Institute for Research in Construction used the CCHT twin houses to determine the amount of cooling energy that awnings would save. The study also compared temperatures in rooms with awnings to those without, and examined the effect of awnings on interior light levels. This followed an earlier study of solar shading screens and rollshutters (see *Home Builder*, Volume 23, No. 3, May 2010)

The awning experiment ran from August 21 to September 19, 2010. The retractable canvas awnings were mounted on the three largest south-facing windows of the CCHT experimental house and covered the top half of the glazing. The awnings were left in a single position for the duration of the experiment, though this type can be manually adjusted. The control house was operated without awnings. Both houses featured Venetian blinds on the interior, in the open (horizontal slat) position. The two houses were operated with the windows closed and the A/C under thermostat control.

Awnings installed on the CCHT experimental house

Energy Use

As expected, energy savings were greatest when there was more solar radiation. During the experiment period, the awnings resulted in average daily cooling energy savings of 3.2 kWh or 17% of the total amount used in the control house. When projected to a full cooling season, the awnings are expected to result in a seasonal saving of 401 kWh or 15%.

Occupants of similar houses who open windows to control temperatures and only use the A/C when necessary would likely incur smaller cooling loads that could result in smaller savings attributable to the awnings.

Temperatures

The awnings significantly reduced temperatures in the rooms that had awnings, and in most of the rooms that did not. Without awnings, the daily maximum temperatures often exceed the thermostat set-point – which is common with large high solar gain windows. This indicates that in houses with enough cooling capacity and enough air circulation to all rooms to maintain the set-point temperature, the awnings could further reduce cooling energy.

Light Levels

Because the awnings cover only about the top half of a window, they do admit natural light and leave much of the view to the outside unobstructed. However, measurements at a height of 0.6 m in the living rooms showed that awnings reduced light levels (illuminance) in the rooms where they were installed, and increased the amount of time that illuminance was below recommended levels.

It is possible that some occupants would find the reduced illuminance unacceptable, and would react by turning on lights, thus negating some of the energy savings. Increased use of lights would increase energy use directly, and indirectly by increasing cooling loads. The extent will depend on the activities the occupants are engaged in, and their subjective reactions to particular light levels.

Since savings due to awnings are in the order of three kWh per day, it seems unlikely that occasional increased use of lights would negate the energy savings to any large degree, especially in energy-efficient houses with energy-efficient lighting. It should also be noted that in very energy-efficient houses, shading devices might be controlled automatically, being deployed only when needed to avoid overheating or increased cooling loads. This is unlikely to occur during periods of low light levels.

Ramifications for Builders

Movable external shading devices such as the awnings tested in this project can significantly decrease the amount of energy required for cooling a house while keeping temperatures closer to the desired level compared to houses without any shadings.

The effective use of a combination of shading with high-performing south-facing windows may represent an effective means to achieve incremental summer time savings and comfort in a low-energy house, without compromising winter performance. In some low-energy designs and locations, exterior shading could even make the difference between needing or not needing air conditioning.

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CCHT is a partnership between the National Research Council of Canada, Natural Resources Canada's CanmetEnergy, and Canada Mortgage and Housing Corporation. For more information, contact Marianne Armstrong at 613-991-0967 or marianne.armstrong@nrc-cnrc.gc.ca, or visit the CCHT website at www.ccht-cctr.gc.ca