NRC·CNRC
Institute for Research in Construction

Bringing quality to the built environment

Demand Responsive Buildings

Objectives

To evaluate how occupants respond to ramps (steady changes) in indoor environment conditions, particularly degradation of conditions from prevailing recommended practice. To better define the limits of reducing building power demand during periods of electrical grid stress (load shedding).

Background

When electricity demand exceeds supply, brownouts or blackouts may occur unless utilities import additional capacity or switch in peak-capacity generators. A third option is for end-users to respond to the peak power difficulty by reducing their demand. In this context, it is increasingly likely that buildings will need to curtail their grid electrical usage during peak periods by temporarily shedding load. Many load-shedding scenarios involve adjusting building systems. For example, lighting may be dimmed, chillers switched off, and ventilation fan speeds reduced. While these adjustments will degrade the indoor environment, such practice may be a reasonable alternative to a brownout or blackout. IRC's focus in this project is to gain a better understanding of occupants' tolerance for such degradation. How quickly they detect the changes, and the effects on their mood, satisfaction and performance will be key outcomes.

Statement of Work

This work is being carried out in three parts:

1. Literature review of previous research, which shows that occupants are unlikely to notice temperature changes to the indoor environment associated with load shedding, or to consider them unacceptable, and that light levels can decline by about 20% before being detected.
2. Laboratory studies investigating the response of occupants to ramps in indoor environment conditions, in particular, degradation of conditions from recommended practice. Results to date show that light levels may be dimmed temporarily by up to 40% if carried out over longer time periods (e.g. 2% per minute), especially if there is no immediate prior expectation of dimming, or there is substantial daylight present.
3. A field study to demonstrate load shedding using a commercial dimming lighting control system in a real building.

Expected Outcomes

- Separate reports on each part of the research
- Papers in scientific journals and conferences
- Guidelines for practitioners and industry

Partners

Public Works and Government Services Canada, Panel on Energy Research and Development, Natural Resources Canada, Lighting Research Office, Electric Power Research Institute (EPRI) with the support of the J.H. McClung Lighting Research Foundation

Start/Completion Dates

The project began in 2004 and will be completed in 2008.

Project Manager

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For more information, see http://irc.nrc-cnrc.gc.ca/ie/lighting/office/demand_e.html

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