CARD project shows potential of task tuning of lighting in commercial buildings

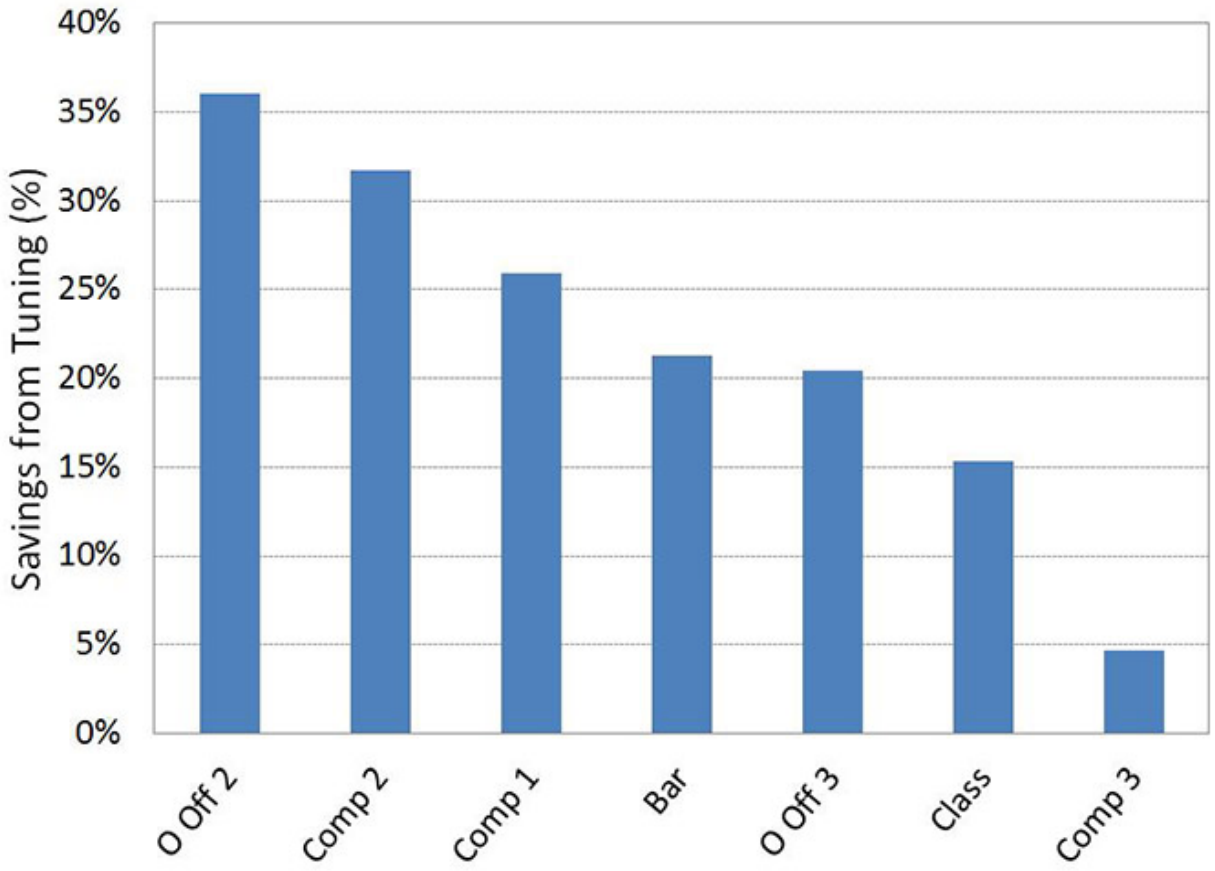
Many commercial spaces are over-lit for a variety of reasons (for example, the presence of natural light, repurposing of spaces over time, lighting areas that are unoccupied). The process of adjusting lights to create lighting levels appropriate for location- or task-specific lighting needs is known as task tuning (sometimes called institutional tuning or high-end trim). Task tuning relies on commissioning methods and/or technology to accomplish this.

A meta-study from 2012 suggested that task tuning has the potential to save 36% of lighting energy.[1] However, because it is relatively new to the marketplace, it suffers from both a lack of understanding on how to implement and of verified energy savings to justify its cost. Seventhwave monitored lighting systems in a number of commercial buildings (Figure 1) in Minnesota and Wisconsin before and after implementing task tuning as part of a CARD-funded research project to address these issues.

Figure 1: One of the commercial spaces monitored in task tuning study (photo courtesy of Seventhwave)

The measured data from this study shows that the average savings from task tuning was approximately 613 kWh for every kW of lighting that was dimmable, or about 22 percent of the dimmable lighting energy. Savings ranged from as high as 36 percent or 1,662 kWh/kW of dimmable lighting in a highly over lit office with relatively long hours of operation, to as low as 5 percent or 136 kWh/kW of dimmable lighting in a computer lab with relatively short hours of operation and not strongly over lit. Figure 2 shows the distribution of energy savings across the spaces where the lighting was measured.

Figure 2: Distribution of measured savings for task tuning (by %) for the over-lit spaces



Characteristics that tended to correspond to high potential for task tuning savings were:

1. A lighting system that had not been commissioned or was commissioned by the owner.
2. A lighting system that had been designed by a contractor as opposed to a lighting designer or electrical engineer.
3. A lighting system in an educational facility, public assembly building, or office.
4. A lighting system with dimming controlling significant electric power in spaces with longer hours of operation, such as open offices with photo control or LEDs. Dimmable systems for A/V equipment did not exhibit high levels of savings opportunity.

It should be noted that while task tuning savings of systems with photo control were relatively high, they were lower, on average, than systems without photo control, indicating some interaction of energy savings in systems with photo control.

In order to break even in terms of life cycle cost, owners can afford to spend up to $750 per kilowatt of dimmable lighting for hardware and time associated with task tuning. The savings from task tuning are not sufficient solely to justify the incremental cost of purchasing a dimmable lighting system. This upgrade is more likely to be driven by other design requirements such as daylighting, controllability needs, or occupant satisfaction.

However, when these design needs result in a dimmable lighting system being installed, task tuning is a very cost-effective way to increase savings further. Analyzing payback from task tuning for a dimmable system without equipment costs (i.e., based only on time and labor costs) resulted in a simple payback of between 0.5 and 1.1 years. Given the attractiveness of these paybacks, the study recommends implementation of task tuning in new construction projects or major renovations in which a dimming system is already planned as part of the design requirements. For the same reason, if a dimming system already exists in a facility, task tuning should be strongly considered as a way to achieve cost-effective energy savings.

When performing task tuning, it is important to balance energy savings with occupant visual comfort. Complicating this balance is the fact that occupants perceive light levels differently both individually and under varying situations. Because of this, the study recommends that task tuning always incorporate occupant feedback. Although this may result in lower immediate energy savings, it would increase energy savings persistence.

In total, the study estimates that task tuning could potentially save Minnesota 5,023 megawatt hours annually, or the equivalent of 528 typical Minnesota household's annual electric consumption. This energy savings would reduce greenhouse gas emissions by 4,843 tons of carbon dioxide, or the equivalent of taking 1,020 passenger vehicles off the road for a year.

Full details on the study can be found in the final report, Adjusting Lighting Levels in Commercial Buildings, Energy Savings from Institutional Tuning (pdf), available for download on Commerce's website. In addition, an on-demand video and fact sheet are available on Seventhwave's Task Tuning web page. For further information, contact CARD program administrator Mary Sue Lobenstein.

Reference

[1] *Williams. 2012. "Lighting Controls in Commercial Buildings," by Williams, A., Atkinson, B., Garbesi, K., Page, E., and Rubinstein, F. Leukos, Vol. 8, No. 3, January 2012, pg. 161-180.*