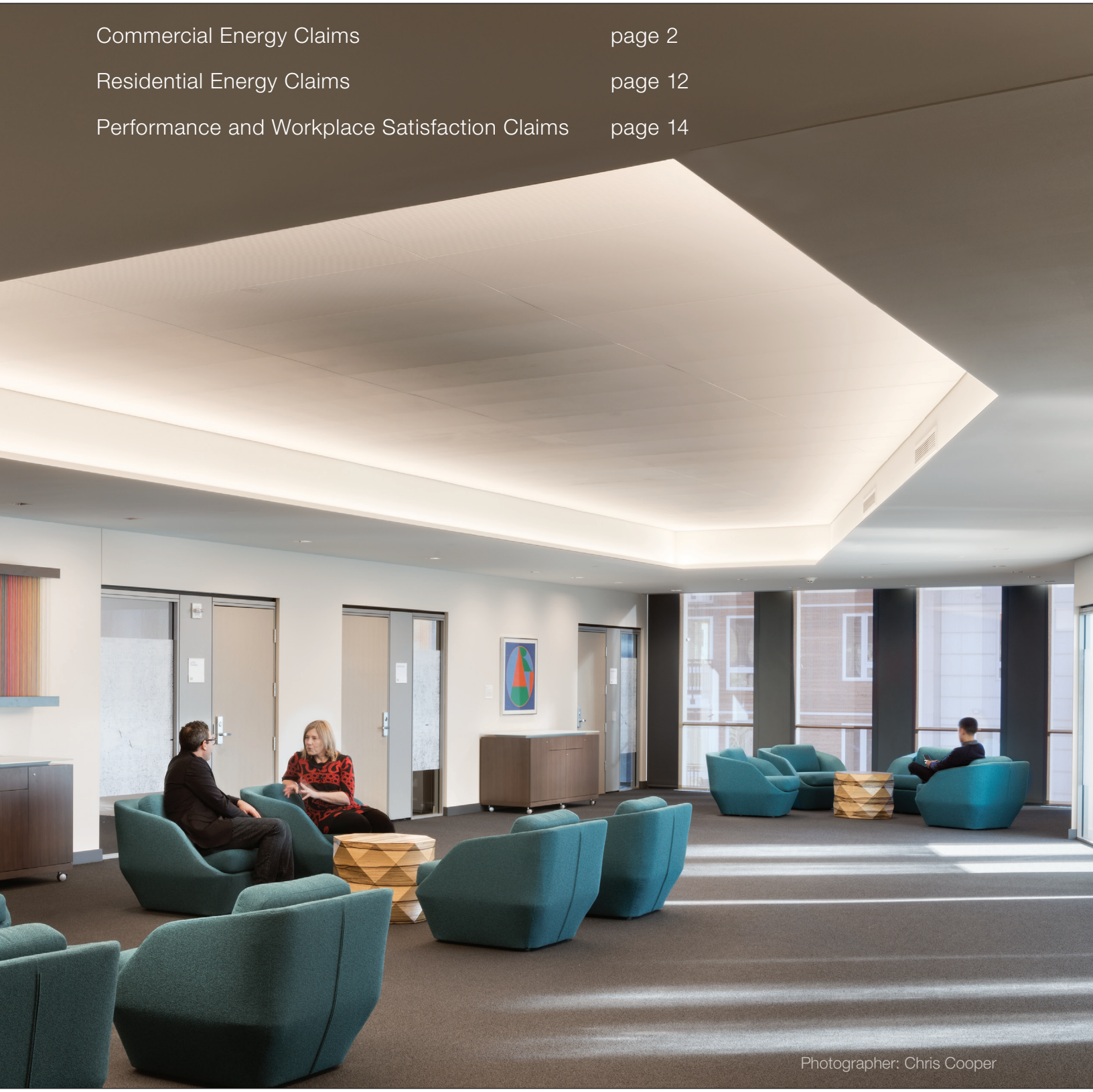
LUTRON REFERENCES



Photographer: Chris Cooper

LUTRON

COMMERCIAL ENERGY CLAIMS

These are claims currently utilized by Lutron for commercial product marketing. The claims in this document may be amended from time to time as more information becomes available. The primary purpose of the document is to provide greater visibility to customers on the sources and assumptions of the claims.

Lutron controls can save up to 60% of lighting energy consumption.

Description:
Compared with manual (non-automated) controls, up to 60% lighting energy savings is possible on projects that utilize all of the lighting control strategies (occupancy sensing, high end trim, personal control and daylight harvesting). Actual energy savings may vary depending on prior occupant usage, among other factors.

Sources:
The following paper: Williams A, et al. 2012. Lighting Controls in Commercial Buildings. Leukos. 8(3) pg 161–180 discusses savings from multiple strategies at a building level. However, many case studies of installed Lutron products have shown total combined savings to be in the 60% range.

Lighting accounts for 17% of commercial electricity consumption.

Description:
This information is taken from the Commercial Buildings Energy Consumption Survey (CBECS) 2012 [1], the most comprehensive collection of information for building energy use and other building related metrics. It is expected that newer data will be available in 2020 (tentative).

Sources:
[1] Energy Information Administration. 2012 Commercial Building Energy Consumption Survey, released May 2016.

COMMERCIAL ENERGY CLAIMS

Using Lutron solutions can reduce a commercial building's overall electricity use by up to 10%.

Description:
Lighting accounts for 17% of building electricity usage [1]. Compared with manual (non-automated) controls, up to 60% lighting energy savings is possible on projects that utilize all of the lighting control strategies (occupancy sensing, high-end trim, personal control and daylight harvesting). A 60% reduction in 17% of building electricity results in 10% total electricity savings. Additional savings can be achieved by adding strategies beyond lighting controls such as shades and HVAC integration. Actual energy savings may vary depending on strategies utilized, prior occupant usage and overall building energy performance, among other factors.

Sources:
[1] Energy Information Administration. 2012 Commercial Building Energy Consumption Survey, released May 2016.

Scheduling can save 10–20% of lighting energy.

Description:
Energy savings were estimated using data from VonNieda et al [1], based on 50% reduction of after-hours lighting energy waste [1]. The savings for scheduling were computed based on adding scheduling to a space with only manual lighting shutoff. Actual savings may vary depending on strategies utilized and prior occupant usage among other factors.

Sources:
[1] VonNieda B, Maniccia D, & Tweed A. 2000. An analysis of the energy and cost savings potential of occupancy sensors for commercial lighting systems. Proceedings of the Illuminating Engineering Society. Paper #43.

COMMERCIAL ENERGY CLAIMS

Occupancy/Vacancy sensing can save 20–60% of lighting energy.

Description:
Savings based on adding occupancy sensors to manual shutoff. The stated savings are based on average savings found for different room types by Von Nieda et al [1] at different timeout periods. Actual savings may vary depending on timeout periods utilized and prior occupant usage among other factors.

Sources:
[1] VonNieda B, Maniccia D, & Tweed A. 2000. An analysis of the energy and cost savings potential of occupancy sensors for commercial lighting systems. Proceedings of the Illuminating Engineering Society. Paper #43.

Partial-On can save an additional 50% of lighting energy in private offices.

Description:
Savings based on adding partial on control to occupancy sensors that turn on to 100% [1]. Actual savings may vary depending on timeout periods, partial on light level and prior occupant usage among other factors.

Strategy	Additional Savings Beyond Std. Occupancy Sensing[1]
Auto-On to 100%	Baseline
Manual On to 100%*	30%
Manual On to 50%	46%
Auto On to 50%	52%

Sources:
[1] Papamichael, K., et.al. February 2010. Bi-Level Switching in Office Spaces. California Lighting Technology Center.

*Manual On to 100% extrapolated from data presented in this paper.

COMMERCIAL ENERGY CLAIMS

High-end Trim can save 10–30% of lighting energy.

Description:
Savings based on adding high end trim to lights on at full output. Williams et al [1] showed that high end trim or "institutional tuning" saves up to 36% in office spaces and up to 60% in retail (non-mall) spaces. Savings for high end trim vary based on full output light level and the tasks performed in the space among other factors.

Sources:
[1] Williams A, et al. 2012. Lighting Controls in Commercial Buildings. Leukos. 8(3) pg 161–180.

Daylight Harvesting can save 25–60% of lighting energy.

Description:
Savings based on comparing a dimmed, automated daylight dimming lighting control system to a system controlled only by manual shutoff [1]. Maximum savings of 60% was seen in places with high window transmittance and for work areas adjacent to a window. Low end savings of 25% was for a second row of windows with lower Visible Transmittance. Actual savings may vary based on window transmittance, the room characteristics, and occupant usage among other factors.

Sources:
[1] Reinhart CF. 2002. Effects of interior design on the daylight availability in open plan offices. Study of the American Commission for an Energy Efficient Environment (ACE) Conference Proceedings. To achieve maximum lighting savings, automated shades are utilized.

Personal Dimming Control can save 10–20% of lighting energy.

Description:
Galasiu [1] showed that savings based on comparing a manual on/off control to a dimming control. When occupants are given individual dimming control in their immediate work area, energy savings of 10–20% is achievable. The study was done in an open office environment. Actual savings may vary based on occupant usage among other factors.

Sources:
[1] Galasiu AD, et al. 2007. Energy saving lighting control systems for open-plan offices: A field study. Leukos. 4(1) pg 7–29.

COMMERCIAL ENERGY CLAIMS

Controllable window shading can save 10–20% of cooling energy.

Description:
Savings is based on adding automated shades to a window without shades. The savings is taken from a Lutron commissioned study through Purdue University [1]. A number of fabric and glass combinations as well as facade orientations were tested for different US cities. Actual savings may vary based on window transmittance, room characteristics, and occupant usage among other factors.
Sources:
[1] Lutron commissioned study by Herrick Laboratories. Purdue University. 2011.

Eliminating glare from windows can increase productivity by up to 25%.

Description:
Glare from windows was found to reduce productivity by up to 25% in a study conducted by the Heschong Mahone Group [1]. The actual reduction in productivity may vary based on many factors including occupant sensitivity to sunlight.
Sources:
[1] Heschong Mahone Group, Inc., 2003. Windows and offices: A study of office workers performance and the indoor environment. Prepared for the California Energy Commission

Automated shades can increase lighting energy savings from daylight harvesting by 1.6 kWh/sq.ft./yr.

Description:
Lutron Electronics worked with Purdue University to analyze the benefits and savings potential of Lutron's Hyperion automated shading systems [1]. Savings are based on energy simulation of a perimeter private office with a lighting power density of 0.9 W/ft², a standard clear double pane glass, and a shade fabric with 5% transmittance and 76% reflectance. Values shown are the average of three window to wall ratios: 20%, 40%, and 60%. The base case was modeled with manual shades in the closed position. Daylight harvesting system required. Actual savings may vary based on window transmittance, room characteristics, how far the shades are closed and occupant usage among other factors.
Sources:
[1] Lutron commissioned study by Herrick Laboratories. Purdue University. 2013.

COMMERCIAL ENERGY CLAIMS

Demand Responsive Lighting can save 30–50% of lighting power during peak periods.

Description:
The savings are based on a study [1] of an office building and a college campus. The study showed that dimming by 20% can be done in less than a minute and dimming down to 50% could be done over a 30 minute period. When combined with daylighting, fixtures could be dimmed down by 80% output without impacting a majority of the occupants.

Sources:
[1] Newsham GR & Birt B. 2010. Demand-responsive lighting: a field study. Leukos. 6(3) pg 203–225.

Plug Load Control can save 15–50% of energy use on controllable loads

Description:
The savings are based on comparing energy use of devices with automatic shutoff by occupancy sensing to the same loads being controlled manually with an on/off switch [1]. The study considered a wide variety of plug loads including printers, monitors and desk lamps. Actual energy savings may vary, depending on devices controlled, standby power settings, and prior occupant usage, among other factors.

Sources:
Ecos. 2011. Commercial office plug load savings assessment. California Energy Commission PIER Program.

HVAC integration can save 5–15% of HVAC energy.

Description:
The savings are based on detailed simulations described in a paper published by Southern California Edison [1] and another by the Pacific Northwest National Lab [2]. The savings range varied widely based on the assumptions for the studies. The simulation considered office/school buildings and the energy savings potential in different regions by utilizing an occupancy sensor to setback temperature during periods of space vacancy.

Sources:
[1] Southern California Edison Company, 2011. “Classroom HVAC Occupancy Sensor”.
[2] Zhang, J., et. al, 2013. “Energy Savings for Occupancy Based Control (OBC) of Variable-Air-Volume (VAV) systems. Prepared for the U.S. Department of Energy.

COMMERCIAL ENERGY CLAIMS

Occupancy-based temperature setback can save 10–30% of HVAC energy in hotel guest rooms.

Description:
Savings based on using occupancy-based thermostats in guest rooms to set back HVAC temperature when the guest room is vacant [1]. This field study evaluated savings using multiple hotel rooms in different climates. Actual savings may vary depending on HVAC system and control types, timeout periods, and occupant usage among other factors.

Sources:
[1] GP Sullivan and J Blanchard. 2012. Guest Room HVAC Occupancy-Based Control Technology Demonstration. Prepared for the U.S. Department of Energy By Pacific Northwest National Laboratory.

Monitoring/Feedback can save 5–15% of energy for monitored loads.

Description:
Darby [1] showed that direct energy feedback provided savings of 5–15%. Actual savings may vary depending upon prior occupant usage and awareness about environmental issues among other factors.

Sources:
[1] Darby S. 2006. The effectiveness of feedback on energy consumption. Environmental Change Institute, University of Oxford.

COMMERCIAL ENERGY CLAIMS

Save up to 80% of lighting energy in stairwells with Lutron's stairwell solution.

Description:
Savings up to 80% based on replacing a 4 ft T12 fixture (2–40 W lamps at 100% output) with a 4 ft LED Lutron stairwell solution (44 W at 80% high-end output, 20% low-end output). Existing system is at full output 24 hours a day, while replacement system is at full output for 6 hours and low-end output for 18 hours a day. Actual savings may vary based on existing fixture wattage and stairwell occupancy. Always verify replacement system meets light level requirements.

Sources:

Lamp Type	Wattage	Number per landing	% of Hours on per year	Number of Hours of Usage	Power Consumption - Occupied Periods	Power Consumption - Unoccupied Periods	Energy Consumption in kWh/yr.
T12	80	1	100%	8,760	100%	100%	700.8
LED w/ controls	44	1	25%	2,190	74%	23%	137.8

Save 50–80% of lighting energy in gymnasium or warehouse with Lutron's High bay solutions.

Description:
80% savings assumes replacement of a 1000 W Metal Halide High Bay Fixture with a 192 W Fluorescent High Bay Fixture, with an expected reduction in light level. A typical replacement with minimal or no light reduction achieves savings closer to 50%. Actual savings may vary based on existing fixture wattage and occupancy among other factors. Always verify replacement system meets light level requirements.

Lamp Type	Wattage	Number of Hours of Usage	Energy Consumption in kWh/yr.
Metal Halide	1000	4,000	4,000
T8 (32 W)	192	2,500 Hours at 100%, 1,000 Hours at 50%	576

COMMERCIAL ENERGY CLAIMS

Every year, installed Lutron controls save nearly 10 Billion kWh of lighting energy.

Description:
Estimated savings based on Lutron sales; 296 kWh annual energy use for residential circuits (a); 2,492 kWh annual energy use for commercial circuits (b); 20% savings from dimming (c); a U.S. average electricity rate of $0.11 per kWh (d); estimated greenhouse gas equivalency (e); and the average generating capacity of a coal power plant (d).

a. Computed from energy usage by room type from the report published by Navigant. [1] and surveys of installed room types [2].
b. Computed from 712 W per circuit (Lutron project data.) and 3,500 annual hours.
c. Information on dimming savings from the California study [3].
d. Energy Information Administration (EIA)
e. Information on CO2e emissions were computed using this source [4].

This claim is made by looking at multiple data points, including historical sales, energy savings from installed products in both residential and commercial buildings and bases quantification of savings from data collected from US DOE and EPA.

Sources:
[1] Navigant. 2002. U.S. Lighting Market Characterization
[2] Lutron commissioned Ipsos surveys
[3] Lighting Efficiency Technology Report: Volume I. 1999. California Energy Commission.
[4] U.S. annual non-base load CO2 output emission rate, year 2007 data U.S. Environmental Protection Agency, Washington, DC.
To learn more, download whitepaper at:
www.lutron.com/10billionkwh

Reducing light output by 75% is associated with only a 50% reduction in perceived light level.

Description:
This statement is based on perception curves from the IES Handbook [1] published by the Illumination Engineering Society, which helps establish standards for lighting and daylighting design.

Sources:
[1] Rea M. 2000. IESNA Lighting Handbook: Ninth Edition. Illuminating Engineering Society of North America. New York.

COMMERCIAL ENERGY CLAIMS

Reduce labor time by up to 70% with wireless Lutron products.

Description:
Savings based on a comparison of installing a typical wired solution (including (1) wall switch, (1) wired sensor, and (1) power pack) at an estimated installation of 50 minutes, to a Lutron wireless solution (including (1) Maestro Wireless switch and (1) Radio Powr Savr occupancy sensor) at an estimated 15 minutes. Labor time may vary based on room size and conditions.
Sources:
To learn more, go to
www.lutron.com/wirelessinstall

Exterior Lighting Control can save 30 to 60% of lighting energy

Description:
Lutron evaluated measured energy savings of over 200 actual projects installed over a 5-year period which resulted in a mean energy savings of 45%. The range of energy savings included 62% savings at the 90th percentile and 28% energy savings at the 10th percentile. Actual energy savings may vary based on usage among other factors.

RESIDENTIAL ENERGY CLAIMS

These or any other claims will be supported by a reference to the source or a disclaimer in packaging or point of purchase displays. The primary purpose of the document is to provide greater visibility to customers on the sources and assumptions of the claims.

Lighting energy savings of 20% can be achieved with residential dimming.

Description:
Savings based on replacing a standard switch with a dimmer in a residence [1]. Actual savings may vary based on occupant use among other factors.

Sources:
[1] Heschong Mahone Group. 1999. Lighting Efficiency Technology Report. Prepared for the California Energy Commission.

Lighting energy savings of 50% can be achieved with residential occupancy sensing.

Description:
Savings based on replacing a standard switch with an occupancy sensor in a residence [1]. Actual savings may vary based on occupant use among other factors.

Sources:
[1] Heschong Mahone Group. 1999. Lighting Efficiency Technology Report. Prepared for the California Energy Commission.

Lighting energy savings of 60% can be achieved by combining dimming and occupancy sensing in a residence.

Description:

Estimated lighting savings based on a power reduction of 20% (dimmer) and a 50% reduction in hours of use (sensor) [1]. Actual savings may vary based on occupant use among other factors.

Sources:

[1] Heschong Mahone Group. 1999. Lighting Efficiency Technology Report. Prepared for the California Energy Commission.

PRODUCTIVITY AND WORKPLACE SATISFACTION CLAIMS

These are claims currently utilized by Lutron for its marketing regarding the role of lighting in supporting worker productivity and workplace satisfaction. The claims in this document may be amended from time to time as more information becomes available. The primary purpose of the document is to provide greater visibility to customers on the sources and assumptions of the claims.

Increased access to daylight and views can improve productivity at work.[1, 2]

Description:

In a study, participants with large windows and high vegetation content in their view were found to perform 10% to 25% better on tests of mental function and memory recall than those with no view.[1]

Sources:

[1] Heschong Mahone Group (2003). Windows and Offices: A Study of Office Worker Performance and the Indoor Environment. Detailed Report. Fair Oaks, CA.

[2] Browning, B., Cooper, C. (2015). The global impact of biophilic design in the workplace. Interface. Retrieved from: https://www.interface.com/US/en-US/campaign/positive-spaces/Human-Spaces-Report-en_US

Providing personal control of lights and shades can improve satisfaction at work.[3, 4]

Description:

Being able to achieve one's preferred lighting conditions increases satisfaction with the environment.[3]

One study showed that the preferred lighting conditions varied greatly, requiring an illiminance range of 93 to 777 lux to satisfy 95% of the occupants. [4]

Sources:

[3] Newsham, G., Veitch, J., Arsenault, C., & Duval, C. (2004, July). Effect of dimming control on office worker satisfaction and performance. Proceedings of the IESNA Annual Conference, p. 19-41.

[4] Boyce, P. R., Veitch, J. A., Newsham, G. R., Jones, C. C., Heerwagen, J., Myer, M., & Hunter, C. M. (2006). Occupant use of switching and dimming controls in offices. Lighting Research & Technology, 38(4), p. 358-376.

PRODUCTIVITY AND WORKPLACE SATISFACTION CLAIMS

Employees value access to daylight & views and prioritize it over other amenities.[5, 6]

Description:

Forty-four percent of 7,600 employees surveyed in an international study ranked natural light as their most-wanted element in their workplace – more than twice as desired as the second most-wanted element (indoor plants, 20%).[5]

In a study of 7600 employees worldwide, 44% ranked natural light as the most desired workplace feature, more than twice as desired as the second most wanted element (indoor plants, 20%).[5]

In a survey of 1,614 North American employees, over half ranked natural light as their most important office perk, higher than onsite cafeterias, fitness centers, child care and medical care.[6]

Sources:

[5] Browning, B., Cooper, C. (2015). The global impact of biophilic design in the workplace. Interface. Retrieved from: https://www.interface.com/US/en-US/campaign/positive-spaces/Human-Spaces-Report-en_US.

[6] Future Workplace. (2018) https://workplacetrends.com/wp-content/uploads/2018/08/The-Employee-ExperienceFINAL08-072.pdf

Access to daylight and views can be an important factor in employee recruitment and retention.[7, 8, 9, 10]

Description:

In a survey of over 1,600 office employees in North America, over half indicated access to natural light and views improved their organizational commitment.[7]

A study of 7600 employees worldwide found that natural light was the most desired workplace element and that 33% of the participants stated that workplace design would affect their decision to work at a company.[10]

Sources:

[7] Future Workplace. (2018) https://workplacetrends.com/wp-content/uploads/2018/08/The-Employee-ExperienceFINAL08-072.pdf

[8] Leather, P., Pyrgas, M., Beale, D., & Lawrence, C. (1998). Windows in the workplace: Sunlight, view, and occupational stress. Environment and behavior, 30(6), p. 739-762.

[9] Alimoglu, M. K., & Donmez, L. (2005). Daylight exposure and the other predictors of burnout among nurses in a University Hospital. International journal of nursing studies, 42(5), p. 549-555.

[10] Browning, B., Cooper, C. (2015). The global impact of biophilic design in the workplace. Interface. Retrieved from: https://www.interface.com/US/en-US/campaign/positive-spaces/Human-Spaces-Report-en_US.

PRODUCTIVITY AND WORKPLACE SATISFACTION CLAIMS

Increased access to daylight and views can improve satisfaction at work.[11, 12]

Description:

Three in four office workers surveyed in North America felt that access to natural light and views improved their work satisfaction.[12]

Sources:

[11] Browning, B., Cooper, C. (2015). The global impact of biophilic design in the workplace. Interface. Retrieved from: https://www.interface.com/US/en-US/campaign/positive-spaces/Human-Spaces-Report-en_US

[12] Future Workplace. (2018) https://workplacetrends.com/wp-content/uploads/2018/08/The-Employee-ExperienceFINAL08-072.pdf

Increased access to daylight and views can contribute to a sense of well-being.[13, 14]

Description:

In a study of 1600 North American employees, 78% mention natural light and views having a direct impact on their overall happiness and well-being.[14]

Sources:

[13] Farley, K. M., & Veitch, J. A. (2001). A room with a view: A review of the effects of windows on work and well-being.

[14] Future Workplace. (2018) https://workplacetrends.com/wp-content/uploads/2018/08/The-Employee-ExperienceFINAL08-072.pdf

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