

Daylighting Facts and Figures

Worker Productivity

- Employers can boost productivity by 7.1% annually by improving indoor air quality, increasing daylight and controlling office temperatures, according to a 2003 student study of green building by the Massachusetts Technology Collaborative, the state's development agency for renewable energy. *(Salt Lake Tribune, Feb. 19, 2006)*
- A 2003 study of office worker productivity conducted by the California Energy Commission found exposure to daylight was consistently linked with higher levels of concentration and better short-term memory. *(Wall Street Journal, Oct. 19, 2004)*
- Daylight illumination levels were significant and positive in predicting better performance on a test of mental function and attention. The Backwards Numbers test is widely accepted in psychological research as a valid test of mental function and attention spans. An increase in daylight illumination levels from one to 20 foot candles resulted in a 13% improvement in the ability to instantly recall strings of numbers. *(“Integrated Energy Systems: Productivity and Building Science” Report prepared for the California Energy Commission Public Interest Energy Research Program by the New Building Institute Inc., October 2003)*
- A 2001 study by the Lighting Research Center in Troy, N.Y. of the impact of daylight on worker productivity during winter months found that workers in windowed offices spent significantly more time working on their computers than workers in interior, windowless offices. *(California Energy Commission website, www.energy.ca.gov, 2002)*
- According to betterbricks.com, a resource promoting sustainability concepts, “The initial costs of improving a facility through better lighting, heating and cooling systems can be offset exponentially by the productivity gains of a more productive workforce. In a typical office, energy costs run \$2 per square foot, while employee salaries and benefits are \$130 per square foot or more. Even slight changes in productivity can have a major impact on the bottom line.” *(Journal of Property Management, September 2001)*
- According to the Peter Kiewit Institute of Information Science, Technology and Engineering at the University of Nebraska, poor lighting in the workplace can lead to excessive sick days, worker discontent, high staff turnover rates and poor-quality work. Natural light, however, makes workers feel and work better, prevents eye strain, helps people retain what they have learned and boosts productivity. *(Chicago Tribune, June 5, 2002)*
- Research suggests that unvarying electric light can lead to a low-level kind of sensory deprivation that can lead to impairment of organized thinking, depression, confusion and general irritability. By contrast, variability of light has been shown to have a positive impact on worker performance. A study of shift workers under a daylight-simulating skylight showed improved performance of cognitively challenging tasks by creating a higher sense of mental arousal. *(Report by the Parsons School of Design, New School of Social Research in New York analyzing 60 studies and articles on the topic of daylighting and productivity, 1999)*



- The Rocky Mountain Institute lists “high levels of daylight” among the five major contributors to worker productivity. *(Buildings, August 2002)*
- According to the International Labor Organization (ILO), American productivity grew a mere 22% between 1980 and 1996 – vs. at least 30% in Europe and 43% in Japan. In these tougher economic times, maximizing building productivity is more critical than ever in ensuring the success of facilities and their occupants. Improper lighting levels negatively impacts productivity – too much or too little can leave workers drowsy. The effective use of daylighting can improve people’s moods and energy levels. *(Buildings, May 2002)*
- Carnegie Mellon University’s Intelligent Workplace design studio found that improved lighting with an extra up-front cost of \$370,000 saved almost \$700,00 in energy and operating costs for a typical workplace. However, the resulting gains in productivity were worth as much as \$14 million. Here’s why: In a typical building, energy costs average \$1.50 to \$2.50 per square foot, while salaries exceed \$200 per square foot. Cutting energy use in half typically saves \$1 per square foot per year, while boosting productivity just 5% saves more than \$10 per square foot. *(The non-profit Center for Energy & Climate Solutions’ Cool Companies website, www.cool-companies.org, 2002)*
- According to the Natural Resources Defense Council, workers who enjoy their environments, whether due to good air, natural materials or daylighting, work harder. Even a 1% increase in productivity can save the equivalent to a year’s utility bill. *(Corporate Report Wisconsin, November 1998)*
- VeriFone, a subsidiary of Hewlett-Packard in Costa Mesa, Calif., upgraded its 76,000-square-foot building to include a series of roof skylights and other energy-efficient features. On sunny days, workers used only natural daylight and small task lights. Workers no longer complained about end-of-the-day headaches or end-of-the-week sluggishness. As a result, absenteeism dropped 40% to 45%, employee productivity increased 5% and energy bills were slashed 50%, for a payback time of under one year. *(City of Seattle website, www.ci.seattle.wa.us, 2002)*
(The non-profit Center for Energy & Climate Solutions’ Cool Companies website, www.cool-companies.org, 2002)
- Lockheed Martin reports that after daylighting its facility in Sunnyvale, Calif., the company achieved 15% higher worker productivity. Additionally, the company won a \$1.5 billion defense contract based on increased productivity, profits which paid for the entire building. As an added bonus, the company saved \$300,000 to \$400,000 a year on energy bills. *(Greening and the Bottom Line: Increasing Productivity Through Energy-Efficient Design, by Joseph Romm and William Browning, 1994)*
(The non-profit Center for Energy & Climate Solutions’ Cool Companies website, www.cool-companies.org, 2002)
- Pennsylvania Power & Light reported that after completing building upgrades to use more daylight, absenteeism rates dropped 25%, productivity increased 13.2% and energy costs declined 69%. The original energy payback was calculated to be a 24% annual return on investment. Once the employee productivity and reduced absenteeism were factored in, however, the actual return on investment was approximately 1,000% per year. In other terms, it was estimated that the lighting retrofit paid for itself not in the 4.1 years estimated, but in just 69 days. *(Seattle Times, January 18, 2000)*
(Architecture Week, July 2000)
(Sustainable Development International Corp. website, www.smartoffice.com, 2002)
- Workers in one Boeing facility stated natural light improved their ability to detect imperfections in jet



panels during assembly by 20%. The savings associated with this ability to catch errors actually exceeded the building's annual energy savings, which was 90%.

(London Financial Times, April 10, 1996)

(U.S. Department of Energy and Rocky Mountain Institute Report, "Greening the Building and the Bottom Line: Increasing Productivity Through Energy-Efficient Design," 1994)

- Compaq Computer's facilities manager saved the company about \$1 million a year by cutting back on energy use. By increasing daylighting in the building, worker productivity increased by 55% in just one year.
(Sustainable Development International Corp. website, www.smartoffice.com, 2002)
- Higher occupant productivity and satisfaction are likely to result from the better visual quality that is provided by good daylighting design. Daylight provides the truest and most vivid color rendition of all available light sources. There is also evidence that the high concentration of blue wavelengths in daylight help the eye to see more detail with greatest precision, especially at lower light levels. Mental stimulation is perhaps the biggest benefit of natural light. Daylight reinforces natural circadian rhythms and the production of neural transmitters, such as serotonin. Higher illumination levels have been associated with greater mental acuity and the simple variability of daylight may be key to mental stimulation. Studies show that lab animals learn and remember better when they are kept in a naturally variable and stimulating environment.
(Betterbricks.com, 2002)
- At the present time, much of the green building literature focuses on air quality and physical health, thereby ignoring the other dimensions that are equally important. Ironically, many of the prominent features of green buildings are likely to have the greatest impact on cognitive and psycho-social well-being. For instance, contact with nature and sunlight penetration has been found to enhance emotional functioning. Positive emotions, in turn, are associated with creativity and improved cognitive functioning.
(Environmental Design & Construction, January 2001)
- According to EREC, daylighting may reduce the loss of worker productivity during power failures. Studies show that if a worker in a daylight office can continue productive work for even one hour during a power loss, the dollar savings are equal to the cost of lighting that person's work area for an entire year.
(Reference Briefs found on the EREC's website, <http://www.eren.doe.gov>, Updated August 2002)
- Lighting is the number one contributor to office productivity according to a Harris Poll.
(Los Angeles Times, April 1, 1998)
- The U.S. Green Building Council's Sustainable Building Technical Manual reports that worker productivity can be increased by up to 15% by implementing smart daylighting. Because salaries of building occupants far exceed the construction or operating costs of a building, any sustainable design features that positively impact productivity, however modestly, will pay back the investment over time.
(Environmental Design & Construction, January 2001 and July 2002)
- Mail sorters at the main U.S. Post Office in Reno, Nev., became the most productive and error-free in the western U.S. after a retrofit to include natural light. In five months, productivity on the machines under the new lighting shot up almost 10%, leveling off to about 6% after one year. Working in a more naturally lit environment resulted in employees who did their jobs better and faster. While combined energy savings and maintenance savings came to about \$50,000 per year, the improvements in employee productivity (\$400,000 to \$500,000) dwarfed the energy savings, resulting in a payback of less than 12 months.
(Journal of Property Management, January 2000)
(The non-profit Center for Energy & Climate Solutions' Cool Companies website, www.cool-companies.org, 2002)



- A pre- and post-occupancy analysis of the new facility for Herman Miller, a furniture manufacturer in Holland, Mich., found the following:

- Workers in the new, extensively daylight, “green” facility had more positive attitudes and work experiences compared to those in the previously occupied building (which was not daylight).
- They gave their work environment a 17% higher score than their previous building, with increased numbers saying they looked forward to going to work (70% in the new building compared to 45% in the old building).
- Over 20% reported an increase sense of being in good spirits while at work.
- Workers in the new building reported higher job satisfaction and greater sense of belonging in the new building.
- They also reported that the daylight interior made it easier for them to relax and gave them more contact with nature. Approximately 60% perceived the new building as healthier.
- While it is not uncommon for companies to experience a significant drop in productivity following a move (that can take weeks or months to recover from), Herman Miller actually reported a modest increase in productivity in the nine months following its move. (Even small increases in productivity are viewed as providing a competitive advantage in the marketplace.)
- The analysis reported that daytime shift workers revealed much more positive attitudes than those working in the same facility during night shifts, reinforcing the impact of daylight on the workers rather than just the newer facility itself.
- Happier employees resulted in late deliveries being cut in half and an increase in product quality.
- Electricity costs were reduced by 18% on a square foot basis.

(Environmental Design & Construction, July 2002 and January 2001)

(Corporate Report Wisconsin, November 1998)

- According to the Rocky Mountain Institute, productivity gains of 6% to 16%, including decreased absenteeism and improved quality of work, have been reported from energy-efficient building design. Since companies spend an average of 70 times as much money (per square foot per year) on employee salaries as on energy, an increase of just 1% in productivity can result in savings that exceed the company’s entire energy bill.

(Journal of Property Management, January 2000)

- Daylight is essential to a sense of well-being, and a lack of variation in lighting (e.g. natural, general, accent and task) can result in sensory deprivation: boredom, fatigue, lack of concentration and even reduction of intellectual capacity.

(Business First of Columbus, March 24, 2000)

