NEVADA SURE BET PROGRAM

Offered By: NV Energy
Administered By: KEMA Services, Inc

Daylighting is a Sure Bet for Energy Savings – Especially in New Construction Projects

Artificial lighting must be installed in most buildings to provide lighting after dark and on cloudy days. Most commercial buildings are designed with lighting systems that draw between 1 and 2 watts per square foot of floor space. These systems are often operated all day regardless of how bright it is outdoors. Using natural sunlight for inside lighting can substantially reduce energy consumption of daytime lighting requirements. The practice of using natural light to replace artificial lighting is called "daylighting" or sometimes "daylight harvesting". While it might seem simple to add openings in the roof or walls, an effective daylighting design requires careful consideration of several factors, all of which are crucial to achieving the expected energy savings. These factors include:

Automatic Controls
In order to reduce energy use consistently, it is recommended that the daylighting system includes automatic controls, with an option for manual override. The automatic controls will reduce or shut off the artificial lights when natural light levels are sufficient. The light levels should remain in a fairly consistent range and not fluctuate or turn on and off every few minutes, as this can be very distracting to the building occupant. This means that dimming controls or stepped controls within each fixture in association with light-level sensors should be used. While this might seem fairly simple in concept, the technology of light-level sensing and dimming control is currently still in the development phase.

Heat Gain
Daylighting should be installed in a manner that minimizes heat gain. Sunlight can add significantly to cooling loads if it is not carefully controlled. Generally systems that use reflected light should be used. Direct sunlight should be avoided.

Light Quality and Distribution
The designer must carefully consider light QUALITY and DISTRIBUTION in the daylighting design. Direct sunlight can be very bright; it can result in reflections on computer screens and create visibility problems to the occupant due to contrast.

There are a number of options for bringing daylight into buildings. A few of these are listed below:

1. Clerestories – raised – roof areas with vertical glass openings. These are often used for lobbies, hallways or other generally open areas with high ceilings.

1. "Skylights" or simple openings through the roof that allow light to enter. They are limited to top floor rooms and must be carefully located and shaded to ensure that direct lighting is not too bright or cause excessive heat gain.

2. Solar "tubes" or shafts – These are shafts or tubes with an opening at the top (usually through the roof) with a vertical, reflective shaft that conveys the light to an opening in the ceiling, typically fitted with an interior diffuser. Pre-fabricated tubes are available from several manufacturers with fixed openings or optional reflective "sun-tracking" roof fittings. Reflective shafts may also be site-built.

3. Windows – Simple fixed glazing can also be an effective source of daylighting. To be effective it usually must be located high on the wall and be accompanied by passive or active shades and reflective "light shelves" either mounted inside or outside the window to distribute the lighting to the interior of the space.

There are a number of calculation tools available online to support daylighting designs. To check them out, do a web search on "Daylighting" or look at the following public domain links below:

http://www.eere.energy.gov/buildings/info/design/integratedbuilding/passivedaylighting.html
http://www.daylighting.org/
http://windows.lbl.gov/daylighting/designguide/designguide.html

Some of these sites will provide a means to estimate energy and energy cost savings. Depending on the application, daylighting can be effective 4 to 8 hours per day. As a very rough rule of thumb, the energy savings can be estimated by the following formula:

Annual kWh Savings = Controlled lighting watts/1000 X Annual operating days X 6 hours per day

Annual energy cost savings can be estimated by multiplying the annual kWh savings by the facility average cost of electricity: typically about 10 cents per kWh. The cost of incorporating daylighting into the building envelope design will vary substantially depending on the design option chosen.

A cost/benefit analysis of a typical application would show the following: A typical lighting system might require 1.5 watts per square foot. At that rate, every 10,000 square feet requires 15 kilowatts (kW) of lighting power. Assuming that the building is occupied 6,000 hours per year (including custodial and other activities) this area would consume 90,000 kilowatt-hours (kWh) every year. At a typical cost (including demand charges and taxes, etc.) of 10 cents per kilowatt-hour, the lighting would cost a total of $9,000 or 90 cents per square foot. If the lighting can be reduced or shut off 6 hours per day, about 20% of this lighting cost could be saved or about $1,800 per year.

Case Studies:
1. Daylighting designs have been installed in several Clark County Schools with support from NV Energy Sure Bet Incentive Program. At one school, high-window daylighting with on/off switching of outboard fixtures was installed. At another school, solar tubes with light level sensors and continuous dimming ballasts were installed in "T-5" fluorescent fixtures. At other schools, clerestories are designed in the hallway and lobby areas and north facing "monitor" skylights are installed in some classrooms in conjunction with light-sensing controls.

2. An adult education facility in Las Vegas received Sure Bet incentives for installing skylights in the lobby area allowing the artificial lighting to be shut off part of the day.

Sure Bet offer incentives for daylighting installations through the Custom Application for retrofits and the Performance Based approach in the New Construction Application. Incentives are $0.10/kWh for on-peak kWh savings and $0.05 for non on-peak kWh saved for retrofit projects. Incentives are $0.10/kWh for on-peak kWh and $0.06/kWh for non on-peak kWh for new construction projects. Customers are encouraged to contact the Sure Bet team if daylighting is being considered in a building design or in s retrofit project.