EnergyIdeas Clearinghouse

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Product & Technology Review

EnergySaver™

EnergySaver is one of several products manufactured by Electric City Corporation to reduce voltage to lighting circuits (on demand via remote control), often as part of a utility demand reduction program. The voltage reduction reduces energy consumption and brightness.

Image provided by Electric City Corporation.

Product

EnergySaver and companion products, GlobalCommander® and Virtual "Negawatt" Power Plan®

Manufacturer

Electric City Corporation
1280 Landmeier Rd.
Elk Grove Village, Illinois 60007
Phone: (847) 437-1666
Website: *www.elccorp.com*

Distribution Contact in the Northwest

There is no distribution contact in the Northwest. Purchase must be made directly through the manufacturer.

Product Debut in the U.S.

The company was formed in 1988. The EnergySaver entered the market shortly after that.

Product Function and Application According to the Manufacturer

The EnergySaver is a lighting energy management system that can save energy and peak demand by reducing the voltage supplied to lighting, or by turning off lighting as appropriate. It does this remotely, communicating with the lights via any building automation system based on open protocol. This means that remote control can be implemented by an existing energy management system using BACnet, or Lonworks, or via computer through a LAN.

The system can be extended to two or more buildings or facilities with centralized control provided by the GlobalCommander product.

Product & Technology Reviews (PTR) are developed for Northwest electric utilities. EnergyIdeas Clearinghouse engineers review published literature for objective, independent test results. No primary testing was conducted by the reviewer for the preparation of this document. PTR factsheets describe the technology, discuss available data, and suggest additional testing needed to verify energy saving claims.
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The GlobalCommander can integrate and control EnergySaver systems in multiple facilities. The GlobalCommander can communicate by modem, Internet, or phone line with high-speed wide area networking. The buildings do not need to have energy management systems.

EnergySaver works by reducing voltage to lights when appropriate. Voltage reduction is done by torodial transformers, which, unlike "electronic" chopping circuits, do not introduce line side harmonics. Lighting voltage can be reduced to respond to a utility contract, or rate incentive, or when lighting is supplemented by ambient daylighting. Voltage reduction reduces lighting levels, so it must be implemented where and when lighting levels are ample enough to be reduced without going below Illuminating Engineering Society of North America (IESNA) recommendations, or impacting occupant comfort and function.

As provided, the EnergySaver does not sense or determine when dimming is appropriate, but it can be connected to a local occupancy or brightness sensor if that is the desired method of control. It is typically configured to respond to a command from a local or remote operator, which may be manually issued or directed automatically by an energy management system or an occupancy sensor. According to the manufacturer, the maximum amount of voltage reduction under which fluorescent lights can operate successfully (without special dimming ballasts) is about 20-25 percent, and about 30-35 percent for HID lights.

With a plan that Electric City calls the Virtual "Negawatt" Power Plan (VNPP®), a utility can accomplish peak shaving using GlobalCommander in conjunction with EnergySaver units to reduce loads for multiple customers. In exchange for hosting the system and allowing remote control over peak demand, customers receive the technology for free and benefit from the reduction in their energy and demand bill whenever voltage reduction is activated.

Energy Savings Claims

The manufacturer's website claims the product will reduce energy consumption by 15 to 35 percent in indoor and outdoor commercial, institutional and industrial lighting systems. This presumably represents the savings only while the lights are dimmed, not the overall annual energy savings.

Non-Energy Benefits

The manufacturer claims that the lifetime of lamps and ballasts is extended when they are operated at reduced voltage. While this is true of incandescent lights, the IESNA handbook says that dimming does not extend the lamp life of anything other than incandescent. No lamp manufacturer has ever claimed that dimming extends the lamp life of fluorescent or HID. The effects on lamp life from voltage-reduction vary with the type of lamp and ballast, as well as the extent of voltage reduction.

The National Lighting Product Information Program of the Lighting Research Center said that it is reasonable to expect magnetic ballasts to last longer under reduced voltage because they tend to run cooler under reduced voltage. On the other hand, voltage reduction can reduce electrode temperature in some fluorescent lamp and ballast combinations, causing sputtering which blackens the ends of lamps and reduces lumen output. In this case, the effect of voltage reduction on lamp life can be adverse.

Lights, like most electrical devices, are made to operate satisfactorily at ±10 percent of nameplate voltage. Users should check with the lighting manufacturers to be sure their warranty will be honored if lighting voltage is reduced below 90 percent of nameplate voltage.

Independent Testing Results

The product was tested by "etc Group, Inc." for PacifiCorp in a 277-volt HID lighting application. Voltage was reduced, in increments, up to 21.7 percent. The energy savings were somewhat greater than the

voltage reduction, i.e., energy savings were 27 percent when voltage was reduced 21.7 percent. The lighting level was reduced about twice as much as the voltage. This is a greater reduction in lighting level than is suggested by the manufacturer or than was found in the Sacramento Municipal Utility District case study cited below. Testing showed good sinusoidal current, with no introduction of harmonic distortion or transients on either line side or load side.

Cost

According to the manufacturer, the cost of a commercial application, including the EnergySaver and GlobalCommander, is in the range of $500 to $550 per curtailed kW. For instance, you could achieve a one kW peak reduction by controlling approximately 120-150 forty-watt fluorescent lamps.

Alternative Products and Strategies

There are other lighting controllers that dim lights and reduce power for fluorescent and HID lights. Many products characterized as "dimmers" operate with special ballasts and are intended for a wider range of dimming (necessary for spaces with varied uses like training or entertainment).

There are energy management systems that control multiple building systems from a central location. However, we did not find another dedicated voltage reduction system for lighting that provides a centralized control system that can control multiple buildings.

Case Studies

Commonwealth Edison of northern Illinois is currently implementing a project based on the EnergySaver and GlobalCommander. It is operational and will ultimately control 50 megawatts of lighting power. By November 2004, customer participation was growing at about 50 percent of the target capacity. Commonwealth Edison paid for the system and secured customer agreements that Commonwealth may initiate lighting curtailment to agreed-upon levels within IESNA standards as they may need. The customers do not have control. The systems have all been tested as operational, although in 2004 northern Illinois enjoyed a mild summer (their peak season) and thus the utility did not need to curtail power.

A much smaller but well monitored "showcase project" was conducted at Rayley's Supermarket in Carmichael, California by Sacramento Municipal Utility District. The facility was lighted by T8 fluorescents. The EnergySaver was used to drop voltage by 18 percent. This resulted in an 18 percent reduction in illumination levels and a 19.4 percent reduction in energy and demand. Annual savings were $8,897 per year, with a 2.9-year simple payback.

Suggestions for Further Research and Testing

The greatest remaining uncertainty regarding this product is its effect on a broad variety of lamps and ballasts. It would be valuable to establish the relationship of both illuminance and power consumption to voltage (from nominal voltage down to 65 percent voltage for HID, and down to 75 percent voltage for fluorescent). A more important and controversial issue is the impact on operating life of various lamps and ballasts at different levels of voltage reduction. For lifetime studies, end of life should be defined as the point at which the lamp no longer will sustain normal operation without flicker, or excess lumen loss at the reduced voltage level.

Illuminance testing should document the power reducer efficiency factor (PREF), which is the ratio of system efficacy before and after adding the EnergySaver. If the PREF is less than 1.0, it will reduce the efficiency of the lighting system.

Current crest factor (CCF) is unlikely to be a problem with the transformer-based voltage regulation of the EnergySaver. However, it should also be measured with any ballast and lamp combination tested. High CCF

can reduce lamp life by accelerating the loss of emissive material on the electrodes due to sputtering. Most lamp manufacturers void their warranties if the CCF exceeds 1.7.

Additional Comments by Reviewer

From the end-user perspective, if a facility is continuously over-lit or has inefficient lighting, delamping or upgrading lamps or luminaires is a good idea before investing in a lighting control system. Then a lower capacity lighting control system can be purchased. Remember that potential savings are very site specific. The amount of power reduction, dimming, and associated savings varies with different lamps and ballasts. Savings may not occur at all with active front-end fluorescent ballasts, but these ballasts are relatively rare.

The most difficult part of predicting savings will be to determine how the lighting reduction interacts with HVAC heating and cooling energy. This is always a challenge with any lighting retrofit inside conditioned spaces. Lighting savings are amplified when spaces are being cooled and attenuated when they are being heated. Large buildings are typically dominated by cooling load, so the overall adjustment will be to amplify savings. A building computer simulation is the only way to get a good grasp on the adjustment necessary to account for HVAC interaction.

A notable aspect of the EnergySaver is that it maintains a sinusoidal wave when voltage is reduced. Many household dimmers and industrial motor voltage controllers chop out part of the voltage wave to reduce RMS voltage, with resulting high harmonics that can harm sensitive electronic equipment.

How a lighting system is controlled, and the magnitude of energy savings and peak shaving, will depend upon whether the system is customer-owned and controlled or utility-owned and dispatched. The utility will want to curtail when capacity is short, or wholesale energy costs are high. The customer will want to curtail at critical times to reduce demand charges, or any time less lighting is needed because of circumstances like daylighting. These differing objectives can be brought into closer alignment when advanced metering strategies more closely align the cost of providing power with customer charges in real time. Economists call this “sending the right price signals.”

The EnergySaver-GlobalCommander system works well for a utility seeking to implement conservation voltage reduction (CVR). Typically CVR applied at the distribution level cannot discriminate between loads and is greatly limited by critical loads like motors that draw more current, run hotter, and lose capacity with any voltage reduction. With the EnergySaver-GlobalCommander system, the amount of voltage reduction can be independently set for different customers and even different lighting circuits. This system allows a utility to dispatch tailored CVR where it works, and bypass circuits where it doesn’t. Before implementing this system, determine the minimum voltage for satisfactory and reliable lamp operation by consulting the lighting system manufacturer.

Conclusion

The EnergySaver is a lighting voltage controller that reduces power levels by reducing voltage, without introducing harmonics or other adverse power quality problems. It can be implemented for user control but it has been strongly promoted for utility peak demand limiting and as a conservation voltage reduction (CVR) technology dispatched by the utility. The EnergySaver will save energy. The amount saved depends upon the type of lighting, the amount of voltage reduction, and of course the frequency and duration of voltage reduction events.

Additional Information

Northwest businesses and utilities can contact the EnergyIdeas Clearinghouse for additional information on this, or other energy technologies and products. Contact:

Phone: 1-800-872-3568
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The EnergyIdeas Clearinghouse is a technical assistance service managed by the WSU Extension Energy Program with support from the Northwest Energy Efficiency Alliance.

Reviewer

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Note: Product & Technology Reviews are peer reviewed by objective industry professionals prior to publishing.

References

- *Specifier Reports: Lighting Circuit Power Reducer,* National Lighting Product Information Program, Lighting Research Center, Rensselaer Polytechnic Institute, Troy, NY, October 1998.

- *Customer Advanced Technologies Program Technology Evaluation Report: Lighting Circuit Power Reducers for Fluorescent Lighting Applications,* Sacramento Municipal Utility District, October 30, 2002.

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