

Proposal Information Template for: **Plug-In, Luminous Signs**

DOCKET
07-AAER-3

DATE JAN 30 2008

RECD. FEB 01 2008

Submitted to:

California Energy Commission

In consideration for the 2008 Rulemaking Proceeding on Appliance Efficiency Regulations,
Docket number 07-AAER-3

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Last Modified: January 30, 2008

This report was prepared by Pacific Gas and Electric Company and funded by the California utility customers under the auspices of the California Public Utilities Commission.

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Proposal Information Template – Plug-In, Luminous Signs**2008 Appliance Efficiency Standards**

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January 30, 2008

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Purpose

This document is a report template to be used by researchers who are evaluating proposed changes to the California Energy Commission's (Commission) appliance efficiency regulations (Title 20, Cal. Code Regs. §§ 1601 – 1608). This report specifically covers Plug-In, Luminous Signs for indoor use. [Note that this is a draft, preliminary report—research is still being conducted on this subject so the estimates given here may be adjusted in subsequent drafts.]

Background

Plug-in signs are appliances commonly used by retail establishments and other venues where visual communication with customers and clients is essential for successful business. Additionally, plug-in signs can function as a means of speech and artistic expression. Plug-in signs—particularly those using hand-formed neon—are historically an important and valued feature of commerce and culture in California, as in the rest of the United States. However, based on our field observations and review of product offerings, we identify many plug-in signs using inefficient light sources and power supplies, and many that either lack controls or use only manual on-off switches. Furthermore, we observed that many of the signs with manual on-off switches had broken or missing pull-cords and therefore needlessly operated 24 hours a day.

New plug in sign technologies, such as light emitting diodes (LEDs) and power supplies with solid-state components, offer significant energy savings and peak demand reduction potentials. They also offer popular non-energy benefits such as dynamic effects, new design choices and little or no maintenance. Just as the market for exit signs and traffic signals was radically transformed by the introduction of LEDs, we believe that LED plug-in luminous signs will follow a similar path of adoption in the long run. The proposed regulation should speed the uptake of new sign technology and immediately deliver energy and environmental benefits to California.

Overview

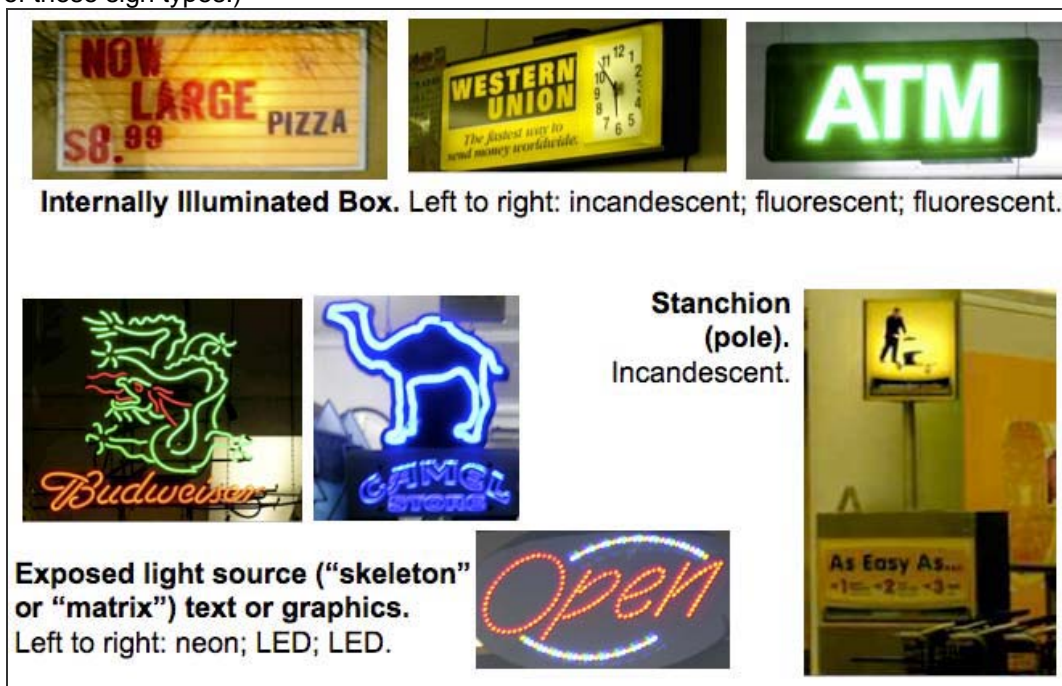
The market is already beginning to take advantage of newer lighting technologies that enable visually equivalent or better plug-in products. The sign industry is generally aware of options for energy efficiency improvements and although historically averse to government intervention, this industry is eager to continue its recent growth trend (up to 14% per year) while better serving its customers who require efficient alternatives. The sign industry's recent participation in Title 24 activities could pave the way for collaboration on plug-in signs, too.

Energy savings opportunities are significant. Advances in light source and controls technologies offer many alternatives to present stock and patterns of use. Present stock utilizes a wide array of light sources, including incandescent, linear fluorescent with magnetic ballast, neon with conventional transformer, neon with more advanced transformers, electroluminescent and light emitting diodes. Without intervention, we expect future stock to include the above, plus organic light emitting diodes. Current market trends favor increased use of light emitting diodes, while neon and incandescent lamp use continues to decline gradually.

Three basic types of plug-in signs are covered by this proposal (as shown in Figure 1):

- Internally illuminated box signs;
- Exposed (non-filtered, non-lensed) light source text or graphics; and,
- Stanchion (or pole) signs.

Figure 1. Plug-In, Luminous Sign Types. (See Figure 2 for suggested alternative light sources to improve the efficiency of these sign types.)



For 2008, we estimate the following demand and use attributable to plug-in signs in commercial and residential sectors of California:

- Estimated number of signs in use, statewide: 2,800,000
- Total input power demand: 132 MW
- Total input power demand at peak: 132 MW
- Total daily use: 2.3 GWh
- Total annual use: 835 GWh

Plug-in signs are used mainly by commercial enterprises. Not-for-profits and consumers account for very small percentages of the total number of signs in use. (See Appendix A.) The major groups of commercial users for plug-in signs are:

- **Food and beverage industry:** 62% of units in use. (Restaurants, grocery stores, supermarkets, liquor stores, bars and pubs, restaurant equipment suppliers and beverage distributors).
- **Grooming and health services:** 7.8% of units in use. (Hair care and treatment, manicures and pedicures, medical and dental retail services, and beauty and day spas).
- **Financial services industry:** 5.4% of units in use. (Banks, check cashing retailers and bail bond services).

The proposed Title 20 recommendation will be highly cost-effective. The costs for the above groups should be minimal to zero because more efficient lighting technologies can either replace less efficient systems or control the hours of use of conventional signs, without increased first cost or removal of aesthetic choices for visual communication. Major benefits would include significantly lower operating costs, increased visual design options and effects, and greater, more varied control of hours of use.

| | |
|-----------------------------------|--|
| Description of Standards Proposal | <p>Proposed requirements for all self-contained sign units that plug into 120V AC building mains power and are intended for indoor use only.</p> <p>A. Input power demand: Establish a maximum watts per square foot (W/sf) based on the area of the sign face(s). For example, <12 W/sf for box signs; <8 W/sf for exposed light source signs; and, <2 W/sf per face for stanchion signs. (Note: these are draft levels)</p> <p>B. Controls: Each sign shall have an integral toggle switch or remote switch for ON/OFF control. For signs with a face area >4sf, a supplemental time-of-operation control, such as a photosensor, timer, or remotely addressable timer.</p> |
|-----------------------------------|--|

| | |
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| California Stock and Sales | <p>Stock of signs installed in California in 2008: 2,800,000 units.</p> <p>Annual sales of sign units in California: 500,000 units.</p> <p>Annual growth rate in the national sign industry was 5-14% for 2000 through 2006.</p> |
| Energy Savings and Demand Reduction | <p>Energy use in California: 835.2 GWh/yr</p> <p>Peak demand: 135.7 MW</p> <p>Savings in energy use*: 584.6 GWh/yr at full replacement.</p> <p>Peak demand savings*: 40.7 MW at full replacement by 2018.</p> <p>* The proposed regulation will reduce thermal load in buildings and thus reduce summer cooling loads; we have not quantified or incorporated this effect yet.</p> |
| Economic Analysis | <p>Life cycle cost per unit: 50% lower than the 2008 base case unit.</p> <p>Life cycle benefit: between 30% and 70%, assuming reduced operating costs, extended design life and no maintenance costs.</p> <p>Benefit/cost ratio: TBD (>1). We expect benefits to outweigh costs significantly.</p> |
| Non-Energy Benefits | <p>Assuming that most new signs under this proposal use either LED or other solid-state technologies, then there should be extended design life, no maintenance costs, no mercury, and minimal (if any) lead in the signs. End-of-life disposal or recycling should be less burdensome due to lower weight, more benign materials. In cases where neon is replaced with LEDs, the electrical operating requirements are typically low-voltage, reducing fire and electrical shock hazards.</p> |
| Environmental Impacts | <p>The proposal does not create any adverse environmental impacts. Due to lower energy use, atmospheric emissions (including ozone-depleting gases) should decrease. The more efficient lighting measures weigh less and are smaller in some dimensions, so environmental and energy impacts associated with manufacturing, packaging, and shipping to the job site will be reduced relative to the base case. LEDs in particular do not contain mercury or lead, as do many of the existing lamp types in signs. Thus, the reduced material supplies needed for manufacturing should entail less mining and reduced end of life material disposal</p> |

| | |
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| Acceptance Issues | <p>Signs are ubiquitous for businesses. They are acquired or changed frequently. Users and retailers of signs would resist any restrictions on design choices due to the legal precedents set nationally that classify signs as a form of free speech. Generally the market trend is toward increased numbers and use of signs of all types, bolstered by targeted marketing by sign retailers, economic development programs and small business advocacy campaigns. Retailers and users view LEDs favorably and some recognize the relatively low energy demand of LEDs compared to conventional light sources for plug-in signs.</p> <p>A label could increase purchaser awareness of the energy and environmental benefits of new products. This proposal would be suitable for highly targeted incentive programs such as rebates to distributors, headquarter rebates to chain store procurement offices, or coupon and take-back programs for small, independent businesses.</p> <p>The California and national sign industry associations and representatives are participating in the Title 24 regulatory process for outdoor signage. Resistance to regulation that is perceived as economically burdensome may be counterbalanced by the industry's desire to be "green" and to increase sales and profits.</p> |
|-------------------|---|

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| AB 1109 (California Lighting Efficiency and Toxics Reduction Act) | <p>The proposed recommendation is related to AB 1109 (Huffman) and the following should be considered when analyzing California's effort to meet the goals of the Act.</p> <p>Many existing box and stanchion signs use general service incandescent lamps (A-lamps). Also, we assume that one out of every 2000 homes in California uses a plug-in sign for decorative purposes.</p> <p>Lighting Measure Availability and Cost: The principal manufacturers of incandescent and fluorescent lamps used in signs are General Electric, Osram Sylvania, Philips, Panasonic, Westinghouse and many smaller brands, both USA-based and abroad. Major electronic firms manufacture other components such as ballasts, transformers and circuit drivers. Mass-produced signs are marketed by Fallon, Everlight and many other sources. (See Appendix B.)</p> <p>The proposed lighting measure is readily available from multiple providers, via online sales, mass-market channels and local sign shops. California has a higher proportion of sign manufacturers, retailers and installers compared to the rest of the USA. For example, of the entities that are certified by one listing body to manufacture signs, California represents 15% of the total certified in the USA; similarly, California represents 17% of the total for skeletal neon signs, 48% of the total for changeable message signs, and 23% of the total for sign components.</p> <p>Should the recommendations be adopted, the sign industry has the capacity to supply new technologies in quantities sufficient for statewide compliance. Presently, many providers import their products from Asia; this is a widespread trend in the worldwide lighting industry.</p> |
| Federal Preemption or other Regulatory or Legislative Considerations | <p>Many local jurisdictions have stringent and quite varied sign regulations; most are focused on outdoor signage. Some local laws do, however, apply to signage in windows. Signs are a form of free speech and are considered an operational right for businesses. The only federal program presently addressing energy efficiency in signs is in EPCACT 2005, and applies only to exit signs. Any federal legislation pertinent to lamps may also affect lamps used in signs, although unusual lamp types or lamps dedicated to special use (such as vibration-resistant incandescent bulbs) may be exempted from federal rules. California Appliance Efficiency Regulations 1605.3 Table K applies to incandescent lamps used in signs.</p> |

Methodology

To categorize the types and frequencies of signs indoors, we photographed, videotaped and counted plug-in signs in a wide variety of establishments in San Francisco, Oakland, Orange County, South San Francisco, Los Angeles, and San Diego. We made observations during daylight and evening hours. Trade articles from magazines such as *Signs of the Times*, *LEDs Magazine* and *Digital Signage Monthly* were also reviewed for trend and market information.

The authors found no comprehensive data on energy and signage; therefore we examined many websites of online retailers of all types of plug-in signs, compiling average data for size, input power demand and other factors. From these observations and information, we made conservative assumptions and, where possible, referenced figures developed by SCE or by the PG&E Title 24 team. We have not yet conducted interviews or workshops with manufacturers or their trade associations.

Analysis and Results

Many existing signs are in poor operating and visual condition. Although some establishments change signs frequently, some businesses continue to operate “vintage” or simply out-of-date equipment. In particular, we were surprised to identify incandescent lamps in many box-type and stanchion signs. The qualities of incandescent lamps do not offer any advantages in these applications and, in fact, seem to cause deterioration of the sign surfaces. Box signs also may use linear fluorescent lamps, which do give ample and even light distribution. However, they also emit ultraviolet, which deteriorates the lenses and filters after prolonged use. If users prefer to continue using linear fluorescent lamps, there are newer, lamp types and ballasts that can increase efficiency. Exposed neon signs have a distinctive visual impact; they may not be as easy to displace with other types of newer light sources. Even so, the power supplies (transformers) for exposed neon signs offer energy efficiency opportunities.

We found ample opportunity to introduce newer, more efficient components and systems to sign users. Certain lamps are typically used in each of the three types of plug-in signs. However, we found many sign distributors offering alternative light sources and other system components that increase the efficiency of the appliance without sacrificing the qualities sought by users. We summarize these options in Figure 2. Some of these options enable retrofits of existing appliances, but we assume that in many cases users would adopt the newer technologies when they replace the entire plug-in sign.

Figure 2. Alternatives to existing light sources used in plug-in signs.

| |
|--|
| Internally Illuminated Rectangular Box or Panel (Examples: OPEN; brand name or logo) |
| Incandescent → CFL with electronic ballast |
| Linear Fluorescent (FL) → FL with electronic ballast |
| Compact Fluorescent (CFL) → CFL with electronic ballast |
| Neon → neon with efficient transformer; or, LED |
| Electroluminescent → Organic LED (future possibility) |
| Graphic or Text, Some with Dynamic Effects (Examples: OPEN; beverages; prices) |

| |
|--|
| Electroluminescent → LED or O LED |
| Neon → neon with efficient transformer; or, LED |
| LED → LED with high efficiency driver |
| Stanchion, Pole or End-Cap (Examples: Next-in-line; point-of-purchase) |
| Incandescent → CFL with electronic ballast |
| Compact Fluorescent (CFL) → CFL with electronic ballast |
| Light Emitting Diode (LED) → LED with high efficiency driver |

Our observations are consistent with the results of a recent study on signage conducted by Southern California Edison, which found that, “Over 70% of indoor neon is plug-in and operates during day. Indoor neon represents 28% of total linear feet, 20% of installed wattage, and 29% of annual kWh.” Furthermore, SCE found that for replacement of neon open signs with LED open signs, “Technology [is] currently available which allows replacement: Any color sign can be replaced; and, approximately 1/10th of energy and demand is [used]” (Higa 2008). However, we note that some users may prefer other light sources for aesthetic reasons, so our analyses assumed a mix of alternative light sources.

SCE suggests, “that there is a much greater energy impact produced from interior neon signs than was previously thought and that there are Energy Efficiency, Demand Reduction, and Demand Response potentials that need to be explored.” (SCE 2007). We will collaborate with SCE and the sign industry to further explore and quantify energy savings measures that would yield beneficial outcomes for all stakeholders in California as part of completing the CASE Report.

We found many signs operating in full sunlight, at peak utility demand hours, when their visual impact was negligible. However, most sign users did not appear to turn signs off during sunlight hours—many could not because the signs lacked accessible or automatic controls. We did not examine whether signs in storefront windows were plugged into a switchable electrical circuit, but we did observe potential fire and electrical shock hazards due to broken and/or multiple signs plugged into electrical outlets that were not designed to power numerous high-wattage devices. We also found in the industry a lack of consistent sign components and system definitions, product types, testing methods and labels. While we can adapt some elements from other documents, developing consistent, consensus-based standards will require further research and stakeholder input. There are many players involved in the sign industry, so we suggest conducting several stakeholder workshops in various regions of California to gain representative perspectives on the recommendations.

Recommendations

Proposed requirements for all self-contained sign units that plug into 120V AC building mains power and are intended for indoor use only.

A. Input power demand: Establish a maximum watts per square foot (W/sf) based on the area of the sign face(s). For example, <12 W/sf for box signs; <8 W/sf for exposed light source signs; and, <2 W/sf per face for stanchion signs. (Note: these are draft levels)

B. Controls: Each sign shall have an integral toggle switch or remote switch for ON/OFF control. For signs with a face area >4sf, a supplemental time-of-operation control, such as a photosensor, timer, or remotely addressable timer.

The maximum levels should be set for each of the three basic types of signs according to technical feasibility, and these levels should be harmonized, if possible, with other Title 20 and Title 24 requirements. Plug-in signs should bear a label clearly stating input power demand (at maximum usage setting). Consumer education and incentive programs could accelerate the adoption of more energy-efficient signage in California.

Bibliography and Other Research

The authors consulted with PG&E's staff (Steve Blanc, Gary Fernstrom and Pat Eilert) and the PG&E Title 24 consultants who worked on sign component and system issues, including Michael Neils and HMG. The authors attended several industry trade shows (ISA 2007 in Las Vegas and LightFair 2007 in New York) where we met manufacturers and distributors. We participated in Underwriter Laboratories' LED workshop held in Chicago,

We may conduct tests on several samples of each of the three types of signs using various light source alternatives, in order to better establish energy savings potentials for light source and controls options. If we do conduct tests, we will incorporate test methods as available from sources such as: CEC Appliance Efficiency Regulations, CEC Building Efficiency Regulations, US DOE SSL CALIPER program, US EPA ENERGY STAR Exit Sign program, UL, NEMA, IEC and ANSI.

References

CEC. 2007 Appliance Efficiency Regulations. December 2007. CEC-400-2007-016-REV1. Revised December 29, 2007. Sacramento, CA.

Higa, Randall. 2008. SCE Title 20 AB 1109-Related Efforts. CEC Workshop, January 15, 2008, Sacramento, CA.

[SCE] Southern California Edison. 2007. Codes and Standards Project Neon Scoping Study (Draft). CS 07.01 Draft Report. Prepared by Design & Engineering Services, Customer Service Business Unit. October 2, 2007.

Appendix A. Establishments Using Plug-In, Luminous Signs Indoors.

| RANK BY ANNUAL USE OF PLUG-IN SIGNS | | | | |
|---|---|--------------------|-------|------------|
| Types of establishments likely to use plug-in signs | annual watt-hours per type of establishment | | | |
| Commercial | annual watt-hours | subtotal | GWH | % of total |
| restaurants | 271268730000 | food and beverage | | |
| grocery stores & Supermarkets | 150734196000 | | | |
| liquor stores | 38050155000 | | | |
| bars & pubs | 26726760000 | | | |
| restaurant Equipment & Supplies | 1062763200 | | | |
| beverage distributors | 14764761000 | 502607365200 | 502.6 | 61.9 |
| bank 16148 | 33949555200 | financial services | | |
| check cashing | 5510916000 | | | |
| bail bonds | 4088116800 | 43548588000 | 43.5 | 5.4 |
| hair care & treatment | 32777817600 | health & grooming | | |
| manicures & pedicures | 24987024000 | | | |
| medical, dental and health services | 1752000000 | | | |
| beauty & Day Spas | 3884184000 | 63401025600 | 63.4 | 7.8 |
| drug stores | 23549508000 | | | |
| gas station | 21857601600 | | | |
| consumer Electronics Stores | 15866112000 | | | |
| lodging | 13361409000 | | | |
| sporting Goods Dealers | 12310077600 | | | |
| sign dealers | 11781324000 | | | |
| cell phones | 8177284800 | | | |
| hardware Dealers | 5466240000 | | | |
| auto Parts Retail | 5384246400 | | | |
| office supplies | 4429756800 | | | |
| toy Stores | 3915194400 | | | |
| mail Services & Package Shipping | 3769603200 | | | |
| clothing Stores | 3734563200 | | | |
| auto rentals | 3114968400 | | | |
| movie theaters | 2664792000 | | | |
| churches | 2505447600 | | | |
| sportswear Retail | 2446142400 | | | |
| employment agencies | 2062980000 | | | |
| gift Shops | 1584333600 | | | |
| body Art & Piercing | 1524240000 | | | |
| florist | 1519422000 | | | |
| bakeries Retail | 1401381000 | | | |
| auto Washing & Polishing | 1273003200 | | | |
| pet Food & Supplies Retail | 1134244800 | | | |
| jewelers | 1030723500 | | | |
| video & dvd rental | 917347200 | | | |
| shoe Stores | 642108000 | | | |
| real estate agencies | 438657000 | | | |
| auto Dealers | 375694500 | | | |
| music Stores | 273662400 | | | |

Appendix B. List of Plug-In Sign Manufacturers and Retailers Marketing Products in California (as of December 2008, not comprehensive)

| LED SIGNS AND COMPONENTS | | NEON SIGNS AND COMPONENTS |
|---|---------------------------------------|--------------------------------------|
| 100 West Electronics, LLC | Lambda Research Corporation | AEI Components |
| Acclaim Lighting, LLC | LED EFFECTS INC | Alpha American |
| ACF Components & Fasteners, Inc. | LED International Holdings Limited | ARCHITECTURAL CATHODE LIGHTING INC |
| Act One Communications Inc. | LED Marlat | Arter Neon Sign Inc |
| ACTION MEDIA TECHNOLOGIES INC | Led Neon Light | Arter Neon Sign Inc |
| Actown | LED, Inc. | B K SIGNS INC |
| Adaptive Micro Systems LLC | LEDotti Optoelectronics, Inc. | Brille Lite Sign |
| AD-ART INC | Ledman Optoelectronic Co., Ltd. | Broadcast Impressions Group |
| AddViva Co. Ltd. | LEDPAC | Data Display Systems |
| AHEAD Optoelectronics, Inc. | LEDplus GmbH | Digital View |
| Allanson International, Inc. | LEDvista Limited | Duco Technologies Inc |
| Alpha American | Leadtek Electronics USA Corp. | Electrosonic Systems Inc |
| Alto Sign Inc | Liberty Trading International | Enhance America Inc |
| Andris | Lighting and Production Resources | Estakon Inc |
| Arrow Electronics, Inc. | Lighting Control & Design | Everbrite, LLC |
| ARROW SIGN CO | Lightek Electronics Co. Ltd | Everything Neon |
| Art Ware America Inc. | LIHong Electronics CO., LTD. | Falcon Luminous Products Corporation |
| Assign Technology | Lita Tech | FIRST SIGNS CO |
| Aurora Light and Magic Limited | LMP Lichttechnik GmbH | FlexMedia |
| AutoComm, Inc. | Lumilient Technologies, Inc. | Hera Lighting L.P. |
| BFI Optilas Ltd | Lumination | Kirch Industrial Company |
| BHT Sign Inc. | LUMIRON | Leadtek Electronics USA Corp. |
| Brille Lite Sign | MATKO | NEON MADE |
| Broadcast Impressions Group | Maxx International | Neon Sign World |
| Bruck Lighting Systems | Meltonic Co., Ltd | Neon Signs and Décor.Com |
| Budget Lighting, Inc. | MFOT Co., LTD | Neon Tech-Alluma Tech-Lite Tech |
| Bulbrite Industries, Inc | Neon Tech - Alluma Tech - Lite Tech | Night Rainbow Tech Ltd |
| Canada LEDS | Neo-Neon International Ltd | Novamedia Group |
| CAO Group, Inc. | Nu-Tech | NSI ARCHITECTURAL CATHODE INC |
| Carmanah Signs Inc | ODECO ELECTRONICA | Princess Pedicure Spas |
| Christopher Lighting Co | OPTEC DISPLAYS INC | Real Digital Media |
| Creative Lab Co., Ltd. | Optrans Universal Corporation | REDBOXX / Ross & Associates, Inc |
| Dadronics | OSRAM SYLVANIA Products Inc | Regency Lighting |
| Data Display Systems | PERMLIGHT PRODUCTS INC | Service Select Signs |
| DOP | Philips | Sunrise Systems, Inc. |
| Dalean UK | Photonix Products Ltd | Symon Communications, Inc. |
| Device Semiconductor Sdn Bhd | PLASTOLED SYSTEMS | Techni-Lite Systems |
| DR GRAPHIX IMAGING INC | Pro-Lite, Inc. | Totalight Systems |
| Duco Technologies Inc | PublicScreen and Lightsystem Ltd | TRIAD MAGNETICS |
| DURALED LIGHTING TECHNOLOGIES | Regency Lighting | UltraSigns Electrical Advertising |
| ElectraLED, Inc. | ROHM | Visual Marketing Inc |
| Element Labs | Sallent Pty Ltd | Wireless Ronin Technologies |
| EpiTech Technology Corporation | Sayco | YOUNG ELECTRIC SIGN CO |
| Epson America | Sealectronic | |
| Estakon Inc | Shenzhen Haiju Tech Co., LTD | |
| Euro Display | Shenzhen Quality Lighting Co., Ltd | |
| Everbrite, LLC | Shenzhen UniLight Electronic Co., Ltd | |
| Everlight International Corp. | SHINA Opto Electronics Co., Ltd. | |
| Falcon Luminous Products | Showcase Components | |
| FAWCO Technology | Signal-Tech LED Signs | |
| Fawco Technology | SIGNTRONIX | |
| FEASA | SteenLED | |
| Flexmedia Canda Inc | Spectra Displays Ltd | |
| ForeSight Lighting | STOMEE.COM | |
| Forge Europe | Stylmark | |
| Foryard Optoelectronics Co., Ltd. | Sunrise Systems, Inc. | |
| Future Lighting | Super Vision International | |
| Genius Plastic Optical Fiber Industries | Symon Communications, Inc. | |
| GSFK Design Ltd | TC Millwork | |
| Guang Li-Light Power Technology | Techni-Lite Systems | |
| Hera Lighting L.P. | Teclsign Light Panel Co., Ltd. | |
| High Power Lighting Corp. | The Fox Group, Inc. | |
| Highlands architectural Led lighting | The LED Sign Company | |
| III-V Compounds, Inc. | TLLC UK Ltd | |
| iLight Technologies | Totalight Systems | |
| Imighen Inc | TRI MOTION DESIGN | |
| J & J ELECTRONICS INC | Til North Lighting | |
| Jahabow Industries Inc | U S TRAFFIC CORP A QUIXOTE CO | |
| Jesco Lighting | versebright | |
| JS LED POWER INC | Wireless Ronin Technologies | |