

## Purchasing for Pollution Prevention

### Environmentally Preferable LED Exit Signs: Saving Money and Protecting the Environment Through Energy Efficiency

According to the US Department of Energy, there are more than 100 million exit signs in use in the United States. These signs are typically lit by incandescent lamps and are estimated to consume 30 to 35 billion kilowatt-hours of electricity annually.<sup>1</sup>

Newer models of exit signs replace incandescent bulbs with either high-efficiency light-emitting diodes (LEDs) or compact fluorescent lamps. By specifying new exit signs (or retrofitting existing incandescent-lit signs<sup>2</sup>) with LED technology, municipalities and facilities can conserve energy, save money, and reduce their exit signs' impact on the environment by eliminating fluorescent bulbs that contain mercury.

#### What factors should purchasers consider when specifying new exit signs?

**FIXTURE DESIGN.** Lighting technology, design aesthetic, and backup power requirements vary widely, as do the associated prices.

**ENERGY CONSUMPTION.** Two-lamp exit signs use from 1 to 50 watts of electricity. LED, incandescent, and compact fluorescent lamps use dramatically different amounts of energy. Exit signs using LEDs typically use about 10 to 50 times less energy than those with incandescent bulbs.

**LAMP LIFE.** The length of time a lamp lasts is a critical factor, since lamp replacement costs (including lamp and labor costs, as well as the administrative cost of ordering lamps) will be incurred more frequently when lamps have a shorter rated life. An LED exit sign can last for 10 years with no lamp change-outs. During this time, a fluorescent bulb may need to be replaced six or more times and an incandescent bulb up to 30 times.

**BACKUP POWER SOURCE.** Building codes require emergency exit signs to have a backup battery in case of

power loss. Batteries found in standalone exit signs must be rechargeable and usually contain toxic metals (usually cadmium or lead) that require disposal as hazardous waste or recycling under the Universal Waste Rule, depending on local regulations.<sup>3</sup>

#### Are LEDs environmentally preferable compared to incandescent or fluorescent lamps?

Yes. Incandescent and compact fluorescent lamps use more power than LEDs, and that power may be generated by coal-burning power plants, which are the largest source of mercury releases in the US, according to the EPA.<sup>4</sup> The EPA estimates that, on average, 0.016 mg of mercury is emitted for each kilowatt-hour of electricity used in the US.<sup>5</sup>

Though significantly more energy efficient than incandescent lamps, fluorescent lamps contain mercury, which can be released to the environment when lamps break, either during use or after disposal. Mercury is a potent

<sup>1</sup> Energy Star, "Exit Signs," [http://www.energystar.gov/index.cfm?c=exit\\_signs.pr\\_exit\\_signs](http://www.energystar.gov/index.cfm?c=exit_signs.pr_exit_signs).

<sup>2</sup> Because of the high initial cost of LEDs, it may not be cost-effective to retrofit exit signs containing compact fluorescent bulbs with LEDs, even though LEDs are more energy efficient.

<sup>3</sup> For information on recycling rechargeable batteries at end of life, see <http://www.rbrc.org>.

<sup>4</sup> US EPA, Mercury Study: Report to Congress, EPA-452/R-97-004, December 1997, <http://www.epa.gov/oar/mercury.html>.

<sup>5</sup> US EPA, *Mercury Emissions from the Disposal of Fluorescent Lamps: Revised Model*, final report, March 31, 1998, <http://www.epa.gov/epaoswer/hazwaste/id/merc-emi/merc-pgs/emmrpt.pdf>.

neurotoxin that is not readily broken down in the environment and can cause serious damage to the developing brains of infants and young children. The fluorescent lamps in one exit sign can contain more than 10 mg of mercury.<sup>6</sup> Thus, by switching to LEDs, a facility with 20 exit signs can reduce mercury use over a 10-year period from more than 750 mg to zero, and mercury emissions related to power use from 450 mg to 30 mg. 750 mg of mercury can contaminate over 1,000 fish to the point where they cannot be eaten.<sup>7</sup>

### What are the comparative life-cycle costs of incandescent, fluorescent, and LED lamps?

Even though the initial purchase price of LED exit signs can be significantly higher than that of incandescent or fluorescent lamps, their life-cycle costs are much lower. LED exit signs use less electricity and the lamps have a rated life five times longer than that of incandescent or fluorescent lamps, equal to the expected life of the fixture. Payback time for investing in new LED fixtures can range from three months to just over four years, depending on the fixture used and electricity costs. Use the Energy Star calculator at [http://208.254.22.7/ia/business/bulk\\_purchasing/bpsavings\\_calc/Calc\\_Exit\\_Signs.xls](http://208.254.22.7/ia/business/bulk_purchasing/bpsavings_calc/Calc_Exit_Signs.xls) to estimate your payback time.

#### LIFE-CYCLE COST FACTORS OF EXIT SIGNS<sup>8</sup>

Lamp Type	Fixture Cost	Wattage	Lamp Life
Incandescent	\$20 – \$100	30 – 50 watts	3,000 – 19,000 hrs.
Compact fluorescent	\$125 – \$200	10 – 16 watts	13,000 hrs.
Light-emitting diode (LED)	\$30 – \$250	1– 3 watts	10 yrs.+ <sup>9</sup>

<sup>6</sup> New Jersey Purchase Bureau, “Lamps, Incandescent, HID, Fluorescent, Including Low Mercury,” Notice of Award T-0192, August 1, 2003, <http://www.state.nj.us/treasury/purchase/notice/contracts/t0192.shtml>.

<sup>7</sup> Assuming a 3 pound fish and a consumption advisory level of 0.5 parts per million mercury.

<sup>8</sup> Price, wattage, and lamp life ranges are from an informal survey of product information from vendors, manufacturers, and the Federal Energy Management Program, including Cooper Lighting at <http://www.cooperlighting.com>, Lithonia at <http://www.Lithonia.com>, and Grainger at <http://www.grainger.com>; personal communications with Jeff Samuels, Spectro Lume, Inc., July 2003, and Ralph Williams, SRB Technologies, July 2003; “How to Buy an Energy-Efficient Exit Sign,” [http://www.eere.energy.gov/femp/procurement/exit\\_sign.html](http://www.eere.energy.gov/femp/procurement/exit_sign.html).

<sup>9</sup> Overall fixture life cannot be guaranteed beyond 10 years, so extended lamp life beyond 10 years is not relevant.

### How much money can a facility save by using LED technology compared to incandescent or compact fluorescent?

The savings realized by a specific facility will vary depending on regional energy costs, labor costs associated with changing spent lamps, and the number of exit signs used. The following table compares life-cycle costs of the three lamp types, assuming that electricity costs \$.08 per kilowatt-hour (kWh), that the cost of purchasing and changing a lamp is \$10, and that there are no other maintenance requirements for any of the exit sign types.

#### COST COMPARISON OF EXIT SIGNS OVER 10 YEARS

Electricity Cost Per Exit Sign			
Incandescent	Compact	Fluorescent	LED
Wattage	30 – 50 watts	10 – 16 watts	1 – 3 watts
Annual Energy Use (kWh)	263 – 438	88 – 140	9 – 26
Annual Energy Cost	\$21 – \$35	\$7 – \$11	\$0.70 – \$2
10-Year Energy Cost	\$210 – \$350	\$70 – \$112	\$7 – \$21
Lamp Replacement Cost Per Exit Sign			
No. Replacement Lamps Used in 10 Years	4 – 29	6	0
Cost of Lamp Replacement	\$40 – \$280	\$60	–
Total Maintenance and Electricity Cost Over 10 Years			
Per Exit Sign	\$390 – \$490	\$130 – \$172	\$7 – \$21

### Can I retrofit my existing fixtures with LED lamps?

Numerous LED lamps are available to fit existing incandescent fixtures. Known as direct retrofit lamps, these can cost as little as \$24 to almost \$40 for a two-lamp fixture.<sup>10</sup> Basing calculations of cost on \$.08 per

<sup>10</sup> Price information from Grainger, <http://www.grainger.com>, and Good Mart, [http://www.goodmart.com/products/bulb\\_exit\\_sign\\_retrofit\\_kit.htm](http://www.goodmart.com/products/bulb_exit_sign_retrofit_kit.htm).

kWh, \$24 to \$40 per fixture, and \$10 for the labor to replace the lamp, retrofitting an existing incandescent fixture with a direct retrofit LED model will pay for itself in approximately two years. LEDs are incompatible with fluorescent ballasts, so retrofit kits for compact fluorescent exit sign fixtures are not available. Agencies wishing to replace exit signs containing compact fluorescents with LEDs must purchase new exit signs, which will have a longer payback period.

### **Are LED exit signs and retrofits widely available?**

Yes. LED exit signs and retrofits are available from most major national lighting and building equipment vendors.

### **Can old exit signs be thrown in the trash?**

Incandescent and LED lamps may be disposed of with ordinary solid waste. Compact fluorescent lamps contain mercury and lead and are best handled by recycling at end of life (to capture their mercury content) through a licensed hazardous waste handler. Emergency exit signs are also required by law to have rechargeable batteries or other backup systems in case of a power outage. Many rechargeable batteries used in exit signs contain cadmium, lead, or other metals that can make the batteries hazardous waste, and so these should be recycled through the Rechargeable Battery Recycling Corp. (<http://www.rbrc.org>) or by a licensed hazardous waste handler.

### **What about tritium exit signs?**

Some exit signs are powered by the radioactive element tritium in order to run without electricity. Since tritium is radioactive, the signs are regulated by the Nuclear Regulatory Commission (NRC).<sup>11</sup> INFORM recommends that tritium signs only be used in instances where power cannot be supplied. There are several issues regarding tritium signs that end users should be aware of:<sup>12</sup>

- Tritium is a colorless, odorless gas and may not disperse from enclosed areas.
- Few companies have a take-back program for these signs, and collection for disposal can cost up to \$100 per lamp.

- Since a tritium exit sign can last up to 25 years, end users may not be aware that the lamp is a radioactive product or that it requires special handling at end of life if management, or even ownership, of the facility has changed.

### **Recommendations**

- When purchasing new fixtures, select LED exit signs.
- When replacing incandescent lamps in existing fixtures, retrofit with LED lamps.
- Replace all fluorescent exit sign fixtures with LED fixtures if the payback period is acceptable.
- Recycle all fluorescent lamps with a licensed hazardous waste handler.
- Recycle all rechargeable batteries through the Rechargeable Battery Recycling Corp. (<http://www.rbrc.org>) or through a certified battery recycling facility.
- When specifying new buildings or fixtures, specify LED exit signs:
- *All exit signs should utilize a light-emitting diode (LED) light source and should not use incandescent or fluorescent lamps.*

### **For more information**

#### **Lighting Research Center's Exit Sign Links**

<http://www.lrc.rpi.edu/programs/lightingTransformation/exits/exitlinks.html>

#### **Virginia DEQ Central Office LED Exit Sign Energy Saving Case Study**

<http://www.deq.state.va.us/p2/emsled.html>

#### **Energy Star Exit Signs**

[http://www.energystar.gov/index.cfm?c=exit\\_signs.pr\\_exit\\_signs](http://www.energystar.gov/index.cfm?c=exit_signs.pr_exit_signs)

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<sup>11</sup> For more information about regulatory issues with tritium exit signs, see US Nuclear Regulatory Commission, "Program-Specific Guidance About Licenses Authorizing Distribution to General Licensees," Appendix L, Guidance on Self-Luminous Exits (Q&As), NUREG-1556, Vol. 16, [http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v16/#\\_1\\_56](http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v16/#_1_56).

<sup>12</sup> Personal communication, Greg Morose, Product Stewardship Institute, University of Massachusetts at Lowell, August 5, 2003.