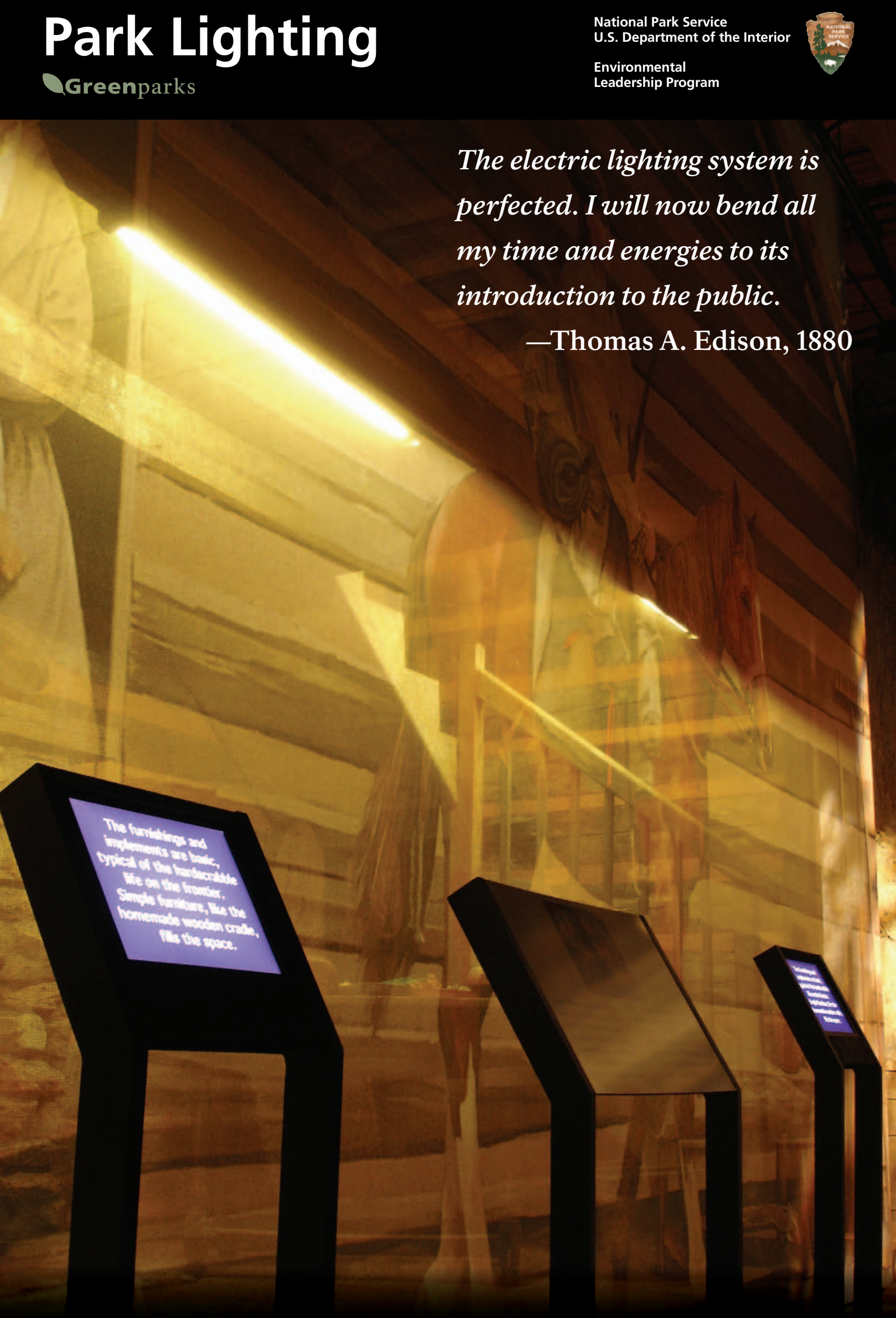


The electric lighting system is perfected. I will now bend all my time and energies to its introduction to the public.

—Thomas A. Edison, 1880



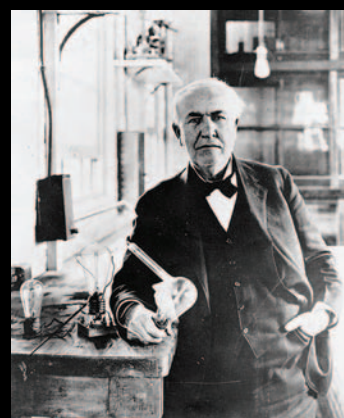
The furnishings and implements are basic, typical of the hardcrabble life on the frontier. Simple furniture, like the homemade wooden cradle, fills the space.

Make the Switch

Environmentally responsible lighting systems help protect national park resources by conserving energy and reducing atmospheric pollutants produced by burning fossil fuels to generate electricity. Innovative lighting also keeps night skies dark—an important factor in astronomy, natural and cultural scenery, and wildlife behavior.

From simple solutions such as compact fluorescent bulbs to complex photovoltaic installations, the National Park Service is developing cost-effective lighting applications to improve safety, productivity, and comfort while reducing impacts on the environment. Such environmental leadership works to ensure successful stewardship of the nation's most important natural and cultural resources for future generations.

Kings Mountain National Military Park exhibits



Thomas A. Edison

Edison Archives, Edison NHS

Park Lighting

National Park Service
U.S. Department of the Interior



Environmental
Leadership Program



Joshua Tree photovoltaic array



Park visitors enjoy dark skies and astronomy talks.

Joshua Tree National Park

Sustainable practices that improve air quality are a priority at Joshua Tree National Park where diesel generators have been replaced with photovoltaic (PV) systems to meet most of the park's electrical demand.

One of several National Park Service sites designated as a Federal Energy Saver Showcase by the Federal Energy Management Program (FEMP), Joshua Tree's Cottonwood Visitor Use Complex features energy-efficient

fluorescent fixtures and lamps, as well as occupancy sensors to control lighting. Such upgrades reduce pollutant emissions by approximately 85 percent and lower park annual operating costs by about 90 percent. Joshua Tree staff documented the retrofit process and integrated the project into interpretive tours that focus on renewable energy. Additional improvements continue through private sector rebates, repair and rehabilitation funds, and FEMP grants.

Dark Night Skies

Nighttime light pollution results from the upward and lateral distribution of light from fixtures or reflection off surfaces. The International Dark-Sky Association estimates that about one third of light used outdoors escapes into the sky where it causes glare, light trespass, and sky glow. Under a dark, unpolluted sky, more than 5,000 stars should be visible; yet, only a few hundred are seen from a suburban location with moderate light pollution. Fewer remain visible in large cities.

Lighting Costs

Lighting not only illuminates facilities and highlights informational and interpretive exhibits; it affects park management and budgets, the economy, and our environment.

Indoor and outdoor lighting accounts for a significant share of our nation's electricity consumption and associated pollution, depending on lighting design and electrical generation methods. About one-quarter of the nation's electricity budget is spent on lighting, or more than \$37 billion annually (about \$130 per person). Much of this expense is unnecessary. Modern technologies and maintenance practices can help cut lighting costs in half while enhancing lighting quality and reducing environmental impacts and upkeep. Incandescent and other traditional technologies can be replaced with compact fluorescent lamps (CFLs), advanced high-intensity discharge lamps instead of mercury vapor, and lighting controls.

The U.S. Environmental Protection Agency estimates that if the five most frequently used light fixtures (or bulbs) in each American home were replaced with energy-efficient alternatives, every homeowner would save more than \$60, resulting in annual energy cost savings of \$6 billion. In addition more than \$2 billion would be saved if all lights were shielded or pointed downward. Such changes would also reduce toxic pollutants such as nitrogen oxides (NOx) and sulfur oxides (SOx)—primary components of smog and acid rain—that enter the atmosphere. This would prevent the emission of more than one trillion pounds of greenhouse gases, a pollution savings equivalent to closing 21 power plants.

Find Out More

Visit these websites for further information regarding energy-efficient lighting systems:

- Energy Efficiency and Renewable Energy program, U.S. Department of Energy: www.eere.energy.gov
- Energy Star Program: www.energystar.gov
- Green Seal: www.greenseal.org
- International Dark-Sky Association: www.darksky.org
- National Park Service Lightscape: www2.nature.nps.gov/air/lightscapes
- U.S. Environmental Protection Agency Environmentally Preferable Purchasing: www.epa.gov/epp/



Bright Ideas for Better Lighting

A lighting guide developed by the Illuminating Engineers Society of North America (www.iesna.org) provides recommended light levels for specific tasks. These suggestions help save energy, increase user comfort, and reduce pollution from public facilities, offices, and homes alike.

Use appropriate light levels and fixtures only where needed to manage energy use. Basic maintenance practices such as turning off unneeded lights can help control lighting costs; however, the most cost-effective lighting strategies require additional action and awareness:

1. Replace existing lamps with energy-efficient equivalents.
2. Use natural lighting wherever possible.
3. Find renewable energy solutions.
4. Install controls such as motion sensors.
5. Direct outdoor lighting downward.

Change Your Bulbs

The lamp replacement strategy for offices, workshops, and other park spaces often involves replacing 60/75/100-watt incandescent lamps with compact fluorescent lamps. Available in various shapes and sizes to fit everyday lighting fixtures, CFLs now cost less and are available from most general merchandise suppliers. Replacing incandescent lamps with CFLs noticeably reduces energy consumption. Using the 1/4- or 1/5-to-1 rule for CFL replacement wattage (a CFL of 1/4 to 1/5 the wattage of the existing incandescent lamp) should provide the space served by these incandescent lamps with the same, if not more, light.

Similarly, replacement of linear fluorescent tubes with more effective units (same lumen output, less wattage) and mercury vapor lamps with metal halides, ceramic metal halides, or even fluorescent units can yield significant savings. Savings increase even more when such replacements become part of an established maintenance schedule.



(En)Lightened Use

For large or mixed-use facilities, one of the first steps in improving efficiency is a preliminary energy audit to assess the savings potential of various lighting measures. These audits prove essential for lighting energy efficiency because a number of easy efficiency measures are available that offer very short cost recovery periods, depending on the age and type of lighting equipment in service. As a rule, first evaluate lights that remain on the longest to determine their efficiency.

Consider if they really need to remain on, or if a simple on-off schedule can be implemented to reduce their "on" hours. Consider controls such as occupancy sensors to reduce "on" time for storage and low-use areas. Such technology can pay for itself in a relatively short time.

Shed Some Light

De-lamping is another simple way to reduce energy consumption. Some outdoor areas, office spaces, and most hallways are over lit, especially in older facilities. When de-lamping, care must be taken to ensure that lamps are removed in a uniform fashion without producing areas of darkness. Remaining light levels must prove sufficient for activities conducted in those spaces. De-lamping is most effective when the remaining lamps and ballasts are still matched. Depending on the existing wiring, some ballasts can consume as much energy with a partial load as with a full load.

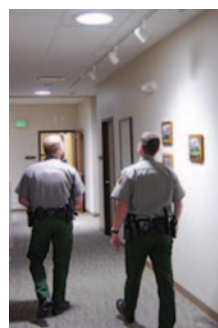
Lower the Glow

Outdoor lighting is often overlooked. Lighting in national parks must consider energy efficiency, visitor and employee safety and comfort, preservation of dark night skies, and effects on wildlife. Timers and motion sensors ensure that lights remain on only when needed. Other improvements include eliminating upward-pointing lights (such as landscaping lights or flagpole fixtures) or installing shields or cutoffs to reflect useful light downward rather than into the atmosphere.

CFL bulb photo (above) courtesy of Full Spectrum Solutions, Inc.



CFLs in desktop fixtures



solar tube lighting



efficient exhibit lighting



pathway bollard light