



CELEBRATING
20 YEARS OF
ENERGY STAR

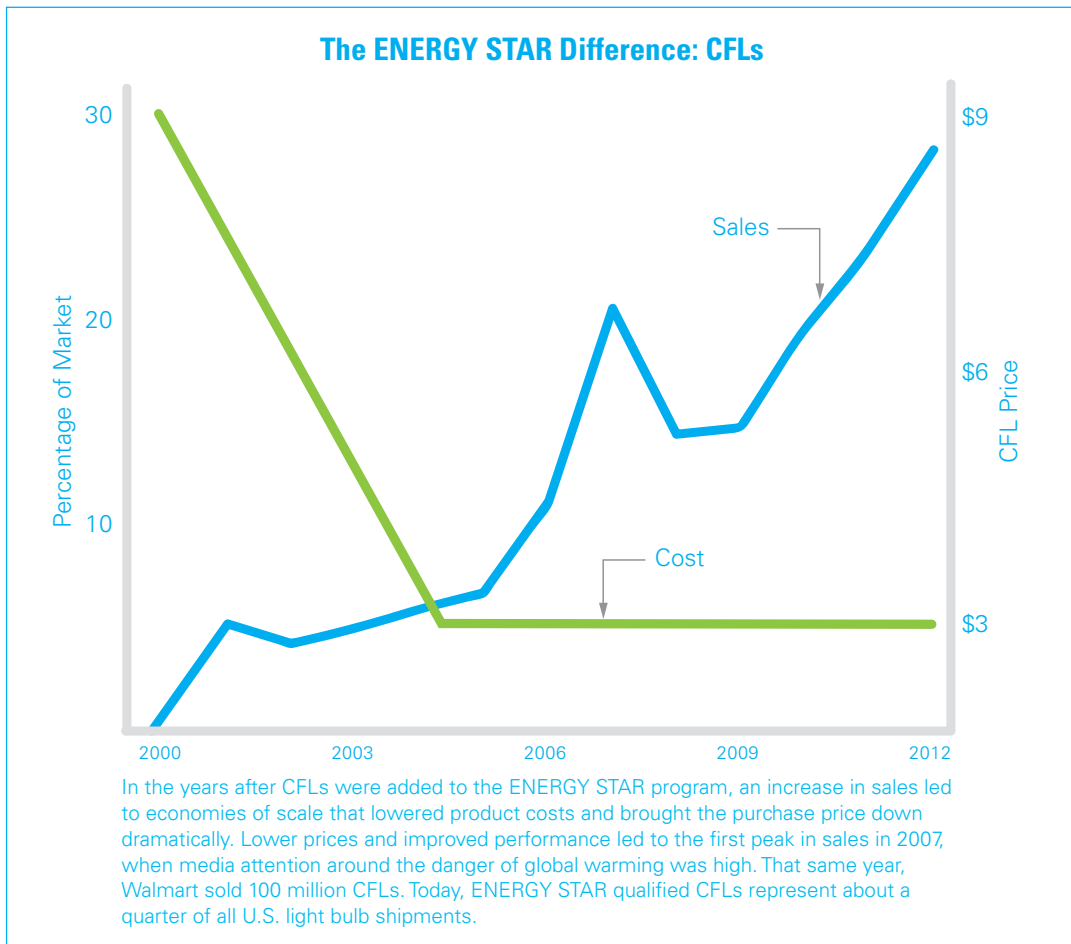


Product Retrospective: Residential Lighting

Though credited with the invention of the electric light bulb, Thomas Alva Edison did not actually file U.S. Patent 223,898 until January 27, 1880—75 years after the fundamental technology and principles of electric light were developed. Most early light bulbs were not commercially viable because they did not last very long and were too expensive to produce. Edison’s patent was for an improvement in electric lamps—“giving light by incandescence”—and their method of manufacture.¹ After many decades, bulb technology improved significantly and cost decreased. Use in the U.S. began to skyrocket.

The downside to this great American success story is that lighting now uses a great deal of energy—about 12 percent of residential energy consumption goes to lighting—and much of that energy is converted to wasted heat, not light. In traditional incandescent bulbs, which work by heating a filament until it becomes hot enough to emit light, only 10 percent of the energy output produces useful light. The good news is that a growing number of consumers are seeking more efficient ENERGY STAR qualified fixtures and light bulbs to illuminate their homes, lower their energy bills and reduce their carbon footprints.

As with Edison’s electric light, much of the growth in more efficient lighting has come through concerted efforts to improve light quality and increase the longevity of efficient lighting options. As demand has grown, prices have decreased significantly, offering an attractive payback for consumers. But as they say, Rome wasn’t built in a day...



Like the incandescent bulb, fluorescent lighting was invented long before it became commercially viable. General Electric (GE) bought the patent for fluorescent bulb technology in 1938 and showcased the technology and its superior efficiency at the 1939 World's Fair in New York.² While there was some uptake of fluorescent lighting in the commercial sector, due to size, shape, color (the light appeared green) and other factors, early fluorescent lighting was not a great match for most residential applications. The 1970s saw advancements in light bulb design by several manufacturers addressing some of the size and color concerns, and by the late 1980s, utility companies and other energy efficiency program sponsors began promoting compact fluorescent light bulbs (CFLs) to their residential customers as a way to save energy.

Despite these efforts, light bulb usage had not changed much by the 1990s. CFLs accounted for less than one percent of light bulb sales nationally in 1993.³ Unfortunately, the early-model CFLs were not quite ready for prime time, with a host of technical challenges including bulkiness, low light output, and inconsistent performance,⁴ and they were expensive, averaging \$19 each in 1996,⁵ according to some studies. Other market barriers identified at the time included:

- Lack of product performance standards to support efficiency claims
- A segmented U.S. lighting industry that saw itself as responding to consumer demand, not creating it
- Lack of consumer awareness and education
- Lack of coordination among manufacturers, utilities and retailers

An ENERGY STAR specification for residential light fixtures was introduced in 1997, “bringing a benchmark of lighting performance and quality as well as a clearly recognizable brand to the marketplace.”⁶ The goal was to offer consumers an efficient lighting option with no sacrifice in performance. The initial focus on fixtures was also intended to help address issues such as fit and aesthetics, so the fixture and bulb could be designed in an integrated way.

Working with utilities and other regional energy efficiency programs that hosted educational and bulb exchange events around the country, the ENERGY STAR program and its partners achieved early success with torchieres, the tall floor lamps that direct light upward. Conventional halogen torchieres consumed 300 to 500 watts⁷ and were a fire hazard⁸—some events showcased firemen frying eggs on the heat emitted. Efficient ENERGY STAR qualified torchieres did not generate significant wasted heat and were much safer. By September 1999, one million ENERGY STAR qualified torchieres had been sold.⁹



**Beautify
your environment**

It's easy to see that ENERGY STAR® qualified fixtures add style to any décor. But what you can't see is that they help to beautify our environment by using less energy and preventing air pollution. So, when you look to brighten your home, choose an ENERGY STAR and Change a Light, Change the World.

**HELP PROTECT OUR ENVIRONMENT FOR FUTURE GENERATIONS.
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Products that earn the ENERGY STAR® prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
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**CHANGE A LIGHT
CHANGE THE WORLD
ENERGY STAR**

2001

That same year, the U.S. Department of Energy (DOE) launched a stand-alone ENERGY STAR specification for CFL bulbs, garnering even greater support from utilities and regional energy efficiency programs given that bulbs were replaced more frequently than fixtures. Similar to the fixture criteria, this specification set the first benchmark for energy efficiency, quality and performance in CFLs and required that all products be tested by an accredited laboratory.

Over the years and through numerous revisions, the ENERGY STAR lighting specifications tackled the full range of performance issues. Limits, now as short as one second, were placed on how long a CFL could take to light up. Sound rating requirements addressed the hum associated with lighting ballasts. Light quality was approached from every angle, including how long it takes the bulb to warm up to full brightness and how many hours of life before the light starts to dim. Another set of requirements helped to ensure that an object illuminated by an ENERGY STAR qualified light would appear the same as it would if it were lit by a standard bulb. Mercury content was limited. And on top of all that, a minimum two-year warranty was imposed. Throughout the process, DOE and the U.S. Environmental Protection Agency (EPA) focused on using strict performance standards, but also on working with industry and stakeholders to develop entirely new tests when needed. With each revision to the ENERGY STAR program requirements, the quality of the products increased and consumer satisfaction went up.

To help ensure that lighting products associated with the ENERGY STAR label lived up to these many expectations, a group of utilities, energy efficiency advocates and market transformation organizations formed the Program for the Evaluation and Analysis of Residential Lighting (PEARL). They purchased products from retail stores and tested the performance of ENERGY STAR qualified lighting products being promoted in their various service territories. Performance failures were brought to the attention of EPA and DOE. As a result of this testing, numerous products were removed from the program and enhancements were made to the ENERGY STAR lighting requirements. The U.S. government subsequently initiated its own quality assurance testing for ENERGY STAR qualified lighting.

Nationally, starting in 2003, the number of CFLs shipped to retail stores increased to about 50 million per year, and with that increase manufacturers were able to lower prices. National retailers also played a role in the success of CFLs when Walmart pledged to sell 100 million CFLs in 2007. Today, shipments for CFLs are about 300 million per year; much of the increase in sales is due to the impact that ENERGY STAR and its partners have had on product quality and consumer acceptance.

Another important strategy in market transformation was rallying the market to educate consumers on the substantial benefits of ENERGY STAR qualified lighting. In the fall of 2001, retailers, utilities and manufacturers united around the first-ever nationally coordinated lighting promotion: *Change a Light, Change the World*. More than 100 utilities and other program sponsors, hundreds of retailers, and 25 fixture and bulb manufacturers participated in the promotion, which generated media interest that reached millions of prospective purchasers throughout the country. This nationally coordinated promotion has been the cornerstone of ENERGY STAR product outreach ever since,



Don't just replace a light.
Shine.

Pledge to make your next light an ENERGY STAR® at energystar.gov/changealight and join a growing number of people doing their part to preserve energy resources and help reduce the risks of global climate change. It's a small step that will make a big difference for this generation and those to come. **Change a Light. Change the World.**

ENERGY STAR is administered by the U.S. Environmental Protection Agency and U.S. Department of Energy.



2005



2007

eventually transitioning to the *Change the World, Start with ENERGY STAR* campaign in 2008 to include additional ENERGY STAR product categories and promotion of energy-saving behaviors.

Today, satisfaction with CFLs is no longer a big concern, with national surveys finding more than 80 percent of consumers "satisfied" or "very satisfied" with CFL performance.¹⁰ Household penetration is also on the rise. In 2009, 68 million households (60 percent) had at least some energy-efficient compact fluorescent or LED lights.¹¹ Savings from ENERGY STAR qualified CFLs and fixtures are expected to reach 66 billion kilowatt-hours (kWh) per year in 2012, reducing annual electric bills by \$6.4 billion and greenhouse gas emissions by 46 million metric tons.¹²

DOE introduced an ENERGY STAR specification for LED bulbs in 2010, following the earlier pattern of setting high performance criteria. As efficient lighting choices expand, the ENERGY STAR program remains committed to quality and to ensuring that products meet consumer expectations. A recent Consumer Reports article on CFL and LED bulbs found that problems with earlier versions have been overcome and that today's light bulbs "last longer and use far less electricity than traditional incandescent bulbs. Shoppers now have a variety of bulbs to match their needs."¹³ Consumer Reports also stated that "ENERGY STAR qualified bulbs meet high standards for brightness, color, and energy use."¹⁴ Their buying advice: choose ENERGY STAR.

ENDNOTES

¹ U.S. Patent Office. T.A. Edison. Electric-Lamp. No. 223,898, Patented January 27, 1880.

² Bright, A., and Maclaurin, R. (1943, October) Economic Factors Influencing the Development and Introduction of the Fluorescent Lamp. *The Journal of Political Economy*, 51(5), 434-439.

³ Pacific Northwest National Laboratory. (2006). Compact Fluorescent Lighting in America: Lessons Learned on the Way to Market (PNNL-15730). Prepared for U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Building Technologies Program. p.3.8. Retrieved from http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/cfl_lessons_learned_web.pdf.

⁴ *Ibid.*, p. 1.1.

⁵ *Ibid.*, p. 2.2.

⁶ *Ibid.*, p. B.1.

⁷ Siminovitch, M., Marr, L., Mitchell, J., and Page, E. (1997). Energy-Efficient Alternative to Halogen Torchieres (LBNL-40243 Preprint). Lawrence Berkeley National Laboratory. Presented at the IESNA 1997 Annual Conference, August 17-20. Seattle, WA. Retrieved from <http://gaia.lbl.gov/btech/papers/40243.pdf>.

⁸ Lighting Research Center, National Lighting Product Information Program. (2000). Halogen Torchieres Q & A. *Lighting Answers*, 9(3). Retrieved from http://www.lrc.rpi.edu/programs/nlpiip/lightinganswers/halogentorchiers/quest_two.asp.

⁹ Pacific Northwest Laboratory, p. B.1.

¹⁰ U.S. Department of Energy. (2010, September). ENERGY STAR CFL Market Profile: Data Trends and Market Insights. P. 26. Retrieved from http://www.energystar.gov/ia/products/downloads/CFL_Market_Profile_2010.pdf.

¹¹ U.S. Energy Information Administration. (2011). *What's new in our home energy use?* From the Residential Energy Consumption Survey (RECS). Retrieved from <http://www.eia.gov/consumption/residential/reports/2009overview.cfm>.

¹² Homan, G., Sanchez, M., and Brown, R. (2010, November). Calendar Year 2009 Program Benefits for ENERGY STAR Labeled Products. Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division, University of California, Berkeley, California.

¹³ Consumer Reports. (2011, August 30). Consumer Reports Shines a Light on the Best CFL and LED Bulbs. Retrieved from <http://pressroom.consumerreports.org/pressroom/2011/08/crs-first-full-report-on-led-energy-savings-lightbulbs-finds-more-choices-and-savings-yonkers-ny-the-days-of-ineff.html>.

¹⁴ *Ibid.*



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