

Point of View

A Transforming Global Lighting Industry





Introduction

Innovation. It's what defined GE Lighting and the lighting industry more than 130 years ago and what will continue to drive our business forward into the future.

A 50-percent decrease in demand for energy-*inefficient* incandescent light bulbs in the U.S. over the past five years shows that consumer behaviors and lighting preferences are changing. In response, GE Lighting has been working with commercial customers, consumers, industry experts and legislators to optimize our ability to innovate and fine-tune the next generation of lighting solutions that will change the way all of us think about and light our world.

This Point of View paper, "A Transforming Global Lighting Industry," provides:

- A summary of the profound transformation of the global lighting industry that's underway and its effect on consumers, including the U.S. law taking effect in January 2012, which just one in four Americans know about. The new law requires manufacturers to cease production of the long-standing 100-watt incandescent bulb.
- An assessment of lighting options available to consumers when 100-watt, 75-watt, 60-watt and 40-watt standard household incandescent light bulbs are no longer made. Options include bulbs featuring advanced halogen, compact-fluorescent and light-emitting diode (LED) technologies.
- Forecasts of the "solid-state age" on the horizon, a look at progress made with commercial LED solutions and the current "buyer-beware" nature of household LED lighting.
- A review of how GE Lighting's focus on quality, reliability and business investment will benefit customers in upcoming years.

Our hope is that this paper will enhance your understanding of what GE Lighting—and more importantly, our customers—face in the months and years ahead. We at GE see a bright future.



A Transforming Global Lighting Industry

On December 31, 1879, Thomas A. Edison flipped a switch at his Menlo Park laboratory complex in New Jersey and amid much excitement gave the public a glimpse of the world's first practical incandescent light bulb. While many inventors were experimenting with incandescent lighting, this date marked the first widespread public recognition of a commercially viable light bulb that would ultimately replace gaslight systems. The age of practical electric lighting had begun.

December 31, 2011—exactly 132 years later—will mark another dramatic turning point in the history of lighting in the United States. That will be the last day manufacturers will be able to legally make a 100-watt incandescent bulb for sale in the U.S. The long reign of the reliable incandescent bulb will begin to end on January 1, 2012 (one year earlier in California), as federal regulations mandating new energy standards start to take effect. On this day, 100-watt incandescent light bulbs—among the most commonly used household light bulbs with more than 200 million bulbs sold annually in the U.S. alone—can no longer be manufactured for sale in the U.S., although retailers may still sell them until exhausting their inventory, and lamp manufacturers may also sell off their inventory.

After the 100-watt is gone, other wattages will follow. By January 1, 2013, 75-watt bulbs will no longer be manufactured for sale in the U.S., followed by the end of 60-watt and 40-watt incandescent light bulbs on January 1, 2014. This trend has already started in other countries with similar legislation being implemented around the globe. Australia and the European Union began phasing out incandescent bulbs in 2009. Argentina and the Philippines started in 2010, and Russia will begin in 2011. The 100-watt timeline in Canada is January 1, 2011 for British Columbia and January 1, 2012 for the rest of Canada.

The goal: dramatic energy savings

The global lighting industry is undergoing a profound transformation as global demand declines for the most common household lighting product—the incandescent bulb—and the onset of new efficiency standards and technology advancements take hold.

Customers want more efficient bulbs that save energy and money now, and governments are requiring higher-efficiency products for lighting, which consumes approximately 22 percent of all electricity in the U.S.

With an estimated 4 billion Edison screw-based light sockets in American homes, the energy savings related to this transition will be huge. For example, after the 100-watt incandescent lamp is phased out, consumers will be able to achieve approximately the same light output by using halogen bulbs of about 72 watts or compact fluorescent bulbs (CFLs) of about 25 watts.

If the 200 million 100-watt incandescent bulbs sold annually in the U.S. today were replaced with the halogen light bulb, about 4.3 million tons of carbon dioxide or greenhouse gases from electricity production nationwide would be eliminated, the equivalent to removing about 750,000 cars from the road. Looking at it in another way, if 50 percent of U.S. citizens choose halogen light bulbs and 50 percent choose compact fluorescent light bulbs as replacements, the savings would be even greater—elimination of 7.8 million tons of carbon dioxide, equivalent to the removal of nearly 1.4 million cars from the roads. This is just the impact of 100-watt light bulbs removed from service.



Consumer education, options critical

While many consumers and businesses are already moving to more energy-efficient products, the transition for others may be surprising at first. Consumer research by GE Lighting found that three out of four U.S. adults are not yet aware of the new lighting efficiency regulations. When told of the change, focus-group studies revealed that consumers are understandably anxious. Most families take good, inexpensive lighting for granted.

Consumers will want to know if they will have to buy and install new fixtures and whether they will have to rewire their homes. They will worry about the higher costs of alternative lights. They will also worry that these more expensive bulbs won't fit their sockets or perform as advertised.

These are legitimate concerns. When CFLs first were touted as energy-saving alternatives to incandescent bulbs, many buyers found they did not fit properly into lamps, burned out faster than they were supposed to, did not work with dimmers, took a long time to warm up, and gave off a dull yellow glow rather than the soft white light of their familiar incandescent bulbs. Many of those early technical hurdles have been solved, and CFLs have captured nearly 25 percent of the sockets in American households today, with that number sure to grow as energy efficiency regulations take effect.

Consumers will have many options

GE Lighting, a pioneer in making Edison's new lamps a reality for the general public, will lead again in this next lighting revolution. To the anxious, GE Lighting has a simple message: "We have you covered" with many options of reliable, affordable energy-efficient lighting that meet consumers' diverse lighting needs and preferences.

The first thing for consumers to remember is that the incandescent bulb won't completely disappear from stores on January 1, 2012 (January 1, 2011 in California). The transition to light bulbs that are more than 25 percent more energy efficient than those used today, as dictated in the Energy Independence and Security Act of 2007, will be phased in over a few years—2012 thru 2014.

A full range of GE alternative lighting products meeting the new energy standards and consumers' varied needs already are on retail shelves. As it ceases production of incandescent bulbs, GE is ramping up production of newer and better CFLs, advanced halogen products, and solid-state/LED lighting products.

Specialty incandescent bulbs, such as appliance lights, three-way incandescent bulbs and incandescents for other niche applications, are unaffected. This phase-in will allow consumers to still use incandescent lamps for the next few years while the market transitions to more energy-efficient technology.

LED light bulbs that last 22 years

Instead of materials that turn "incandescent" when heated, solid-state products rely on "electro luminescence" from tiny light-emitting diodes, or LEDs. When electricity is applied to an LED, light is emitted from the interface between two different semiconducting materials. The LED is typically put into a ceramic or plastic housing and sold as a finished package that can be easily connected to an electrical circuit.

LED products already on the market burn one-quarter of the electricity of a comparable incandescent bulb and last 25 times longer. In fact, given the expected 22-year life span of GE's new LED lighting product (based on its 25,000-hour rating and 3-hour consumer use per day), this is a bulb that can virtually light a child's bedroom desk lamp from birth through college graduation.



As it has been since the dawn of electrical lighting, GE is the vanguard of this global technological revolution. In 1939, GE scientists introduced the first practical fluorescent lamps at World's Fairs in New York and San Francisco. In 1960, it invented the first practical halogen lamps that could fit into normal light sockets, and soon afterward patented the multi-vapor metal halide lamp. And in 1962, GE's Advanced Semiconductor Laboratory unveiled the visible light-emitting diode.

Today, the company of "ecomagination" is a leading supplier of LED lighting solutions to commercial users in the United States, for whom the technology represents the biggest change since fluorescent lighting swept into offices and stores in the 1950s and 1960s. GE's LED lights can be found in Walmart, Target, and Starbucks stores across the U.S. in refrigeration, signage, and general illumination applications. By late 2010, GE Lighting will launch its first LED bulb that replaces regular household light bulbs. This 40-watt replacement bulb is expected to consume just 9 watts, provide a 77 percent energy savings and produce nearly the same light output as a 40-watt incandescent bulb, while lasting more than 25 times as long.

From emerging technology to widespread adoption

For most consumers, the solid-stage age will not come overnight. While the many benefits are a very persuasive draw for consumers, the initial out-of-pocket cost for household LED lighting products will be higher than traditional light bulbs. As with any new technology, the first generations of high-quality LED light bulbs with comparable light to traditional incandescents—expected to cost between \$40 and \$50 a bulb—will be expensive for the vast majority of households. It's the type of purchase that most likely will be made by early adopters and green enthusiasts.

While initial LED lighting products will be more expensive, they will last longer and save energy. The demand for household LED lighting will grow as the technology improves and becomes more pervasive and prices come down, and as the general public comes to understand that the bulb more than pays for itself over 22 years of energy savings.

While the banning of less efficient lighting will pay off in big energy savings over the coming years, experts say the big environmental payoff will come with solid state.

By the year 2030, the U.S. Department of Energy (DOE) estimates solid-state lighting could save approximately 190 terawatt-hours of electricity per year resulting in \$15 billion in savings a year at today's prices. That roughly equals the annual output of 24 large power plants (1000 MW) or enough electricity to light 95 million homes today. Between now and 2030, the DOE estimates the nation would reduce consumption by 1488 terawatt-hours, representing a savings of \$120 billion in today's prices. And greenhouse gas emissions? They would be reduced by 246 million metric tons of carbon, assuming the same mix of power generation as today.

Commercial users already are being won over. In 2007, industry sales of LEDs for general lighting purposes amounted to just \$340 million, according to market research firm Strategies Unlimited. By 2014, that is projected to go to \$7.3 billion, representing a compounded average annual growth rate of 44 percent.



Buyer beware: Is it too good to be true?

And as is the case with many emerging technologies, such as CFLs in the mid-1980s, manufacturers around the world are trying to seize a piece of the LED market segment by releasing a spate of lighting products to the public—perhaps even without appropriate testing. Most of these LED products carry claims of lasting 25,000 to 50,000 hours and emitting as much light as incandescent bulbs. A stroll through the exhibition hall at the annual LightFair International lighting trade show in 2010 revealed booth after booth of obscure manufacturers displaying LED light bulbs claiming to burn as brightly as a 60-watt incandescent bulb. There is reason to be skeptical and cautious.

For example, the Federal Trade Commission in September 2010 filed a complaint against a California company alleging, among other things, that the company's LED bulbs produced significantly less life and light, as measured in lumens, than claimed by the company.

Independent laboratory tests under the DOE Commercially Available LED Product Evaluation and Reporting Program, better known as CALiPER, has revealed a large percentage of LED lighting products on the market fall short of manufacturers' claims. New standards for screw-in LED bulbs carrying the ENERGY STAR® label administered by the U.S. Environmental Protection Agency went into effect on August 31, 2010. However, many products will not have yet gone through the rigorous, independent testing required to earn the ENERGY STAR label.

The government has demonstrated that it will take action to protect consumers, but consumers should also do their part to protect their investment by buying responsibly and only purchasing from reputable companies that stand behind their products, not only on the day of purchase but throughout the product's life span.

That is important, because given the long life of new lighting products, consumers not only need to be concerned with how brightly a bulb burns now, but also how brightly it will burn 5, 10, or even 15 years from now.

Consumers have been able to count on GE lighting products for more than 130 years and will be able to continue to fully trust the GE brand as the lighting business transforms. GE's policy is to not release a product until its performance has been verified by the industry's most stringent testing regime. The company also continues to lead in advocating for quality standards and testing across the industry, to ensure that consumers are getting what they pay for. The EPA has recognized GE's leadership in quality and performance by awarding GE Appliances & Lighting its ENERGY STAR Sustained Excellence Award for five years straight, a designation the company intends to keep.

The solid-state future

For LED lighting products to really win mass acceptance, the retail prices of lighting devices must come down. This will happen as LED efficiency improves and volumes rise. Within eight or nine years, GE believes that 60-watt replacement LED bulbs will cost less than \$10. At that price, the economic payoff will be obvious and consumer use widely adopted.

The lighting industry is working with the U.S. government to speed the arrival of low-cost, high-quality, solid-state lighting. GE Lighting actively participates in Department of Energy conferences and activities, including the DOE's ambitious "roadmap" to reduce LED costs by around 20 percent a year through 2025.

The roadmap also calls for boosting the efficiency of commercially available warm white LEDs to exceed 150 lumens per watt by 2015.



Reshaping manufacturing

The transition of the lighting industry means big changes for major lighting companies, including GE. For starters, it requires different manufacturing. With demand for standard household incandescent bulbs having declined by 50 percent over the last five or so years, and the onset of lighting efficiency standards, GE Lighting has been reshaping its global manufacturing footprint and consolidating production of incandescent bulbs. That consolidation has led to the closure of some operations across GE's global lighting manufacturing network. GE takes the closure of any of its facilities very seriously, analyzing a number of factors before such a serious decision is made, in particular the impact on the work force. When GE does make a decision to close a facility, the company works very hard to provide affected employees with the benefits and assistance they need to make a positive transition.

GE also is investing in operations as it reshapes its lighting business. The company is investing \$60 million to create a global center of excellence for linear fluorescent manufacturing in Bucyrus, Ohio, an action that will double that plant's employment. Investment in its LED lighting business will increase more than 50 percent from 2009 and will result in the addition of approximately 100 engineering jobs and other positions to support the growth of energy-efficient products. In addition to many new products for professional and household applications, GE is also investing in innovative technologies that help accelerate cost improvements, making LED lighting products more affordable earlier.

Meeting customer needs from lamps to complete solutions

With the convergence of light sources with fixtures, along with the longer life span of new lighting technologies, demand for replacement bulbs will shrink dramatically. That will make designing, supplying, and servicing entire lighting systems more important to the future of lighting companies.

GE Lighting has already begun to transition in that direction. In January 2010, GE formed a new unit called GE Lighting Solutions, LLC. The unit is a combination of Lumination—GE's LED lighting business—with GE Lighting Systems, GE's production operation in North Carolina for outdoor lighting systems. GE Lighting Solutions is based at GE Lighting's headquarters at Nela Park in East Cleveland, Ohio. GE is adding engineers, designers, and salespeople around the world to work with commercial customers and retailers to develop custom lighting systems and solutions. By integrating design, manufacturing, and marketing of lamps, the reshaping of GE Lighting will enable the business to respond more rapidly to technology changes and serve a wider array of market segments and applications while filling customers' needs.

In June 2010, GE Lighting announced a licensing agreement to create flat-panel LED lighting systems for architectural and commercial lighting applications. By teaming with innovative global businesses, GE believes it will be able to get breakthrough products into the marketplace far more quickly. In a dynamic, rapidly evolving industry, this approach also gives GE tremendous flexibility to choose from a wide range of technology options.

The lighting technology revolution is fraught with technological, management, and marketing challenges for the entire industry. But these are challenges GE Lighting is well positioned to solve. After all, GE has been inventing the future of lighting ever since Thomas Edison flipped that switch in Menlo Park.

To learn more, visit GELighting.com/2012. 

Sources: GE Lighting, NEMA - National Electrical Manufacturers Association, U.S. Department of Energy, U.S. Environmental Protection Agency and ENERGY STAR

