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## How Many Lightbulbs Does it Take to Change the World? One. And You're Looking At It.

For years, compact fluorescent bulbs have promised dramatic energy savings--yet they remain a mere curiosity. That's about to change.

**From:** [Issue 108](#) | September 2006 | Page 74 | **By:** Charles Fishman | **Photographs By:** Christopher Griffith

Sitting humbly on shelves in stores everywhere is a product, priced at less than \$3, that will change the world. Soon. It is a fairly ordinary item that nonetheless cuts to the heart of a half-dozen of the most profound, most urgent problems we face. Energy consumption. Rising gasoline costs and electric bills. Greenhouse-gas emissions. Dependence on coal and foreign oil. Global warming.

The product is the compact fluorescent lightbulb, a quirky-looking twist of frosted glass. In the energy business, it is called a "CFL," or an "energy saver." One scientist calls it an "ice-cream-cone spiral," because in its most-advanced, most-appealing version, it looks like nothing so much as a cone of swirled soft-serve ice cream.

Most people have some experience with swirl bulbs, but typically it hasn't been happy. In the early 1990s, you would step into a room in a business traveler's hotel, flip on the lights by the door and between the beds, turn on the desk lamp and the floor lamp, then stand in the gloom looking around and thinking, "There must be another switch somewhere that actually turns on the *light*." Every one of the bulbs flickering to life was a compact fluorescent--and five of them together didn't provide enough light to read the card listing the lineup of cable-TV channels.

For two decades, CFLs lacked precisely what we expect from lightbulbs: strong, unwavering light; quiet; not to mention shapes that actually fit in the places we use bulbs. Now every one of those problems has been conquered. The bulbs come on quickly; their light is bright, white, steady, and silent; and the old U-shaped tubes--they looked like bulbs from a World War II submarine--have mostly been replaced by the swirl. Since 1985, CFLs have changed as much as cell phones and portable music players.

One thing hasn't changed: the energy savings. Compact fluorescents emit the same light as classic incandescents but use 75% or 80% less electricity.

What that means is that if every one of 110 million American households bought just one ice-cream-cone bulb, took it home, and screwed it in the place of an ordinary 60-watt bulb, the energy saved would be enough to power a city of 1.5 million people. One bulb swapped out, enough electricity saved to power all the homes in Delaware and Rhode Island. In terms of oil not burned, or greenhouse gases not exhausted into the atmosphere, one bulb is equivalent to taking 1.3 million cars off the roads.

That's the law of large numbers--a small action, multiplied by 110 million.

The single greatest source of greenhouse gases in the United States is power plants--half our electricity comes from coal plants. One bulb swapped out: enough electricity saved to turn off two entire power plants--or skip building the next two.

Just one swirl per home. The typical U.S. house has between 50 and 100 "sockets" (astonish yourself: Go count the bulbs in your house). So what if we all bought and installed two ice-cream-cone bulbs? Five? Fifteen?

Says David Goldstein, a PhD physicist, MacArthur "genius" fellow, and senior energy scientist with the Natural Resources Defense Council: "This could be just what the world's been waiting for, for the last 20 years."

Swirl bulbs don't just work, they pay for themselves. They use so little power compared with old reliable bulbs, a \$3 swirl pays for itself in lower electric bills in about five months. Screw one in, turn it on, and it's not just lighting your living room, it's dropping quarters in your pocket. The advantages pile up in a way to almost make one giddy. Compact fluorescents, even in heavy use, last 5, 7, 10 years. *Years*. Install one on your 30th birthday; it may be around to help illuminate your 40th.

In an era when political leaders and companies are too fainthearted to ask Americans to sacrifice anything for the greater good, the modern ice-cream swirl bulb requires no sacrifice. Buying and using it helps save the world--and also saves the customer money--with no compromise on quality. Selflessness and self-satisfaction, twirled into a single \$3 purchase.

So far, the impact of compact fluorescents has been trivial, for a simple reason: We haven't bought them. In our outdated experience, they don't work well and they cost too much. Last year, U.S. consumers spent about \$1 billion to buy about 2 billion lightbulbs--5.5 million every day. Just 5%, 100 million, were compact fluorescents. First introduced on March 28, 1980, swirls remain a niche product, more curiosity than revolution.

But that's about to change. It will change before our very eyes. A year from now, chances are that you yourself will have installed a swirl or two, and will likely be quite happy with them. In the name of conservation and good corporate citizenship, not to mention economics, one unlikely company is about

haul us to the lightbulb aisle, reeducate us, and sell us a swirl: Wal-Mart.

In the next 12 months, starting with a major push this month, Wal-Mart wants to sell every one of its regular customers--100 million in all--one swirl bulb. In the process, Wal-Mart wants to change energy consumption in the United States, and energy consciousness, too. It also aims to change its own reputation, to use swirls to make clear how seriously Wal-Mart takes its new positioning as an environmental activist.

It's a bold goal, a remarkable declaration of Wal-Mart's intention to modernize and green up a whole line of business using market oomph. Teaming up with General Electric, which owns about 60% of the residential lightbulb market in the United States, Wal-Mart wants to single-handedly double U.S. sales for CFLs in a year, and it wants demand to surge forward after that.

Diane Lindsley, the hardware buyer who decides what goes in the lightbulb aisles at Wal-Mart, thinks 100 million swirls is perfectly reasonable. "Yes," she says, "it's rational, I think." Before she started buying bulbs for Wal-Mart just three years ago, Lindsley didn't even know what CFLs were. Now she pauses in a way that suggests the kind of determination Wal-Mart can bring to bear when its buyers decide they are going to sell Americans something. "We have plans in place to where it may not take that long."

"Think how many games Wal-Mart has changed. There's no reason they can't change this game."

Which presents a daunting challenge: Wal-Mart's push into swirls won't just help consumers and the environment; it will shatter a business--its own lightbulb business, and that of every lightbulb manufacturer. Because swirls last so long, every one that's sold represents the loss of 6 or 8 or 10 incandescent bulb sales. Swirls will remake the lightbulb industry--dominated by familiar names GE, Philips, Sylvania--the way digital-music downloads have remade selling albums on CD, the way digital cameras revolutionized selling film and envelopes of snapshots. CFLs are a classic example of creative destruction.

GE, facing the prospect of mothballing a centurylong franchise in lightbulbs--well, GE is smiling and swallowing hard. "CFLs are taking off," says Robert Stuart, who heads consumer marketing at GE for lightbulbs. "No one has been as vocal about this recently as Wal-Mart. One hundred million bulbs in a year? It's an aggressive goal. GE will find a way to make sure they are able to do that."

GE, too, has launched a green business initiative: ecomagination, an effort to make environmentally sustainable technologies an ever-larger part of GE's business. Swirls fit well, despite the inevitable cannibalization. "The real issue is, if we don't do it, someone else will," says GE's ecomagination vice president, Lorraine Bolsinger, of Wal-Mart's effort to push CFLs. "It's old thinking to imagine that you can hold on to a business model and outsmart the consumer. You can't."

Steven Hamburg is an associate professor at Brown University, an expert on energy consumption and global warming who helped Wal-Mart think through the spiral-bulb strategy. "Can they change the game? Think how many games Wal-Mart has changed. There's no reason they can't change this game."

## **Fan-Fare**

For Chuck Kerby, it was ceiling fans that made the impact of energy-saving swirl bulbs dramatically clear.

Kerby is a vice president and divisional merchandise manager at Wal-Mart for hardware and paint (and ceiling fans) for all of Wal-Mart's U.S. stores and supercenters. Lindsley is one of 12 buyers working for him. Kerby, who started out collecting shopping carts from the parking lot of Wal-Mart #189 in Kirksville, Missouri, 23 years ago, has known about CFLs for years. "I became aware of them when I would travel and go into a hotel room."

Last year, conversations started in Wal-Mart around the potential of swirls to save customers money on utility bills. "Somebody asked, 'What difference would it make if we changed the bulbs in the ceiling-fan display to CFLs?'" says Kerby. A typical Wal-Mart has 10 models of ceiling fans on display, each with four bulbs. Forty bulbs per store, 3,230 stores.

"Someone went off and did the math," says Kerby. "They told me we could save \$6 million in electric bills by changing the incandescents to CFLs in more than 3,000 Wal-Marts. I couldn't believe it. I didn't know I was paying \$6 million to light those fixtures. I said, that can't be right, go back and do the math again." The numbers came out the same the second time: savings of \$6 million a year. "That, for me, was an 'I got it' moment."

It was Lee Scott, Wal-Mart's CEO, who started Kerby and Lindsley thinking about lightbulbs. "Last fall," says Kerby, "we had had two hurricanes"--Katrina and Rita--"we had oil production disrupted, we had millions of people displaced in the South, and at a Friday officer's meeting not long after Katrina, Lee Scott said, 'Our customers are hurting, our customers' dollar is not going as far as it could.' He challenged everyone in the room to find relevant rollbacks, to lower the price of living and make a difference for our customers." (Wal-Mart-ers really talk that way among themselves.)

In the wake of Katrina, Scott had asked his staff for a briefing on environmental issues, including global warming. One of the people he sat down with was Hamburg, the Brown professor who has won an award from the EPA for his ability to explain climate change.

"It was a very frank conversation," says Hamburg. Not much of a Wal-Mart shopper, he had looked at one piece of Wal-Mart's environmental performance before. In 1994, he critiqued Wal-Mart's first environmentally sensitive store. "As I told Lee, it was a lot of green-wash. He needed to do better....I said, 'What really matters is what's on the shelves. Wal-Mart's influence is much greater in the marketplace than in the built environment.'"

Hamburg has been working with CFLs since the 1980s, so that subject naturally was on the table with Scott. "I think he knew what they were," says Hamburg. "I said, 'It's a very direct return to your consumers, and it has a big positive impact on reducing carbon emissions. So let's do it. *You* do it.'"

The spirals, you could say, were converging. After Scott's exhortation at the Friday officers meeting, Kerby did what a lot of Wal-Mart-ers do when they need to think and reconnect. He went shopping at Wal-Mart.

"I went across the street to #100," says Kerby. "I thought about what people rebuilding would need, I thought about energy costs, I filled the cart, and I brought it all back to the office. I challenged the buyers to look for ways to save money on these important products." One item in his cart: a three-pack of GE compact fluorescents, 60-watt equivalents, for \$9.58--\$3.19 each. You could buy three four-packs of classic GE 60-watt bulbs for that price, 12 regulars for the price of one spiral.

To Diane Lindsley, her boss's point was crystal clear. "I called GE," says Lindsley. "We started negotiating."

Within two weeks, the price on a three-pack of GE spirals at Wal-Mart's across the country was "rolled back" to \$7.58. It was a 21% cut--although the bulbs were still \$2.53 each, 10 times the cost of an ordinary bulb. The agreement with GE was for a 90-day price cut, to help out after Katrina.

Did it make a difference in CFL sales?

"Absolutely," says Lindsley. "Faster than I've ever seen it before. In days."

Then, in late October, says Kerby, "Our friend Oprah had a segment on her show talking about CFL lightbulbs. We didn't ask her to do that or anything. But there certainly is an Oprah factor out there. That show led to a tremendous sales increase in the category that we have maintained to this day." Month over month, Lindsley is selling double the number of spirals she did before Katrina.

It was a perfect swirl: Katrina, Rita, \$70-a-barrel oil, price-chopping, corporate consciousness-raising, with Oprah's lightbulb club thrown in.

"What had started as, 'Let's do something to help the consumer for 90 days,' well, it became obvious this wasn't a 90-day strategy," says Kerby. "World events had changed the lightbulb category. The time had come for the energy-saving lightbulbs. It was going to be a different kind of product going forward."

## Inside the Bulb

Incandescent lightbulbs and spiral lightbulbs make light in entirely different ways, and it is that difference that makes spirals so potent. In a classic 60-watt incandescent bulb, light comes from the little metal filament quivering inside the sealed glass bulb. Electricity passes through the metal thread, heating it to 2,300 degrees Celsius, and the filament glows with the heat and throws off light. Electricity creates heat, heat creates light. It's why incandescent bulbs are so hot--the glass is often 300 degrees. In the trade, incandescents are sometimes known as "a hot wire in a bottle."

Compact fluorescents are something else again. In a fluorescent bulb, the glass tube is filled with gas and a tiny dot of mercury. Electricity leaps off electrodes on either end of the tube and excites the mercury molecules, which have a special property: When so excited, they emit ultraviolet light. That invisible UV light strikes the bulb's phosphor coating, which itself gets excited and emits visible light, which shines out through the tube. Heat is much less of a factor--CFLs run at about 100 degrees.

Making the ionized fog bottled inside a CFL dance to the same steady tune as an incandescent has required a lot of research, and an electronics revolution. Early CFLs cost \$25 per bulb (and still paid for themselves in electricity savings). The light they produced was bluish or pinkish, or varied; the phosphor coating had to be refined. The ballast--built into the bulb rather than in a separate fixture, as with traditional fluorescent tubes--hummed and didn't cycle the electricity quickly enough; it had to be made electronic and miniaturized. Costs came down, as did size. The same wizardry that gives us Hallmark birthday cards that play "Love and Happiness" makes possible CFLs at \$2.60 instead of \$25.

It is this--the way swirls make light--that saves so much energy. In an incandescent, only 5% to 10% of the electricity passing through the wire becomes visible light; the rest becomes heat and invisible UV light. The vibrating mercury vapor atoms in a fluorescent bulb produce light more efficiently than a tungsten filament. You get more photons for every watt of electricity pumped in. An old-fashioned incandescent makes 15 lumens per watt; a 60-watt bulb shines with 900 lumens. In a CFL, you get 60 lumens per watt. To get 900 lumens--to get the light you expect from a 60-watt bulb--you need only 15 watts.

A 60-watt classic bulb and a 15-watt swirl are identically bright--the swirl just uses 45 fewer watts.

## The Swirl Cascade

What really revolutionizes the lightbulb experience, and the business itself, is a second quality of swirls, beyond their ability to squeeze more light from a kilowatt: their longevity.

The compact fluorescents that GE, Philips, and Sylvania are putting on shelves are rated to run for 8,000, 10,000, or 12,000 hours. Few bulbs in a home are lit more than four hours a day; at that rate, an 8,000-hour bulb lasts five-and-a-half years; a 12,000-hour bulb lasts eight years and three months. As swirls take hold, it will be a surprise, a novel event, when a lightbulb goes dark. Imagine all those hard-to-reach bulbs that need to be replaced every three months. From four times a year, to once a decade.

"This is about selling lightbulbs, but it's far bigger. This has huge implications for the world."

And the impact of swirls cascades outward. Since every CFL has the life span of 6, or 8, or 10 equivalent incandescent bulbs, if Wal-Mart alone sells 100 million swirls in the next year, it does away with the need for 100 million old-fashioned bulbs to be manufactured, packaged, shipped, bought, and discarded next year--and every year until 2012 or beyond.

How much is 100 million bulbs? It's 25 million classic GE four-packs. That many boxes of bulbs would fill 262 Wal-Mart tractor trailers, a ghost convoy of Wal-Mart trucks, loaded with nothing but lightbulbs, stretching 3.5 miles--a convoy that will never roll. Every year for six years--just from one bulb, this year. Not to mention the line of garbage trucks necessary to cart 100 million burned-out incandescent bulbs to the landfill.

What you don't make, of course, you never get to sell. As enthusiasm for compact fluorescents mounted in Bentonville, there were multiple strategy meetings between the Wal-Mart lightbulb people and the GE lightbulb people--including a conversation January 12 between Lee Scott and GE CEO Jeffrey Immelt in which swirls were a significant topic.

GE had launched its ecomagination business push in May 2005--neatly summarized by Lorraine Bolsinger: "Green can be green." Scott launched Wal-Mart's sustainability repositioning last October in a speech to his own executives. Understanding the power of the CFL, Scott told them, had helped him see that environmental problems are really a disaster like "Katrina in slow motion." Pledging to take Wal-Mart and its customers and suppliers down a new path, he declared, "Environmental problems are *our* problems."

Immelt and Scott agreed in January that a major push on swirls was in order. But strategic enthusiasm doesn't change a simple short-term fact: Every new energy-saving swirl you sell obliterates sales of six or eight of your classic product. Incandescents won't ever go away--we still use candles--in part because there are some places CFLs simply don't work well. They are not tiny or elegant enough to be chandelier bulbs. They do not work as accent lighting. But in as little as five years, if Wal-Mart sparks a significant conversion to swirls, the lightbulb business will be rocked.

Total unit sales could be half what they are now. In the short run, there's a bonanza: 95% of sockets in U.S. homes don't have swirls in them, and a billion of them, or more, could. At the moment, with CFLs selling for 10 times what regular bulbs do, there's no immediate loss of revenue or profit. But prices won't stay where they are for long. At Sam's Club, Wal-Mart's club-store division, GE swirls already sell

at \$12.73 for an eight-pack--\$1.59 per bulb, or just six times the cost of old-fashioned bulbs. At that price, the economics change. Competition from other retailers will force the price even lower--especially because of what happens next.

Once a third of the sockets in U.S. homes have compact fluorescents--once you sell the bulge of conversion replacements--both incandescent sales and CFL sales will fall off a cliff. Incandescent bulb sales could be cut in half, because we won't use them any more. And after we've installed 1.5 billion swirls, we'll only be buying perhaps 200 million a year, because they're on a six- or eight-year replacement cycle. Executives at Wal-Mart are already imagining a day when the shelf space for lightbulbs is cut by 30% or 40%.

For Wal-Mart, the appeal of swirls is clear, even to GE executives. "Wal-Mart sees its customer putting more money in the gas tank, more into electrical bills--their customer is saying, 'I need some help,'" says Bolsinger. "They are very close to that. If they can help a customer save money in the long haul, that's money that comes back to Wal-Mart."

Once Wal-Mart decides to make swirls an important product, the appeal for GE also becomes clear. It's the power of the big dog: GE can either help Wal-Mart sell swirls, or some other lightbulb company will. In either case, GE's regular-bulb business shrivels. "The business case is pretty clear," says Bolsinger. "If we don't grab the market share of CFLs, we lose." The only way to survive creative destruction, in fact, is to get out in front of the tsunami, to catch the wave.

In the spring, Diane Lindsley changed the way she stocks her 60 feet of lightbulb shelves. Like other merchants, she has struggled for years with whether to group energy-saving bulbs in their own section for conservation geeks, or to mix them in with regular bulbs in the hope more customers will try them. Either way, particularly for a shopper schooled by Wal-Mart itself to focus on price, CFLs that cost 10 times what a dependable 60-watt cost are a hard sell.

Inspired by last fall's rush of swirl sales, Lindsley moved dramatically to emphasize them on her shelves. She decided to have it both ways--to group CFLs together and mix them with regular bulbs. She has made swirls the most prominent bulbs in the store: They are now on the top two or three shelves, at eye level, with the old-fashioned bulbs on the bottom. The prominence is eye-catching--three or four sections of shelves, with bright yellow and green packages of GE CFLs. Horizontally, the swirls form a band of energy savers that stretch down a third of the aisle. Vertically, each shelf unit is both energy savers and incandescents -- 60-watt-equivalent swirls on top, old-fashioned 60-watts below.

For bulbs, "that's the most coveted shelf space in the entire store," says Bolsinger. "It was a bold move on Wal-Mart's part to put it there." Lindsley was taking a risk, giving swirls shelf space their sales didn't quite justify. She was positioning them prominently to drive sales, and in anticipation of more growth.

An even more dramatic push is coming this month, when Wal-Mart will roll out a lightbulb education center in every U.S. store. The display, developed with GE, shows 10 categories of lightbulbs, organized by room through a typical home, with a box showing the CFL appropriate in that area, the equivalent incandescent, and the energy savings a customer can reap from switching. Each category features a warm lifestyle photo of the room in question. Each box is color-coded to match color-coding on the shelves of CFL bulbs.

For a company that measures sales of its merchandise per running foot of shelf space, giving up 12 feet of stock space to a static display, however entrancing, represents a significant investment. Lindsley is evaluated in part based on the bulbs she sells, and "I have to perform, of course," she says. "I have to

have my sales. I think about it differently. I think about it daily. But this is absolutely the right thing to do."

This is at least as big a deal for GE. Between 2004 and 2005, it tripled its manufacturing capacity for compact fluorescents. By the end of 2006, GE will have tripled capacity again. Anticipating the shift to swirls, it plans to close an incandescent bulb factory in St. Louis.

Making compact fluorescents is expensive and complicated, compared with incandescents, in part because of the electronic controls each bulb contains, and in part because swirls remain partly handcrafted. To make each spiral, a Chinese worker wearing gloves takes a tube of glass, holds it over an open flame, then wraps the heat-softened tube around a metal form. The job requires a deft touch so the tube doesn't become flattened while getting its spiral shape.

"For us," says Bolsinger, "the opportunity is to sell enough of them, to get down the [manufacturing] cost curve. We're still pretty early in the learning curve." Greater automation would allow GE to both continue to reduce the price of swirls and keep a margin that softens the blow to the incandescent side of the business.

This fall, GE will rebrand its CFLs as "energy smart" bulbs--in an effort to give them a clear identity equivalent to "soft white"--and launch a major print advertising campaign to support the Wal-Mart push. Working with Wal-Mart, GE has made its bulb packaging both more dramatic and more explicit--it promises that the 60-watt equivalent "saves \$38 in energy." Spend \$2.60, earn \$38. These days, that's a great return.

At the Wal-Mart home office, they talk about swirls with a zeal that goes beyond product promotion, as if the bulbs are a pioneering product, a new way of thinking about retailing. Says Andrew Ruben, Wal-Mart's vice president of sustainability: "We realize that we can influence big things. Energy usage. Efficiency. Dependence on foreign oil. And we realized that if we're really going to move things, it's not about our direct footprint--our stores, our offices--it's about our supply chain and our customers. So this is about selling lightbulbs, but it's far bigger. This has huge implications for the world."

Chuck Kerby did swap out the ceiling-fan bulbs, at least in most Wal-Marts. The idea surfaced in November; it was executed in February. And Kerby has a clear vision of the future.

"It's certainly possible to see a day when a cartoonist will draw a cartoon with a character having an idea," says Kerby, "you know, with the traditional-shaped incandescent lightbulb going on over the character's head--and my grandchildren will look at that and not know what it means. And that's not a bad thing, because we'll be living in a much better world."

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