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CFL Fluorescent Light Bulbs: More Hype Than Value

I used to like fluorescent lights and then I changed my mind.

As the years passed, I found more and more folks like me, and more and more reasons to be uncomfortable with fluorescent lights. When some people see that I don't use them, they try to tell me about how great they are. When I try to explain why I prefer incandescent, I nearly always get a dismissive wave - signaling that I am clearly a fool and whatever tripe I am about to utter is clearly not worth their time. This article represents a glimpse into that tripe.

http://www.richsoil.com/CFL-fluorescent-light-bulbs.jsp

If you leave all of the lightbulbs in your house on 24/7, then replacing all of the incandescent light bulbs in your house with CFL light bulbs will save you money. For people that typically leave lights off when not in use, it turns out that incandescent light is cheaper than fluorescent light - the exact opposite of what we have been told all these years.

With a little knowledge, you can stop wasting money on CFLs. Both in the short term and the long term. The long term stuff includes tax issues and the toxicity tie-in which leads to superfund cleanups and medical bills.

In a nutshell:

- CFLs do not last as long as is claimed
- Many CFLs provide 42% less light than claimed
- CFLs put out 20% to 30% less light as they get older

With these three things alone, I will make a rock solid

case of how incandescent lights are cheaper than CFL. But there's more:

- CFLs are subsidized to make them appear cheaper
- the toxicity of a CFL is downplayed
- there are better ways to save electricity than fiddling with bulb type
- There are incandescent bulbs that are claimed to last longer than fluorescents
- There are new incandescents coming out that give off more light per watt

CFL bulb longevity

Supposedly, a fluorescent light bulb will last ten times longer than an incandescent. It says so right on the box. When my CFL bulbs seemed to burn out faster than my incandescent bulbs, I thought I was doing something wrong or I had bad batch of bulbs. Most of the people I visited with about CFLs reported that they were experiencing something similar. So I started to do more research.

Here is a "100 watt long life incandescent light bulb" on amazon for $1.52. It says that it has a lifespan of 25,000 hours. Apparently, a standard bulb has a lifespan of 1000 hours. Here is a "100 watt equivalent CFL" on amazon for $2.87. It claims a

lifespan of 8,000 hours. I searched for "CFL 100" and came up with bulbs claiming a lifespan of 6,000 to 10,000 hours. The claim of 8,000 hours seemed the most common.

Fluorescent light bulbs don't do well when they are turned on and off a lot. While this is true of incandescent bulbs as well, fluorescent bulbs are far more sensitive this way. Wikipedia says "In the case of a 5-minute on/off cycle the lifespan of a CFL can be reduced to 'close to that of incandescent light bulbs'." Most household light bulb use is less than five minutes: a trip to the bathroom; looking in a closet; a snack from the kitchen; find something in the bedroom; etc. Optimal use for a fluorescent light is to be left on all the time at temperatures between 50 and 80 degrees (F). You can still experience savings when an area needs to be illuminated by artificial light for ten hours or more at a time. But for most households, the need is for a few lights to be on for an hour in the morning and two to five hours at night, and most lights to be on for one to ten minutes as needed. If you try to leave the light on longer so the bulb will last longer, the electricity savings are then lost. A more accurate longevity statement would be "250 to 10,000 hours depending on use."

In this mythbusters light bulb video a group of different light bulbs are turned on and off every two minutes for six weeks.

This makes for 504 hours of time that the lights had power - although they probably burned out before the 504 hour mark. The incandescent and both of the fluorescents were dead at the end of six weeks. I suspect that the 1000 hour rated incandescent outlasted the 10,000 hour rated fluorescent - but they don't say. The important lesson here is that the fluorescent light bulb failed before reaching 5.1% of its rated lifespan (and, yes, the incandescent failed before reaching 51% of its rated lifespan).

I needed more information. Which led to the creation of this video:

Short tangent: A friend of mine told me about how boats long ago used incandescent bulbs that were re-usable. The bulbs all had a way of opening them up and replacing the filament. And the boats carried a light bulb repair kit, complete with a bunch of filaments. Imagine: a light bulb that lasts forever. You just have to mend it with a bit of filament every couple of years. Maybe filaments come in 100 packs for $5.

CFL manufacturers exaggerate brightness

The author of this CFL article used a light meter to measure the light coming from four different 60 watt incandescent bulbs and five different fluorescent bulbs claiming to have light equivalent to a 60 watt bulb. The result was that the average incandescent bulb was 64.5% brighter. And the results were shockingly consistent.

CFL decrease in lumens over time

Fluorescent lights put out less light over time. I remember when I used to use fluorescent bulbs, when I replaced a bulb of the same power, the new bulb seemed about twice as bright as the old bulb. But when I replace an incandescent bulb, they seem about the same level of bright. Is it possible that all of the money saving claims of the CFL producing four times more light per watt is based on a brand new bulb? Maybe they should say that it produces the same light as a 60 watt incandescent bulb in the beginning and a 30 watt incandescent bulb at the end. It turns out that my instincts were not too far off. From wikipedia: "CFLs produce less light later in their lives than when they are new. The light output decay is exponential, with the fastest losses being soon after the lamp is first used. By the end of their lives, CFLs can be expected to produce 70-80% of their original light output."

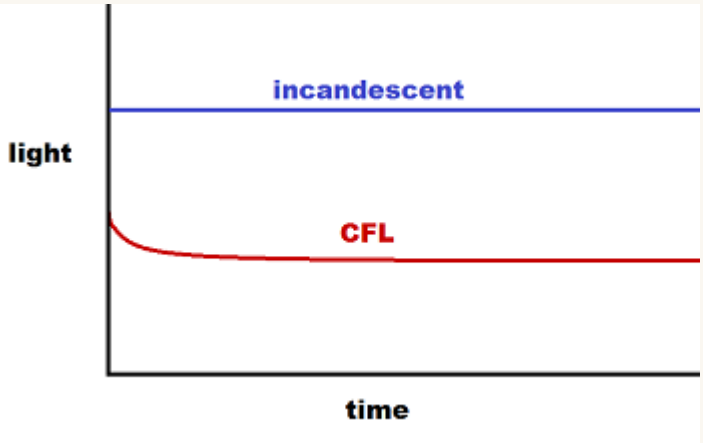
net CFL light per watt correction

At this point I need to combine the light per watt information we have so far. To do this, I want to imagine a room (A) with 100 incandescent lightbulbs, and another room (B) with 100 CFLs. The goal is to figure out how many more CFL lightbulbs we need to add to B have the same average light as A. Which is what is advertised on the CFL box.

Starting with the exaggeration, we have to add 64.5 bulbs. So we now have 164.5.

Next we have the issue of the bulbs giving off less light as time passes. So if the light starts at 100%, quickly degrades to 80% and then slowly ends up 75%, then a rough average approximation of that is 80%. It's as if I put in five light bulbs

and one does not work. To go from four working lights to five, I need to add one. From the perspective of the four bulbs, I need a 25% increase. 25% of 164.5 is 41.125. This brings us to a total of 205.625.



To get the brightness claimed by the CFL manufacturer, we need more than twice as many CFLs. I'm going to use the number 105.6 and call this "the CFL brightness adjustment".

There are claims that a CFL gives off three to five times more light per watt than incandescent. A 10 watt CFL claims to put out the same amount of light as 40 watt incandescent bulb. Four times more light. When we factor in "the CFL brightness adjustment", we need 1.056 more light bulbs. In the end, this means that the CFL is 1.95 times as bright as the incandescent. This is the number I am going to use for the rest of this article as the actual light per watt improvement.

CFL performs poorly for first two minutes

First, a fluorescent light uses about 20 times more power in the first second to get started. So, for a two minute cycle, the total power consumed is 16% higher. Then it can take one to three minutes to reach full brightness. At first, the light might be giving off only 30% of it's maximum light. So if you are only using the light for a minute or two, the efficiency of light per watt is worse than incandescent. If the light is in a place where you never have the lights on more than a minute or two, CFLs are far more expensive than incandescent. Both for the cost of the bulb and for the cost of the electricity.

Between the mythbusters thing and the wikipedia article, I think it is fair to say that if 100% of the use of a CFL is a series of two minute jobs, the overall lifespan of the bulb is closer to 500 hours. Probably less.

Three minutes seems the most common. So if we assume 30% at time zero, and 80% at two minutes, that makes for an average of 55%. When you work in the extra power, this makes the two minute scenario roughly double brightness adjustment.

CFL performs poorly in the cold

Most fluorescent lights don't work in the cold. Some fluorescent lights have been modified with special ballasts to tolerate temperatures below freezing, but they will still fail when it gets to, say, zero (F), although I have heard of some that will go a little colder.

CFL bulbs are toxic

Every fluorescent light bulb contains toxins. Primarily mercury. The toxin issue is severe enough that you are not supposed to throw them away when they die. You are supposed to dispose of them in an appropriate facility. I guess people are supposed to drive their light bulb to the facility for proper disposal? I would call that an extra expense for CFL - your time has value and the fuel to drive there costs something (tiny CFL funeral arrangements are optional). How many people know that fluorescent bulbs are not to be thrown in the garbage? I suspect that 99% of dead fluorescent light bulbs get thrown in the garbage and their toxins can do their toxic thing.

When a CFL breaks in your home, that toxin is now in your home. Do NOT touch the mercury! Cleanup and proper disposal is far too complicated to go into in this article. Here is a stressful story.

A case has been made about the toxicity where if you figure in the amount of energy saved by a fluorescent light bulb, and you work in the average amount of power that comes from coal, and the amount of mercury that is in coal, then if you assume that a fluorescent bulb lasts 10,000 hours, then there is less mercury overall with the fluorescent path.

Put a different way:

From wikipedia: assume 8000 hours of light. The incandescent will be responsible for 5.8 mg of mercury pollution from coal plants, and zero from the bulb. The fluorescent will be responsible for 1.2 mg from the coal plants and 0.6 mg in the bulb.

I have two concerns with this:

> Concern 1: A CFL has three to five milligrams of mercury per bulb. The report elected to count only 0.6 mg because that is what they estimate would leak out of landfills. Therefore, the rest is trapped in the landfill and they are okay with that. I'm not. Next, there is the lifespan of the bulb. 8,000 hours is reasonable for a light that is left on 24/7. For lights in a typical home, 1,000 hours is more accurate. Their report shows the incandescent uses 5.8 mg from the power plants and the fluorescent uses 1.2. So the incandescent uses 4.8 times more power? Further, the report is trying to convey pollution per lumens, so this calls for "the CFL brightness adjustment". My math says 16.4 CFL bulbs with 4 mg each of mercury plus 3.0 mg of pollution from coal. That makes CFL come in at about 68.6 mg of mercury pollution. 11.8 times dirtier than incandescent. And that's just for mercury toxicity - there may be other toxins in CFLs.
>
> Concern 2: Instead of justifying toxic light bulbs with information about how toxic power generation is, I propose we use the non-toxic light bulbs and work on cleaning up our pollution generating power plants. Until the power plants are cleaned up, we can focus on other ways of saving electricity that are far more effective (later in this article).

More on CFL toxicity in the forum thread CFL Toxicity.

CFL bulbs are toxic even when unbroken

People are reporting migraines, rashes and epileptic seizures caused by the CFLs. Lessor concerns are general ill feelings, achy joints, anxiety and common headaches. I've had one report of school children gaining 20 IQ points when moved from a CFL environment to natural light augmented with incandescent

light.

"Dirty Electricity" and EMF radiation is something people debate about, but the people in this video know that the bulbs make them sick, but they cannot explain why. So, are they lying? Is their illness legit? And yet, with incandescent, there is no problem.

In this video, the reporter has heard from 400 people who are certain that CFLs made them sick. There is also some concern about whether CFLs cause cancer.

If you mix a dimmer with the wrong CFL, your house can burn down:

Even without a dimmer involved they catch on fire:

CFL subsidy

This is an area that is massive and complicated. So all I can really do in this article is a bit of a summary and provide some links.

One can buy fluorescent light bulbs for about a buck a pop. Sometimes you can get them for free. Even a whole case of them for free. They used to be something like $20 each. And then for a while, there were government coupons - so you could get them for just $8 each. Then the government made it even easier for the consumer and just gave the money directly to the manufacturer or store or both - no coupon hassle. Many levels of goverment are now involved in doing this, plus power companies. The key is that a free light bulb is not really free. You paid for it with taxes and a higher electric bill. And because all this "free" stuff doesn't happen by itself, there are a lot of people that get paid to shuffle all of the paper and boxes to make it free.

A couple of quick links. Here is a New York Times article about government wanting even more funding for CFL subsidies ("*An official at the Department of Energy's Energy Star program has issued a grim assessment of the market for compact fluorescent light bulbs, or C.F.L.s, and is urging that funding for utility*

incentive programs be intensified."). A reader sent me this link to a blog referencing lots of sources on CFL subsidy ("*Why should taxpayers and utility customers subsidise an arbitrarily chosen product with numerous quality problems and safety issues that customers don't like, to give it an unfair market advantage over other products that customers prefer due to their safety, reliability, versatility and higher quality?*").

Now the government is banning the sale of most incandescent bulbs. With the ban just a couple of months away, I've been watching the stores to see if the incandescent stock dwindles (and stocking up on incandescents). There still appears to be just as many incandescent bulbs as fluorescent. Even with the subsidy, and "obvious energy savings", fluorescent is having a hard time outcompeting incandescent.

Here is a short video I made to try to explain some of this:

For more on CFL subsidies, see the forum thread CFL subsidies

CFL ROI

I received a newsletter from my power company about how the best ROI (return on investment) with electricity is fluorescent bulbs (I'll talk about what I think is the best ROI later in this article). As part of their math, they made the cost of the incandescent bulb the same as a fluorescent. And then they went on to lean on the thing about how the fluorescent supposedly lasts ten times longer. They appeared to suggest that people throw away their perfectly good incandescent bulbs. They neglected to mention that the cost of fluorescent light bulbs is subsidized by our taxes and by their company (which I then pay for via my electric bill - which is supposed to be regulated by another branch of government). If you update the calculation to reflect the actual cost of the fluorescent bulb, the actual lifespan and the actual brightness, the ROI turns out to not exist.

In the table below, I am calculating 20,000 hours (because that's how long the longest lasting bulb runs) of light at five cents per kwh (that's what is on my power bill). And then I try to work in compensation for "the CFL brightness adjustment". I also try to throw in my speculations for the horrendously complicated space of subsidy.

bulb	advertised cost	actual cost to get that much

			light		
	bulb	power	bulb	power	total
40 watt incandescent 1000 hour lifespan $0.47 each	$9.40	$40.00	$9.40	$40.00	$49.40
long life 40 watt incandescent 20,000 hour lifespan $1.82 each	$1.82	$40.00	$1.82	$40.00	$41.82
10 watt CFL 8,000 hour lifespan (claimed - could happen in rare, optimal conditions) $2.65 (subsidized)	$7.95 (subsidized)	$10.00	$16.35 (subsidized)	$20.56	$36.91 (subsidized)
10 watt CFL 1,000 hour lifespan (more realistic) $2.65 (subsidized)	$53.00 (subsidized)	$10.00	$108.97 (subsidized)	$20.56	$129.53 (subsidized)
10 watt CFL two minute scenario 500 hour lifespan $2.65 (subsidized)	$106.00 (subsidized)	$10.00	$435.87 (subsidized)	$41.12	$476.99 (subsidized)
cheap 10	$240.00	$10.0	$493.44	$20.5	$514.00

watt CFL unsubsidized 1000 hour lifespan (speculating that a poor CFL has a lifespan just as short as a poor incandescent) $12 (speculation on unsubsidized cost)		0		6	
quality 10 watt CFL unsubsidized 10,000 hour lifespan $25 (speculation on unsubsidized cost)	$50.00	$10.00	$102.80	$20.56	$123.36
cheap 10 watt CFL subsidized - reflect subsidies and subsidy management in cost of bulb 1000 hour lifespan $32 (speculation)	$640.00	$10.00	$1315.84	$20.56	$1336.40

If your focus is entirely on short term money, and you don't care

about the toxicity, or the subsidy stuff, and you have a situation where the lights stay on eight hours or more at a time, then in that scenario, CFL will be about 10% to 20% cheaper than incandescent. For everything else, incandescent is cheaper.

Try it yourself. If you have a "60 watt equivalent" bulb that has been used for a while, replace it with a 40 watt incandescent. If the CFL packaging is accurate, you should notice that the CFL is much brighter.

Whether the subsidies add up to $3 per bulb or $50 per bulb. CFL is still more expensive than incandescent.

For more on CLF brightness and logevity claims, please see the forum thread CFL brightness and longevity claims

podcast on deeper ugliness of the CFL

My friend Andrew Monhouse shares some powerful information that you probably never heard of.

- Andrew has epilepsy and can feel a siezure coming with modern CFLs
- Andrew is from Australia where incandescent bulbs were banned two years ago - and here is what happened

And we cover a lot of the general nastiness with CFLs

Podcast 100: compact fluorescent lamps

an excellent summary on the role of light bulbs in energy conservation

better ways to save money on electricity

I have a frugal friend named David. When we get together, we frequently bicker about frugality. Then David went to Mexico for four months and needed somebody to watch his house. I just

happened to be moving at the same time and it worked out for me to stay there. The first thing I did was replace the CFLs with incandescent lights. Over the four months I practiced all of the things that I think are frugal. For the seven years that David lived in that house, he never got his monthly power expense lower than $50. I got it down to $15.

David and I both work from home, so this little test will have a lot of apples to apples comparisons.

my lighting habits

Since this article is really about CFL, I want to point out that with my lighting habits, it probably doesn't really matter what sort of light bulb I use. During the day, I rely on daylight. At night, I turn on a single 40 watt incandescent light pointed at the ceiling. As I use the kitchen or bathroom, I'll use those lights for a few minutes. Just before bed, I use a 40 watt light in the bedroom for a minute or so. I use a few LED night lights.

Supposing I use the main light for three hours per night, that would be 1.2kwh in a month. 15 cents for a month. If CFL lived up to its claims, I might save a dime a month. It just isn't worth screwing with.

All of my lighting stuff might add up to 40 or 50 cents a month. I think David uses more lights. Maybe $1.50 or $2 per month.

So when I see massive campaigns to save energy by switching to CFLs, I cannot help but think that even if CFLs worked as claimed, it would require that people use lights hundreds of times more than I do. And I have a really hard time imagining people doing that. People must be turning on all of their lights and leaving them on all day and all night. In which case, they will save far more money by turning their lights off when they are asleep, or not home, or pulling back the curtains during the day. No trip to the store required.

the clothes dryer

To dry my clothes in David's really old dryer typically took an hour and a half. The average dryer uses 4,400 watts. So this works out to 6.6kwh. The cost of electricity at David's house is 12.5 cents per kwh. So each load of laundry is $0.825. At two loads per week, that works out to $7.095 per month. I have these

spiffy clothes drying racks I use.

heating

David's place uses electric heat. I know that David will wait until he feels cold until he turns the heat on. David is developing a healthy relationship with the thermostat: turning it up when he feels cold, turning it down at night, keeping it low when he is away, etc. I set the thermostat to 50 and when it started to get cold I would warm my immediate area. Mostly, I sat on a heating pad set on its lowest setting - the kind that you are supposed to use for a sore back. Using about 15 to 20 watts I think. Sometimes I used a personal heater set at the lowest setting. And about once a week in October I actually turned the central heat on for an hour.

I stayed at David's for July, August, September and October. And a pinch of November. There were a few days in the summer that got pretty cold - and I think David would have turned on the heat for the day. And then in September it got a lot colder. I think David would have run the heat nearly every day in October. Overall, I would guess that in July and August I cut $10 off the electric bill by using less heat. And then $25 in September and $50 in October.

Since then, I spent a winter in Montana, experimenting with all sorts of frugal personal warming stuff. I wrote about making the best of electric heat.

On the topic of heating, I have a house design that requires no heat. And for heating with wood in a conventional home, folks should be aware of the rocket mass heater which can heat your home with five times less wood.

computers and phantom load

David and I both work on computers all day. David does stuff to mitigate phantom load. I don't. We both use big tube-style monitors. Maybe I could have carved another 20 cents off of the $15 per month if I fiddled with the phantom load stuff - but I think it is too small to bother with.

hot water

I take shorter showers and I use a lot less water to wash dishes. I

also wash my clothes with cold water. I would guess that I saved $15 per month by using less hot water.

the fridge

I filled the fridge with stuff. Including bottles of water I had no intention of drinking. I imagined that every time I opened the door, all of the cold air would spill onto the floor. With the fridge full, there is less air to re-cool. I would guess that that trick saved about $4 per month.

cooking

I think David and I are equally matched in how often we eat out vs. eating at home. Although David does a lot more with coffee and tea than I do. I make my coffee with this spiffy electric kettle that uses about a third the power of stove top kettle. My math says that David's coffee and tea costs about $5 per month in electricity. I'm rolling in at about 25 cents.

other ways to save electricity: summary

As I mentioned earlier, David and I bicker about this stuff. And for each point, every person has a different theory. And there are a lot of articles out there written by people that think they are saving power, but their power bill is still $200 per month. The key is what does the power bill say in the end.

For more information and to discuss more about my time at David's please visit this forum thread: bragging about my lower energy footprint.

My time at David's also inspired this forum thread: 20 ways to REALLY reduce your summer utility bills

an interesting thing for those with incandescent lights and electric heat

Supposing it is a really cold day and you will use a LOT of electric heat, then consider this: Every electric thing you run gives off heat. According to the laws of physics, it gives off the exact same amount of heat as your electric heater would put out. So if you were gonna use 10kwh of heat for the day, but you used 7kwh for lights, cooking and stuff like that, then you will

end up using only 3kwh to run the heater to the same temperature. In other words, on a day that you are gonna run your electric heat, you get FREE electricity for everything else! Sort of. :)

Since it gets dark so early in winter, turn on lots and lots of incandescent lights! Make it plenty bright inside! It's free light! Do plenty of baking and cooking on that electric stove. Run the vacuum. Make toast. This would be a great time to do some canning! Or maybe run the self cleaning oven!

last bit about incandescent: new bulbs with more light per watt

The new law coming out that bans incandescent light bulbs, doesn't *exactly* ban incandescent. It just bans lights that have the light per watt that a standard incandescent has. So it looks like the next generation of incandescent will be more efficient.

A 43 watt that light bulb produces the same light as a 60 watt bulb. So it produces about 40% more light (or, you could say it produces the same light as a 60 watt bulb using 28% less electricity).

A 55 watt that light bulb produces the same light as a 75 watt bulb.

A 72 watt that light bulb produces the same light as a 100 watt

bulb.

CFL Light Quality

This next vid is for those folks that say that CFL does not flicker.

This video gives a good idea of how long it takes fluorescent lights to get to their full brightness

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