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Article:Are U.S. CFL's Designed to Make Us Pay More on Our Power Bills?

From PESWiki

(Redirected from Article:Are U.S. CFL's Designed to Make Us Pay More on Our Power Bills)

In Europe, a small capacitor is added to Compact Fluorescent Lamps for power conditioning and additional savings on the utility bills. Similar savings can be realized on AC motors. Why are these inexpensive modifications omitted from U.S. CFLs and many residential motors?

See our page on Directory:Power Factor Correction for a list of companies and devices available for residential power factor correction at the service box.

By Steve Windisch

August 25, 2008

(First published Op-Ed News 8-16-2008)

Adapted for *Pure Energy Systems News* by Sterling D. Allan

There is much talk about Compact Fluorescent Lamps (CFLs) recently. These are the small glass fluorescent tubes often shaped into a coil, designed to directly replace regular incandescent light bulbs. These new CFLs have been touted to save energy, and they do certainly save significant amounts of electricity. But there are some interesting and largely unknown facts about these devices. It would appear that those sold within the United States and other countries may be specifically designed to allow the utility corporations to bill us nearly double what we should be paying for their use.



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Simple Power Factor Correction Capacitor Could Increase Savings

The problem lies in the combination of two factors: First, the CFLs sold in the U.S. are generally built without the addition of a low-cost capacitor to provide something called Power Factor Correction; and second, the way in which our power companies calculate our monthly bill using “AC Apparent Power” instead of “AC Real Power”. Together these factors insure we are not able to see all the possible savings on our electric bills that these new lamps should offer. And in fact, when “AC Power Factor” in consumer devices is examined closer in general, it would seem that CFLs are only the tip of the iceberg when it comes to home and small business customers paying more than they should for power, to a truly staggering extent -- all for the want of a low-cost capacitor.

One would suspect the electric utility corporations do not want you to know this, but it is nonetheless fact anyway: The power companies charge their non-industrial customers using something called “AC Apparent Power”. This is not the same as “AC Real Power”; which takes into effect “AC Reactive Power” caused by electrical Inductance. The difference between Real and Apparent Power is called the AC Power Factor, and is generally determined in these cases by the phase angle difference between the AC Voltage and the AC Current across a device. This phase shift is commonly seen with induction devices such as Compact Fluorescent Lamps, and more importantly, AC motors like those used in common consumer home products such as refrigerators, freezers, washing machines, and air conditioners (by far the greatest users of power in the home).

In large industrial applications, this Power Factor is routinely “corrected” by adding electrical capacitance to the circuit, to “balance” and remove the phase angle difference, bringing it to a state approaching “Resonance”, and thus insuring greatest efficiency. However, Power Factor Correction is mainly unknown in American consumer products; so the “unbalanced” motors and other devices such as CFLs are reported on the Customer’s billing meter to be using more power than they would be consuming if properly built, or if the power companies actually charged us by Watts as they now wrongly claim. And thus many of us are being charged more on our power bills by a significant amount every month than we should be.

When using the Compact Fluorescent Lamps (which are Inductive in nature; meaning they use inductive coils in the circuitry to step-up the voltage of internally-generated pulses to power the fluorescent tubes), there usually is a Power Factor difference of “.55” with the non-PF corrected ones sold here in the U.S.; which means that the “Real Power” figure in Watts is almost half what the Apparent Power figure is. So although these bulbs are indeed saving energy; the electric company is charging us almost double what the actual Watt rating would denote. Simply adding a few low-cost components (mainly a capacitor) to Correct and “balance” the Power Factor would eliminate this. CFLs sold in the European Union appear to always have these low-cost items added into the internal circuitry of the CFL already. When considering the Power Factor of an appliance's AC inductive motor, the consumer can pay up to 25% more in the cost of electricity for operating that device if there is a phase imbalance (which there will most likely be unless a capacitor is added for PF Correction). And literally hundreds of millions of AC motors in U.S. consumer appliances today are not Power Factor Corrected.

Regular “old fashioned” incandescent light bulbs (which are “Resistive” in nature and exhibit very little

AC inductance or capacitance and therefore no phase shift), have an AC Power Factor very close to “1.0”; therefore Real and Apparent Power are virtually the same. So if rated at 75 Watts, then the consumer is charged by the electric company for 75 Volt-Amperes. It is interesting to note that Apparent Power figures should never use the “Watts” metric, and should always be stated in “Volt-Amperes (V/A), although this is not the case with our power companies who erroneously bill us by the “Kilo-Watt Hour: When in fact the residential and small business meters only read Apparent Power and not Real Power. We can easily check this for ourselves: Go outside to where your billing meter is, and look at the dial: It reads in “Volt-Amperes.

Compact Fluorescents designed to replace 75 Watt incandescent bulbs are usually rated by the manufacturer for an impressively low “18 Watts (an AC Real Power figure). The universally-repeated misinformation is that these bulbs use “only about 25% of the power the old-style bulbs do: This is not precisely the truth. In actuality because CFLs sold here in the U.S. have significant inductive Reactance and thus an AC phase difference between Voltage and Current, the Power Factor of the CFL is around “.55. And since we are being charged by the utility in Apparent Power, the draw on our billing meter is actually about 33 Volt-Amperes of power -- nearly double the figure in Watts. And thus is revealed a chronic and institutionalized over-paying by consumers of our electric utility bills: Only because a small low-cost part was left out when our CFLs and appliances were manufactured. Deliberately left out? That is a question which deserved further investigation.

There are Compact Fluorescent Lamps that have a “resonance tuning” capacitor circuitry added internally to solve the phase angle difference and provide a Power Factor near “1: These appear to be sold mainly in Europe; and this was rumored to be done at the insistence of the European testing agency TUV who have some ability to stop imports which do not meet their design criteria. These Power Factor Corrected lamps are not generally seen for sale here in the U.S. (apparently the “U.L. Approval” stamp we are familiar with here does not represent quite so picky a testing regimen). The cost of adding the capacitor to CFLs in mass production would be only a few pennies; and there is no chance at all that any electrical engineer with General Electric or its competitors would not fully understand AC Power Factor: It has been known, taught, and extensively written about for over 100 years. It is just that since the end of World War Two, PF Correction technology has all but disappeared from American consumer products -- as well as the consumer awareness for this important money saving technology. This is certainly not the case in industrial settings or with large buildings. Power Factor Correction is very important in these cases and banks of AC capacitors up to the size of oil drums can often be seen in power rooms for this express purpose. This is because in industrial and large commercial billing, the power companies will usually charge in Real Power, but also charge a penalty if the Power Factor is not within a certain limit. In these cases, since the power company is the one “holding the bag” not the consumer, they are very helpful, and even insistent, when it comes to Power Factor Correction: Providing much information and even consulting help to solve the issues. Is it not odd that they never mention this issue to us, the consumer? Considering we are the ones who pay for the Apparent Power difference when it comes to homes and small business, not them: It then becomes understandable (if “not exactly” ethical).

CFLs offer a great savings in energy, and are very worthy of use in themselves (Power Factor considered or not). However the power companies are benefiting from their use because of a design flaw. Although we can still save 50% by their use over incandescent bulbs, we should be saving 75%. But again, the differences here pale in comparison to what we could be saving on our bills when it comes to Power Factor-Corrected AC induction motors. A few home appliances and some business equipment devices do offer this technology installed by the manufacturer, but most do not in the U.S. If they all did, then we could be saving many billions of Dollars collectively on our power bills each month. This is not so much a “green” energy savings issue, but more a question of billing between the consumer and our electric utilities -- or perhaps an issue of our appliance and CFL manufacturers not adding the Power Correction technology that they should have, and that is already enjoyed by our European friends. This is mainly because of the European Union’s mandated standard #IEC61000-3-2 regarding consumer appliances of over 75 Watts requiring harmonics distortion protection and Power Factor Correction; which was also closely followed by Japan, China, and many other countries -- but largely ignored in the United States. (Please note that European appliances built before the law came into effect in January, 2001 may not have PFC technology installed. But those sold afterwards in Europe, including those built and exported

by American manufacturers, do have Power Factor Correction; just not the ones sold within the U.S.).

The above technical information can be verified by use of a “Kil-A-Watt” or similar power meter, or by use of an oscilloscope measuring the phase angle between Voltage and Current, and then doing the calculations manually. Any text books for the last 100 years on AC electricity can fully explain the meanings and relationships between the terms Phase Angle, Apparent Power, Real Power, Power Correction Factor, Capacitance, Inductance, and Resonance. There are easily-done techniques for checking the Power Factor of your home appliances (simply reading voltage across the motor, and using a shunt to read it’s current draw and comparing them); and a good electrician should be able to do so and provide the added capacitors to “balance” the AC motors of our homes’ major appliances to the point of 0.95 Power Factor (the highest recommended PF figure for motors). If we had unbalanced (out of phase, non-Power Corrected) AC motors in a refrigerator, air conditioner, and washing machine. And our monthly bill was \$200; it is very possible we could to see a savings of \$35 or more on that bill; realized simply by adding the necessary capacitors to bring each appliances’ motor to a Power Factor of close to “0.95”. Such capacitors are of low cost, consume very little energy themselves (when installed in parallel across the motor’s power terminals so they only operate when the motor runs), and the modifications are relatively easy to perform. It is interesting to note that although many “green” advances in motors and electronics have come to pass with consumer devices in recent years, making them significantly more energy efficient; Power Factor Correction technology is still not in widespread use by the U.S. consumer appliance industry. Questions sent to the customer / technical support services of over 8 different U.S. major manufacturers have verified this: None of them apparently do use PFC technology in their appliances. A very good question for us to ask these corporations like General Electric would be: “Why is this?”

When reading about CFLs around the ‘Web, there is much consumer information about them available; and they are certainly a “Hot Item”. Walmart sold roughly 100,000,000 of them last year alone. Yet, in over 12 mainstream articles regarding CFLs ; only one brief mention was seen regarding Power Factor (on G.E.’s CFL pages), which stated that although they were not “Corrected” (with no further explanation of the term given); they were still an important energy saving device. The term “corrected” by itself is meaningless: One wonders why they did not wish to use the proper “Power Factor Corrected”, which is the only acceptable term. Not surprisingly, the “Popular Mechanics” article on CFL consumer awareness from May 2007 also did not mention the Power Factor issue; although an “expert” equipped with “pro meters” measured the wattage of the various models tested. Nor was the issue mentioned on the “Energy Star” pages about CFLs. Several of the CFL models that have the Energy Star “blessing” are not Power Factor Corrected, so it would seem this is not a criteria to gain this “prestigious” award. In fact, at least one of the G.E. refrigerators which won an award for “Best” last year from Energy Star has no Power Correction technology in it either.

Energy Star is a unique sort of creature: Born of an alliance between the U.S. Dept. of Energy and the U. S. Environmental Protection Agency; but actually supported and “steered” by the electronics and appliance manufacturing industries along with the power utility corporations “in partnership”. Knowing this, it is then perhaps no wonder that Energy Star has also all but ignored an important technology like PF. Oddly enough, Power Factor Correction is required for computer power supplies to gain the Energy Star rating (which often have some leading-current Capacitive, not lagging-current Inductive phase shift); yet major appliances that have AC inductive motors with many more times the power usage and possible savings; are not required to have Power Factor Correction technology installed in order to meet Energy Star requirements? This question also begs further investigation. Especially since homes with computer power supplies with current-leading Capacitive phase shift could actually help balance out and improve the total Power Factor when summed with the AC motor’s Inductive current-lagging phase shift causing poor Power Factor. In other words, if they had left the issue alone all together, then the difference we pay on our bills because of Apparent Power could actually be lower.

The costs to the manufacturers of adding Power Factor Correction would be minimal, but the savings to the consumer could be dramatic. If the figures on General Electric’s CFL information web page can be used; over 30 Billion Dollars are “saved” annually by U.S. consumers using CFL’s (this figure assumes the billing is done in Real Power Watts, which it clearly is not in most cases). So knowing what we now do about CFLs and Power

Factor Correction, and that we are actually billed by Apparent Power. Then this would mean that the American consumer is paying over \$14 Billion a year more on their power bills than they should be -- just for non-PF corrected CFLs alone. The amount of money for non-Power Factor Corrected AC motors in homes and small businesses would be difficult to estimate with accuracy (there are several hundred million such motors in operation within the U.S.; with only a small but unknown percentage of the consumer models being Power Factor Corrected); but this amazing figure could easily be well over \$150 Billion annually, all because of missing low-cost components?!

Action

There are many things we can do to save energy; and this is unquestionably a worthy endeavor. But as we have seen, there are also things we can do to simply save money as well. Perhaps it is time to call the electric utilities on their deceptive practice of charging by Apparent Power; and insist that we be billed by Real Power; as their charging by the “Kilo-Watt Hour” wrongly suggests (they should be naming it “Volt-Amperes Hours” to correctly denote Apparent Power). There is some debate on whether the electric utilities are actually being loaded down at their generators with the Apparent Power figure or the Real Power figure. They must always supply Power Factor Correction in their transmission lines and sub-stations anyway, and even at the residential neighborhood transformers. So on one hand they must provide enough power to supply the higher Apparent Power amount; yet the question is which power figure is actually being drawn from the system at the generator end: Real or Apparent? There are differing opinions; but it is much evidence that the entire additional amount of Apparent Power is not seen at the generators (and that the amount is somewhere in between the Real and Apparent figures), meaning consumers are being over-billed, and have been for many decades.

*We can contact our State’s Public Utility Board, and insist action be taken to stop the “time honored tradition of the power companies billing us by the “Kilo-Watt Hour” instead of accurately using the “Volt-Amps Hour” figures that reminds us that we are really paying for Apparent Power, not Real Power -- an age-old “trick” on their part that can be described as deliberate deception; which has helped to successfully suppress the entire question of Power Factor with consumer billing for over a century. Perhaps more importantly, we need to **start insisting that our home and office appliances with AC inductive motors, as well as the CFLs sold in the U.S., all have AC Power Correction technology installed by the manufacturer.** It would cost the appliance manufacturers much less to add the capacitor than for what they pay for the unit’s cardboard shipping box.*

Further Improvements by Modifying CFL Circuitry

Compact Fluorescent Lamps are a wonder of technology. And despite a small danger from Mercury inside the tubes, they are a Godsend to many undeveloped areas of the world where they now provide light when before was only darkness or polluting chemically-fueled lanterns after sundown. But CFLs can certainly be even better and more useful, as proved recently by members of the Free Energy and Open Source Energy community who have greatly improved the lamps efficiency through experimentation; **making them several times more efficient through significant modifications to the circuitry.** By harnessing the usually-ignored energy contained within the collapsing field of the inductive coils in the circuit, the modified CFLs can actually charge batteries while supplying light; “reusing the inductive voltage pulses and creating a system that is nearly self-sustaining. In fact, a small solar panel run only one hour a day may be all that is needed to make this CFL / Battery charging system operate indefinitely in a closed-loop, with “Charge” and “Source” batteries for power, and the solar panel to help keep the regularly-swapped batteries at full charge.

This experimentation and improvement of CFLs, done by many intrepid researchers and inventors of the Open Source Energy movement (especially one known on the Internet as “The Inventor **~Imhotep~**”, who first developed the improved circuit design), have helped bring this very interesting and “illuminating” Power

Factor Correction issue out into the open. For more information on this amazing “nearly-Free Energy” CFL modification, see the Energetic Forums thread link which details the great work done by ****~Imhotep~**** and others; which may prove to be a wonderful boon for many poor people around the world who do not enjoy reliable grid power: Providing bright light to stave off the darkness without pollution, significant cost, or generator/grid power; simply using 2 small or medium-sized 12V batteries, a low-cost solar charger, and modified CFLs (several lamps can be used together per battery set).

Action Summary

1. CFLs are excellent energy savers, but ***ones sold in the U.S. need Power Factor Correction technology built in***, as they have now in Europe. This would save U.S. consumers at least \$14 Billion per year, and cost pennies to the manufacturer to add. Contact the manufacturers such as G.E., and demand that we be offered PF-Corrected CFLs, and ask them WHY we haven't in the past, knowing that the models sold in Europe have them as a requirement.

2. ***AC inductive motors also need Power Factor Correction installed***, and U.S. consumer appliance manufacturers should all be doing this, but currently do not. Older units can be modified to have a low-cost AC capacitor added to them, in order to save consumers a total of over \$150 Billion per year nationally (estimated); just from AC motors that are not Power Factor Corrected. When buying your next appliance, demand Power Factor Correction. Contact your power company and ask them why they never told you about all this; when they do already work closely with their industrial Customers to insure high and efficient levels of PF.

3. Power utility corporations should stop the deceptive practice of charging consumers and small business by the “Kilo-Watt Hour” (which denotes Real Power), and instead use the accurate metric of “Volt-Amperes Hours” for Apparent Power. Or, even better, they should charge consumers by Real Power instead of Apparent Power; and then we would see the need for Power Factor Correction for consumers suddenly championed by the industry, forcing action (because it would then be in their interest to do so): Instead of this important technology being suppressed and ignored for decades, while we continue to pay significantly more for power than we should be. State Public Utility Commissions and consumer Watch agencies can be contacted with the above easily verified information: Don't let up, keep up the complaints until you are contacted back with meaningful answers. The more of us that do so, the faster we will see real results.

4. Corporations such as General Electric and others who build consumer devices such as CFLs and major appliances need to explain to the American people why they have been deliberately allowing us to be over-billed for our power to such a staggering extent, and for so many years. If there was collusion between them and the power utilities, this needs to be investigated and uncovered. “Energy Star”, technically part of the DOE and EPA but in reality a “partnership” between the government, the electric utility corporations, and the electronics and appliance manufacturers; also has some serious explaining to do in this regard. When the IEC standards were introduced in Europe, Japan, China, and elsewhere in 2001. Why did the U.S. not follow suit (since to export to these countries, manufacturers must comply anyway)? And one would think if this was truly a “free and open market” industry, that one or another of our manufacturers eventually would embrace and proudly advertise this great money-saving technology to gain an edge over competitors: But we have not seen this. Why is this? Contact the appliance manufacturers such as General Electric and demand to know why they do not offer Power Factor Correction technology for all their inductive consumer appliances and CFLs.

[Editor's Note: 5. See our page on Directory:Power Factor Correction for a list of companies and devices available for residential power factor correction at the service box.]

Conclusion

CFLs can cost American consumers even less on our power bills than they now do. If we would only demanded the same 100-year old Power Correction technology be installed that our wiser friends in Europe now enjoy. But as stated before, this is just a drop in the bucket compared to the non-Power Factor Corrected AC motors. There are few viable reasons for our appliance manufacturers to continue to ignore this important money-saving technology. Perhaps it is time to ask the power utilities and the U.S. appliance manufacturers if they have ever discussed this issue between themselves; and what was the outcome of those discussions, when over 160 Billion Dollars per year in consumer “over-charging” is in question; year after year. Isn’t this question worth looking into? But these “happy days” for the utility corporations will be ending soon. When put under the hard scrutiny of consumer awareness; they will have no choice but to change their deceptive practices.

Nothing we have seen in the mainstream energy arena in recent years has created a bigger improvement in efficiency than Compact Fluorescent Lamps. They should be used in every American home and office; to save energy and money both. But this does not mean that the power companies should be allowed to “keep” half of those impressive savings for themselves. ***If indeed there was some monstrous secret deal made between them and the manufacturers to suppress and ignore Power Factor Correction in consumer devices, it was made without our approval.*** As the Customer, we do have a voice: One that rings with another kind of “Real Power”. So let us use it; and generate some “corrections” of our own.

Comments

See Discussion page

See Also

- Directory:Compact Fluorescent
- Directory:Compact Fluorescent Lighting (CFL) Downsides
- Directory:Power Factor Correction
- Directory:Steve_Windisch

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"When you're one step ahead of the crowd you're a genius.
When you're two steps ahead, you're a crackpot."
-- Rabbi Shlomo Riskin (Feb. 1998)

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