

“Phasing-out” the Incandescents – Is the Public Misinformed or Disinformed?

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Professional lighting designers are responsible for designing the visual environment of the human habitat thus concerned by ecological issues no less than by any other issue pertaining to light and lighting. Environmental parameters are high-up in their priorities when designing the lighting for any project.

The global misguided effort to ban the incandescent lamp (a lamp is a light source; the bulb is only the glass envelope component of the lamp) and universally replace it by the more efficacious compact fluorescent (CFL) has prompted PLDA, one of the major associations representing the lighting design professionals, to try to react wherever, whenever and however our time and resources will allow us to do so.

The intensive drive to “phase-out” the incandescent lamp, a politically correct term to describe an outright **Ban**, even when it stems from sincere belief that by so doing we will be contributing to reducing greenhouse gas emissions (there is no doubt it is also strongly driven by private economic considerations!), is based on flawed assumptions, themselves built upon erroneous or deficient data. Furthermore, the approach, even were it proved to be true, is a very partial one and disregards the irreversible serious ecological and health harm that might ensue from this campaign.

The major contention ban proponents is that thanks to better efficacy (quantity of light produced per energy unit consumed, expressed in Lumen/Watt – Lm/W), replacing all incandescents in general and in residences in particular with so-called “equivalent” CFLs, will significantly reduce energy consumption thus reduce gas emissions, thus appreciably contribute to slowing Global Warming. As a by-product, consumers will be saving money in the energy saving as well as in the total expenditure on lamp acquisition despite the much higher cost of the CFLs, thanks to their much longer life.

There is no contention regarding the better efficacy of the CFLs: indeed, they consume less energy for an equal quantity of light produced. There is no contention, either, regarding CFLs longer lives. However, these generic statements are where our agreement ends:

Our contentions are (not necessarily in any particular order of priority):

- a. The total energy saved by switching incandescents to compact fluorescents, if any, is much smaller than contended and most probably not of any real impact on the very serious issue of Global Warming.
- b. Consumers' savings, if any, will be much smaller and of much less relevance than contended.
- c. The quality of the visual environment will be significantly adversely affected.
- d. The risks and hazards to the environment and to human health are extremely high and not taken into account. The ban has been set in motion in some places (Australia, UK, EU) without having put in place the minimum safeguards that the proponents are theoretically advocating such as effective and tested recycling measures (**not theoretical but unapplied legislation!**), or efficient and

scientifically proven measures to deal with exposure to toxins resulting from CFL breakage.

- e. In order to convince the public at large of the benefits to the environment and to the consumer's pocket, the ban supporters are feeding the public erroneous and distorted information and hiding other facts that might foster great opposition to the campaign.

For the purpose of this discussion, we are comparing a 60A60/FR (60 Watt General Service Frosted incandescent lamp, one of the most popular in domestic use, that we shall further refer to as 60W), to an 11TC-DSE/827/E27 (an 11 Watt quad tube compact fluorescent with a built-in ballast and an E27 screw base that makes them technically suitable to replace the above incandescent and that we shall further refer to as 11W). This lamp is chosen because until very recently and since the beginning of the campaign, it has been consistently presented by manufacturers and retailers as the "equivalent" to the 60W incandescent lamp. (Interestingly, as of late, the major lamp manufacturers have begun marketing higher wattage CFLs as the "equivalents" of the same 60W but that does not change much to our argument).

Energy Saving

The 60W indeed consumes 60W. The 11W, however, despite it being **presented as consuming 6 times less energy** ($60/11= 5.45$, approximately 6 though rounding it down to 5 would be more honest). However, this does not account for other energetic losses such as those of the poorly designed, low power factor built-in ballast and when measuring the real effect of the lamp on the network, it appears it draws close to 23 VA which is the correct way to measure the true energy consumption. That makes the 11W lamp consuming **only 2.6 times less energy than the 60W**. However, this is not where the maths end: the 60W produces 700-710 lumens (depending on the manufacturer). It's "equivalent" 11W only produces 520-600 lumen (depending on the manufacturer), i.e. between 14% and 26.5% **less quantity** of light. No currently manufactured CFL available in the commerce produces exactly the same lumen package as its "equivalent" incandescent however, for the purpose of true comparison, it is necessary to mathematically bring both sources to a theoretical equivalence so that the results and conclusions are true and correct. Even adopting the lower difference between the two, a theoretical CFL producing 700 lumen would consume approximately 28W, i.e. **only 2.1 times less energy than the 60W**.

But that does not conclude the rough energetic comparison between the two lamps: this only deals with the difference in energy consumption during operation time; in order to be accurate in the comparison, one need to include the energy embedded in manufacturing both lamps and in their "after-death" processing. This information is extremely hard to gather because manufacturers are reluctant to release it for reasons one can only guess. Nevertheless, it stands to reason that a process of manufacturing the simplistic incandescent lamp a borosilicate glass bulb with a vacuum, covering a tungsten wire on glass supports, one that has been perfected and streamlined since the beginning of the 20th century, requires much less energy than one that requires coating the interior of a tube with phosphor, twisting it into its quad-tube shape, inserting into it active Mercury and cathodes, integrating to it an electronic ballast (that in itself has required energy for production). One can imagine that if and when recycled (an issue we shall deal with further on), the process of recycling the incandescent lamp – completely

inert and including very few materials, will require much less energy than one that requires dealing with toxic and non-degradable materials such as Mercury, phosphors, plastics and electronics. Once we get true numbers for the energy embedded in the different lamps beyond their direct consumption during operation, we might learn that the “carbon footprint” of the 11W is not smaller than the one of the 60W but if it still is, we’ll probably be at an honest estimate of **1.1 to 1.3 total less energy consumption** for the 11W than for the 60W!! **Quite a long way from the profusely marketed 6 times less energy....**

Consumer Savings

The rated life of 6,000 hours published by the large quality manufacturers might be a true result of checking the lamps in laboratory conditions. It is true that in reality most of the CFLs manufactured by quality manufacturers live in excess of 4,000 hours, providing they are installed in favourable conditions (good ventilation, no more than one switch-on per day), it is also true that many CFLs of much inferior quality sold in the EU do not live beyond 2,500 hours even in optimal conditions and much less when ventilation is not adequate or when switching-on/off is frequent. Of course, they are much cheaper and as long as they are offered to the public at large, they will be the ones that will be bought! Furthermore, all of the CFLs suffer light loss with aging in such a manner that at 85% of their life, the light they give-out is no more useful. Therefore, if we can assume an average life (till complete “death”) of 3,500 hours, the lamps are only efficient for an average of 3,000 hours. At cheap bulk rate prices, the 60W will cost an average of €0.35 while the “equivalent” 11W will cost an average of €1.90 – 5.5 times more. The effective life of the 60W being 1,000 hours, the consumer will need to buy three 60Ws during the lifetime of one 11W. In absolute terms of money, he will have spent during 3,000 hours of operation €1.05 on 60Ws vs. €1,90 on the 11W. So he would be spending € 0.85 more on the 11W. Nevertheless, on the operating energy consumption, the 60Ws will have consumed 180 Kwh @ € 0.14 = € 25.20 while the 11W 2.6 times less, i.e. € 9.70. Thus the total savings in using the 11W will be of € 14.65 over a period of **two** years (at the average rate of 4 hours burning per day per lamp) or an average saving of € 7.30 per year per lamp replaced. Nice but unfortunately not the whole story: CFLs are currently subsidised through any number of different schemes in the EU in order to encourage their acquisition. Once the consumer will have no choice, CFL subsidies will have no longer any raison d’être and their current high price **will definitely increase**. In recent years, under the influence of lighting professionals as well as under the general pressure to save energy, many home owners have installed simple and cheap but reliable dimmers and occupation sensors, **both energy saving devices** as well as means allowing easy changing of atmosphere in living spaces. Except for one or two extremely expensive models of CFL, many times more expensive than the 11W, (some, as of yet not commercially available) CFLs do not respond to these devices. If and when the manufacturers will produce “affordable” CFLs that can be controlled, the controls themselves are expected to be extremely expensive – much more than the existing ones operating on incandescent lamps. Furthermore, the 11W and other CFLs, despite the campaign declaring that all that needs to be done is replace one lamp by the other, cannot be installed in all luminaires that currently work with incandescents for two major reasons: they are extremely susceptible to heat, making them inappropriate for any enclosed luminaire and for most of recessed luminaires. Furthermore, their geometry is different and their dimensions usually bigger than their incandescent “equivalents” so that they cannot physically fit into the luminaire or else they stick out of it creating a very unappealing look usually accompanied by disturbing glare. That might mean that in

many cases the luminaires will also have to be replaced by new ones, much more expensive (no surprise that luminaire manufacturers are lending their support to the campaign). At the end of the true process, the savings of € 7.30 per year per lamp will most probably turn into real unwanted and “unexpected” out of pocket expenses.

Quality of the Lit Environment

The arguments of the ban proponents are based on measurable or computable quantities and some base documents feeding the campaign such as the IEA’s “Light’s Labour’s Lost” blatantly equate the quantity of light to quality. That is not the case at all:

Not only are the quantities of light of CFL “equivalents” not equal to those of the planned replaced incandescents but also the quality of the light greatly differs. This is due to the fact that the spectrum of the incandescent is a continuous one, i.e. has energy in all wavelengths of the visible electromagnetic spectrum while the spectrum of the CFLs, like all discharge lamps is a discontinuous one, i.e., depending on the composition of the phosphor coating of the tubes will present a lack of or a deficiency in energy at certain wavelengths of the visible spectrum. This characteristic is not immediately visible to the human eye until the emitted light falls on a surface or an object: the energy in each different wavelength corresponds to a colour perceived by the human visual system. If that colour does not exist in the light, its corresponding pigment in materials cannot be perceived by the eye; if the energy in a specific wavelength is deficient, the corresponding pigment in materials will be perceived as dead, washed-out and distorted. The ability of a light source to render “true” colours in materials is a characteristic named Colour Rendering Index (CRI in the US and Ra in the EU). While all incandescents have a Ra of 100 (so does natural daylight, also a continuous spectrum), the best CFLs only have a Ra of 85-87. That means that where colour perception is important, i.e. everywhere the human being lives and spends time, the replacement of incandescents by CFLs is going to inevitably create dull looking spaces, distort colours of architectural finishes (stone, marble, timber, paint, stucco etc.), of furnishings – curtains, carpets, upholstery, furniture finishes, artwork etc.), warp the colour of skin (people are continuously going to look bad/sick in their mirrors as well as in the eyes of their partners).

Incandescent lamps are close to theoretical “point sources” which allow for the design of precise optical systems around them to direct the light in an accurate manner. This permits the creation of accent lighting, a means to create visual interest and drama in spaces. CFLs are diffuse light sources and no engineering will truly make a diffuse light source into a “point-source”. Gone is accent lighting!

Cheap and reliable dimmers installed either in walls or on the luminaires themselves that allowed (while saving energy) to change the atmosphere in an interior space to more intimate or more exuberant will no longer function with the CFLs and when the very few and very costly models of CFLs that allow dimming will become available, there will be a need to replace old luminaires with new suitable ones – expensive – and new dimming devices – highly-priced.

The drive to improve Man’s environment is going to result in its deterioration. Scientific proof that this campaign will effectively contribute to reducing Global Warming might justify worsening the visual environment “by design”. As roughly exhibited above, this is

far from being the case and we are plunging into an absurd which would make Beckett's "Waiting for Godot" seem logical.

Risks and Hazards

Official statistics put the current EU population at 493,000,000. At a conservative estimate of 5 lamps per person in a household, one will reach the conclusion that the Ban intends to replace 2.5 Billion incandescent (and probably more) lamps in the EU alone with CFLs. At an average **efficient** life of 3,000 hours and at an average utilization rate of 4 hours per day, starting a couple of years down the road, the expected mortality of CFLs in the EU will be of approximately 3,290,000 per day.

As previously mentioned, the CFLs contain active toxins among them Mercury (Hg) the quantity of which is approximately 2 mg in the quality lamps and about 5 mg in lower quality lamps. Because of the obvious price issue, the majority of CFLs sold in Europe are of a lower quality, however for the purpose of this exposé, we have assumed that 50% of the CFLs sold in the EU are from quality manufacturers which averages the amount of Hg in each CFL at 3.5 mg.

The EU has published its WEEE (Waste Electrical and Electronic Equipment) directive in 2002. That directive, its annexes and updates also regulate the recycling requirements for CFLs. Our attempts to find out how many plants are WEEE compliant in the EU, how many of them have practically implemented CFL recycling, what precisely is done with the toxins extracted from the CFLs and what is the daily capacity of CFL recycling have been all but fruitful: None of twenty major recycling plants in the EU from which we requested the information even acknowledged receiving our communications. Inside information however indicates that only very few recycling plants are currently setting-up for recycling CFLs; that their daily recycling capacity is very limited and that they intend to return part of the Hg to lamp and pharmaceutical manufacturing while most of it will be treated like radioactive waste, i.e. sunk in barrels in deep sea. (Let it be known that no recycling company dealing with radio-active waste is prepared to guarantee the water tightness of the containers for more than 100 years! Whatever happens after that is "none of our generation's concern"??)

This having been said, and despite EU directives as well as the lamp manufacturers declared responsibility to collect the used CFLs and send them for recycling, no mechanisms are put in place for the collection of this type of waste and the large majority of consumers will dispose of their "dead" CFLs in the regular domestic waste bins. Even if and when such mechanisms will be set-up, our optimistic estimate is that at the very best 50% of the CFLs will eventually go for recycling. That means that at least 50% will reach landfills and through them, our ecosystem.

We are thus expecting, once the whole recycling process is effectively operative throughout the EU, **a minimum of 2 metric tons of Hg to reach our ecosystem annually** (beyond the terrifying quantities that already reach it today!). For illustration purposes, it should be known that 1 mg of Hg suffices to contaminate 5,300 Litres of drinking water! This means that the additional Hg reaching our ecosystem will be sufficient to contaminate the entire Lake Geneva – the largest fresh water body in Europe – within 8 years! Furthermore, studies have shown that it would take a theoretical mass of soil of 18mx18mx17m to neutralize 1 mg of Hg!! Neutralizing 2 metric tons of Hg would thus require **10, 835 km³ of soil!**

This issue is tantamount to an ecological catastrophe in the waiting, especially in view of what is known regarding the effects of Hg on the human brain (main cause of Alzheimer and dementia). The fact that we are already absorbing large quantities of Hg through eating fish and drinking tap water does nothing to temper the fear of this potential addition. Europe risks seeing in the near future a generation of people reaching stages of dementia and contracting Alzheimer disease at a very young age! Unfortunately if and when that happens, the process will be irreversible! Even assuming our fears to be pessimistic, can anyone guarantee this will not happen? Is anyone or any body really prepared to assume this kind of responsibility? The tobacco industry in the US never forced anyone to smoke at gun point yet when sued by those who suffered the consequences of smoking, they were found guilty and paid-out many billions of dollars. The EU and the individual governments actively pursuing this campaign, are not giving the consumer the choice – they are forcing all of us, at gun point – to consume the Hg that will result from this campaign. They will have no defence and no recourse once they get sued by those who will be affected. None of them will be able to contend that “they did not know”!

Still within the framework of risks and hazards but at the private consumer level: Who has not dropped a lamp at home while relamping or just by accident? There is absolutely no reason to think that CFLs will not break at the same rate as incandescents. However, unlike the incandescents, once the CFL breaks, it releases the odourless Hg that it contains. While the campaign for banning the incandescents is in full motion, Hazmat (Hazardous Materials) agencies have not issued any concrete and practical directives to the public at large as to how to deal with the matter. Again, for illustration purposes, in the state of Maine, following the breakage of a CFL while replacing a lamp, the local Hazmat agency recommended the treatment of a private contractor who charged the family in excess of \$ 2,000 for the cleanup (so much for consumer “savings”) and they had to evacuate their premises for two weeks. In other cases it was reported that different agencies give different recommendations, beginning with very impractical ones such as wearing masks for undetermined lengths of time after such a breakage, refraining from cleaning the breakage area with a vacuum cleaner again for an undetermined period of time, collecting the debris with a wet cloth and disposing of it all in a hermetically sealed container, keeping the windows open for a duration of one week, etc. Quite obviously except for the fact that the CFL contains dangerous toxins, no one really knows what to do if these are accidentally released in a dwelling and no authority is prepared and trained to deal with such matters.

When recently queried on this issue, Mr. Keven Verdun, chairman of the Lighting Association UK, representing major manufacturers and suppliers of lamps and associated products, answered that he did not see why the industry should print a warning on the packaging of the CFLs. His rationale was that CFLs and linear fluorescents (also containing Hg in even larger quantities) had been in domestic use for the past 20 years and no one had raised the issue. This sounds like the industry is worried that the public at large, if informed of the danger might start mounting a serious opposition to the campaign – that would really create a serious dent in their financial projections for the coming years...

Recent presentations of the EU bodies responsible for collecting the data which will serve as the basis for the proposed legislation demonstrated that the raw data collected

was inaccurate, misleading and that the issues of health and safety had really not been thought through.

Is the Public Misinformed or Disinformed?

The packaging of the CFL does give the technical information regarding the lamp however the public at large doesn't have the technical know how to understand it. What it does clearly understand is the very graphical indication that this lamp = 6 "equivalent" incandescents. This, of course is total disinformation seeing that the real numbers are very far from it.

In very few instances, we have found CFL packaging that mentions, **in very small print**, that the lamp is not suitable for installation in enclosed or recessed luminaires. On most manufacturers' packaging there is no mention of these limitations.

Nowhere is there any mention of the limitations in controlling the CFLs (incompatibility with standard dimmers and other presence or light sensors).

Nowhere is there any mention of any toxic "ingredients" contained in the CFL or of the measures to be taken if exposed to them. When reacting to some voiced criticism regarding the addition of serious amounts of Hg to the ecosystem, some proponents of the Ban retort that power stations create much higher quantities of Hg for the energy consumed by the incandescents than the CFLs would contribute by replacing these incandescents. Once again a distortion of truth: Hg is indeed created in the process of generating electricity but only by coal-fired plants. The calculations that are produced to "prove" this point assume that all the power for lighting energy consumption is generated only by coal-fired plants. These count for less than 50% of all power plants throughout the EU. Quite obviously, the lamps cannot "choose" their electricity provider and on the average, only 50% of them get their energy from such plants. Furthermore, the average production of Hg of the 50 "dirtiest" coal-fired plants in the US (we couldn't gather enough statistical info in the EU) stands at 44kg/Twh. The 11W, with a consumption of 23VA over an average of 3,500 hours produces an average of 3.5 mg of Hg which is only very slightly less than that average – 43.5 kg Hg/TWh, and much more than the last 30 plants in the list of the 50 "dirtiest" plants in the US (the last in the list – still considered a very dirty plant – produces only 28.5 kg Hg/TWh!).

The consumers are, of course, not informed that the quality of the light they will be living in will be significantly inferior to the one they have had until now.

The only information that is going out, in profusion, is the one that is expected to have the major impact on the public – the one stipulating that by carrying-out this change, everyone will be a partner in saving energy, in reducing gas emissions, in slowing Global Warming, in saving "Mother Earth", all this while saving money. As shown above, all of these premises are extremely dubious.

It is safe to assume that had the public been informed of all of the above, including of the real potential danger for "Mother Earth" from this action and the personal danger of multiplying the number of CFLs in the residences, the opposition to the campaign would grow exponentially and would probably prompt governments and the EU to halt the drive, at the very least until much further impartial and scientific investigations and

preparations are carried-out to ensure the safeguard of nature and of the consumers and maybe to prove that the entire issue is misguided and ill-advised.

As a last thought – fifteen years ago, Greenpeace, one of the major proponents of the campaign, hypothesizing that replacing incandescents with compact fluorescents might save energy, commissioned a scientist to investigate the matter. Dr. Klaus Stanjek carried out the research and returned to Greenpeace with a document entitled – **“Energy “Saving” Lamps = Energy Wasting Lamps”**. Greenpeace at that point lost their scientific, ethical and moral ground by seeking “other researchers” that would corroborate their hypothesis by attempting to discredit Dr. Stanjek and some of his arguments instead of reviewing it in light of the findings of the research they themselves had commissioned.

It seems that most bodies involved today in this galloping campaign are either of the Greenpeace “format”, i.e. strongly believe in their argument and are not willing to let contradicting facts, data and information interfere with their pre-conceived ideas, laudable as they may theoretically be, or of the privately economically interested bodies who stand to make big profits from this campaign’s outcome but disguise their interest in an ecological discourse.

Now is the time for a serious hiatus.

Now is the time to rethink.

Now is the time to save the big money that has not yet been spent on the preparations for legislation.

Now is the time to redirect resources to real and significant energy saving issues such as the gigantic energy losses at the level of power stations, high-voltage cables and transformation stations.