

How much light do you need?



3W LED
home made Lamp
or
100W incandescent?

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LED Bulbs Save Substantial Energy, a Study Finds

By ERIC A. TAUB

Published: November 29, 2009

Does the latest generation of energy-saving light bulbs save energy? A comprehensive study conducted by Osram, the German lighting company, provides evidence that they do.

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Rick Friedman for The New York Times

While that may seem self-evident, until the [release of the report](#) on Monday the answer remained unclear.

That is because no one knew if the production of LED lamps required more energy than needed for standard incandescent bulbs. While it is indisputable that LEDs use a fraction of the electricity of a regular bulb to create the same amount of light, if more energy were used in the manufacturing and distribution process, then the lighting industry could be traveling down a technological dead end.

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127
HOURS
NOVEMBER 5

Cases Considered



Figure 2: Type of lamps compared in the Life Cycle Assessment: a 40 W incandescent lamp, a compact fluorescent DULUX Superstar and a Parathom LED lamp

Results from Osram

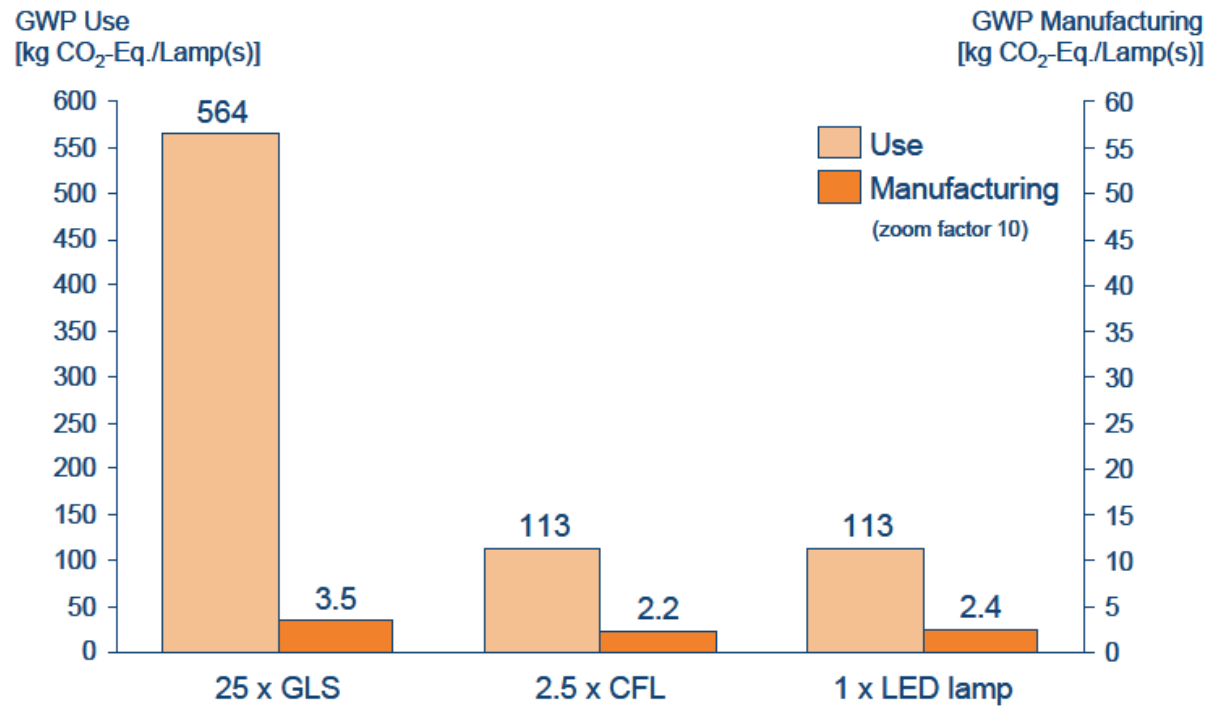


Fig. 10 Global Warming Potential for manufacturing and use of all three lamps

Life Cycle Assessment of Illuminants
A comparison of Light Bulbs, Compact Fluorescent Lamps
and LED Lamps

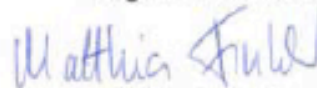
performed by
Siemens AG, Corporate Technology (CT MM Eco)

is in accordance and consistent with

DIN EN ISO 14040
DIN EN ISO 14044

The Critical Review Panel found the overall quality of the methodology
and its execution to be very adequate for the purpose of this study.

August, 25th 2009



Technische Universität Berlin
Prof. Dr. Matthias Friebel (Chair)



DTU Technical University of Denmark
Associate Professor / Cand. scient.
Stig Irving Olsen



Lirio Gribl
Prof. Dr.-Ing. Jens Hasselbach

Energy consumption in the production of high-brightness light-emitting diodes

Matthews, D.H. Matthews, H.S. Jaramillo, P. Weber, C.L.
Carnegie Mellon Univ., Pittsburgh, PA, USA;

This paper appears in: [Sustainable Systems and Technology, 2009. ISSST '09. IEEE International Symposium on](#)

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Abstract

High-brightness light-emitting diodes (LEDs) form the basis for solid-state lighting (SSL) systems. SSL systems have the potential to reduce electricity consumption of lighting systems as they are much more efficient than current lighting technologies. One concern is that the full life-cycle energy requirements of SSL systems, including the production of the materials and LED components, may negate any savings during the use phase. As a start to estimating the life-cycle energy requirements of SSL systems, we present an estimate for the manufacturing energy consumption of high-brightness light-emitting diodes. Results are based on full-scale, research-scale, and laboratory-scale equipment energy use data, and data from logic chip production processes. Energy consumption estimates for wafer production are 15 kWh to 60 kWh (approximately 1,000 LEDs).

The Bigger Picture



How do we use new efficient
Lighting technology?



DARRELL K ROYAL - TEXAS MEMORIAL STADIUM
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LONGHORNS



DRIVEN TO DISTRACTION

Digital Billboards, Diversions Drivers Can't Escape



Fabrizio Costantini for The New York Times

Digital billboards puncture the night sky along I-75 in Detroit and can be seen from great distances. Safety advocates say the signs can distract motorists, much like cellphones and P.D.A.'s, and possibly contribute to traffic accidents.

By **MATT RICHTEL**

Published: March 1, 2010

New York Times

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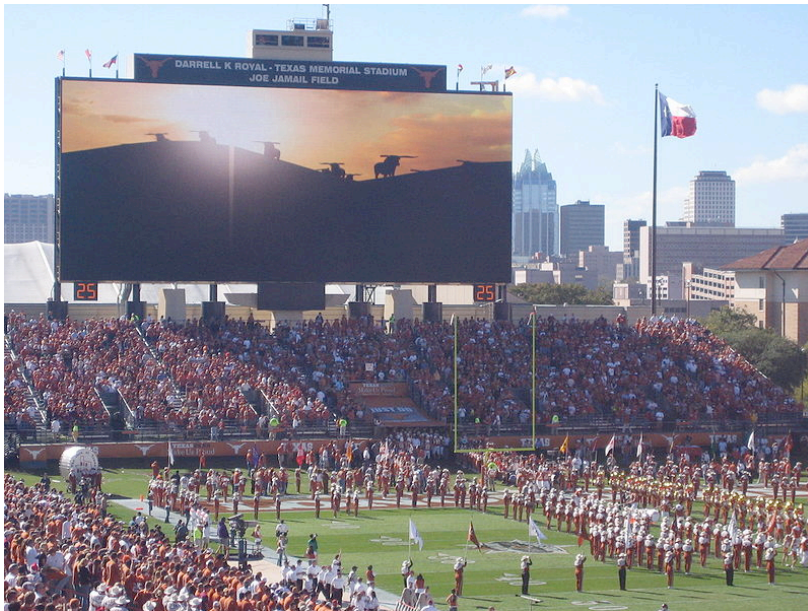
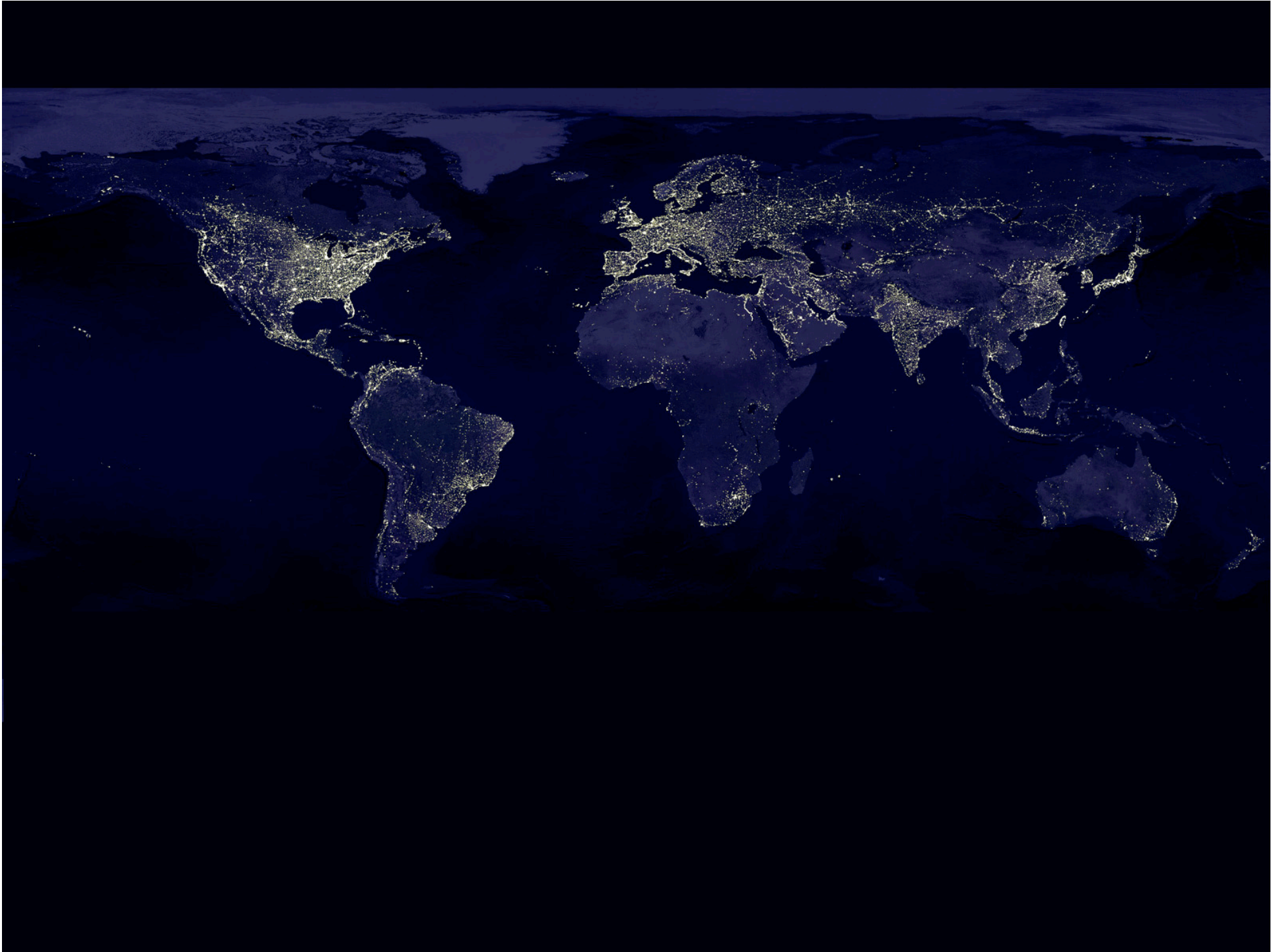


Photo Credit: Barco



► Clive Wynne, editor of *Behavioural Processes*, which published an “obsessively” immaculate paper by Dr Hauser three days before the *Globe*'s revelations, says he is struck by how meticulous recent research in his discipline has been.

In general, scientists see themselves better placed than most to weed out cheats. The more startling a paper's claims, the more likely it is that others will try to replicate it and, if the claims were specious, fail. Moreover, scientists want their work to be replicated; it is the only way it will stand the test of time, observes Robert Seyfarth, a primatologist and Dr Hauser's former mentor.

Many researchers cite Harvard's probe as further proof of science's self-correcting mechanisms, and praise students for doughtily standing up to an authority figure of Dr Hauser's distinction. Gerry Altmann, editor of *Cognition*, agrees, adding: “Although at the time it might appear that each transgression is major, its eventual impact on science is minor.” ■

Energy conservation

Not such a bright idea

Making lighting more efficient could increase energy use, not decrease it

SOLID-STATE lighting, the latest idea to brighten up the world while saving the planet, promises illumination for a fraction of the energy used by incandescent or fluorescent bulbs. A win all round, then: lower electricity bills and (since lighting consumes 6.5% of the world's energy supply) less climate-changing carbon dioxide belching from power stations.

Well, no. Not if history is any guide. Solid-state lamps, which use souped-up versions of the light-emitting diodes that shine from the faces of digital clocks and flash irritatingly on the front panels of audio and video equipment, will indeed make lighting better. But precedent suggests that this will serve merely to increase the demand for light. The consequence may not be just more light for the same amount of energy, but an actual increase in energy consumption, rather than the decrease hoped for by those promoting new forms of lighting.

The light perceived by the human eye is measured in units called lumen-hours. This is about the amount produced by burning a candle for an hour. In 1700 a typical Briton consumed 580 lumen-hours in the course of a year, from candles, wood and oil. Today, burning electric lights, he uses about 46 megalumen-hours—almost 100,000 times as much. Better technology

has stimulated demand, resulting in more energy being purchased for conversion into light.

That, at least, is the conclusion of a study published in the *Journal of Physics D: Applied Physics* by Jeff Tsao of Sandia National Laboratories in New Mexico and his colleagues. They predict that the introduction of solid-state lighting could increase the consumption of light by a factor of ten within two decades.

To work out what solid-state lighting would do to the use of light by 2030, Dr Tsao and his colleagues made some assumptions about global economic output, the price of energy, the efficiency of the new technology and its cost. Assuming that, by 2030, solid-state lights will be about three times more efficient than fluorescent ones and that the price of electricity stays the same in real terms, the number of megalumen-hours consumed by the average person will, according to their model, rise tenfold, from 20 to 202. The amount of electricity needed to generate that light would more than double. Only if the price of electricity were to triple would the amount of electricity used to generate light start to fall by 2030.

Dr Tsao and his colleagues see no immediate end to this process by which improvements in the supply of light stimulate the desire for more—rather as the construction of that other environmental *bête noire*, roads, stimulates the growth of traffic. Even now, the interiors of homes and workplaces are typically lit at only a tenth of the brightness of the outdoors on an overcast day, so there is plenty of room for improvement. And many outdoor areas that people would prefer to be bright at night remain dark because of the expense. If money were no object, some parts of the

outdoors might be illuminated at night to be as bright as day.

It is worth remembering that when gas lights replaced candles and oil lamps in the 19th century, some newspapers reported that they were “glaring” and “dazzling white”. In fact, a gas jet of the time gave off about as much light as a 25 watt incandescent bulb does today. To modern eyes, that is well on the dim side. So, for those who truly wish to reduce the amount of energy expended on lighting the answer may not be to ban old-fashioned incandescent bulbs, as is the current trend, but to make them compulsory. ■

Psychology

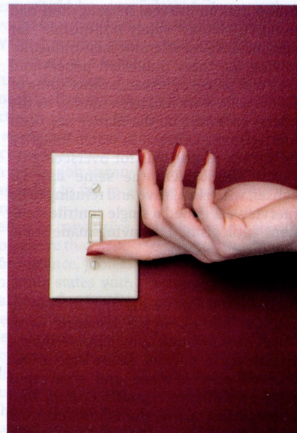
Faith and faithfulness

Praying for your partner stops you straying

INFIDELITY is rampant in nature. Birds, mammals, amphibians and even fish all cheat if the conditions are right, forcing mates to remain perpetually vigilant. People are no different. Although cheats are publicly condemned, or in some cases impeached, infidelity is common and public disapproval does little to dissuade the sinner. The disapproval of God, however, is a different matter, and a new study suggests that prayer can indeed guide people away from adulterous behaviour.

Frank Fincham at Florida State University and his colleagues knew from looking at past studies that couples who attend religious services are more likely to be satisfied with their marriages and less likely to be unfaithful than those who do not, but they did not understand why. Speculating that the act of praying might itself cause romantic relationships to become more resilient, the team set up an experiment to explore prayer and fidelity.

The researchers recruited 83 undergraduates who reported both being in a romantic relationship and praying at least occasionally. Participants were given a survey that is used by psychologists to measure levels of infidelity on a nine-point scale (with nine being highly unfaithful). The survey instructed them to think of the person that they were most attracted to besides their partner and then asked questions like how aroused they felt in that person's presence, how emotionally intimate they had been with him or her, and how physically intimate they had been. In a second survey, participants were asked to state how strongly they agreed with statements like “my relationship with my partner is holy and sacred”, by rating levels of agreement on a nine-point scale (with

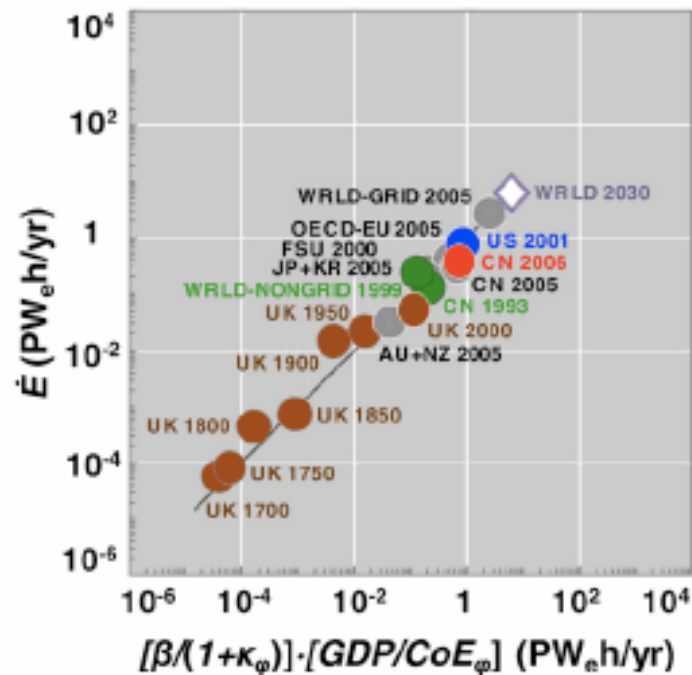
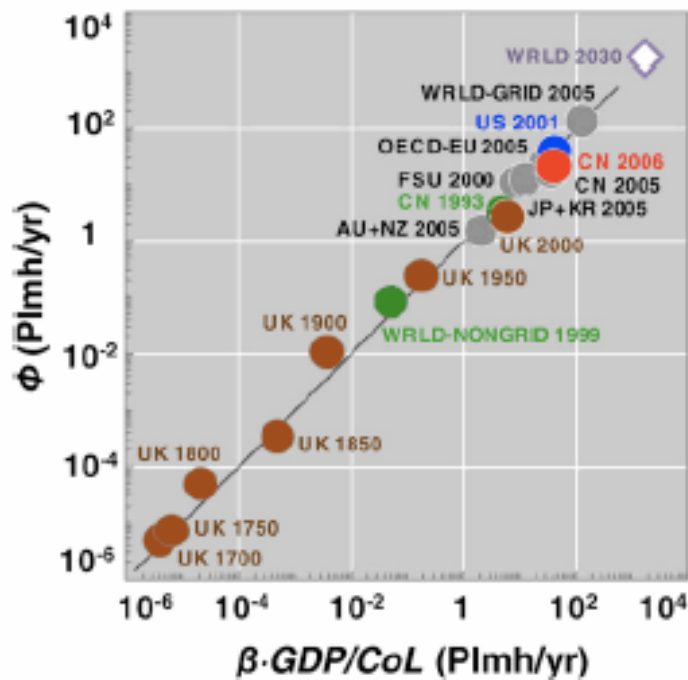


Less is more PHOTOGRAPH BY ANDREW HARRIS

Article in The Economist August 2010

*“Energy conservation,
Not such a bright
Idea”*

*Efficient lighting
Leads to
More energy use
Not less!*



$$! = \frac{gdp}{CoL}$$

$$e = \frac{!}{(1 + \#)} \frac{gdp}{CoE_{\#}}$$

$$e_l = \frac{!}{!}; \quad CoL = \frac{CoE_l}{!} (1 + \#_l)$$

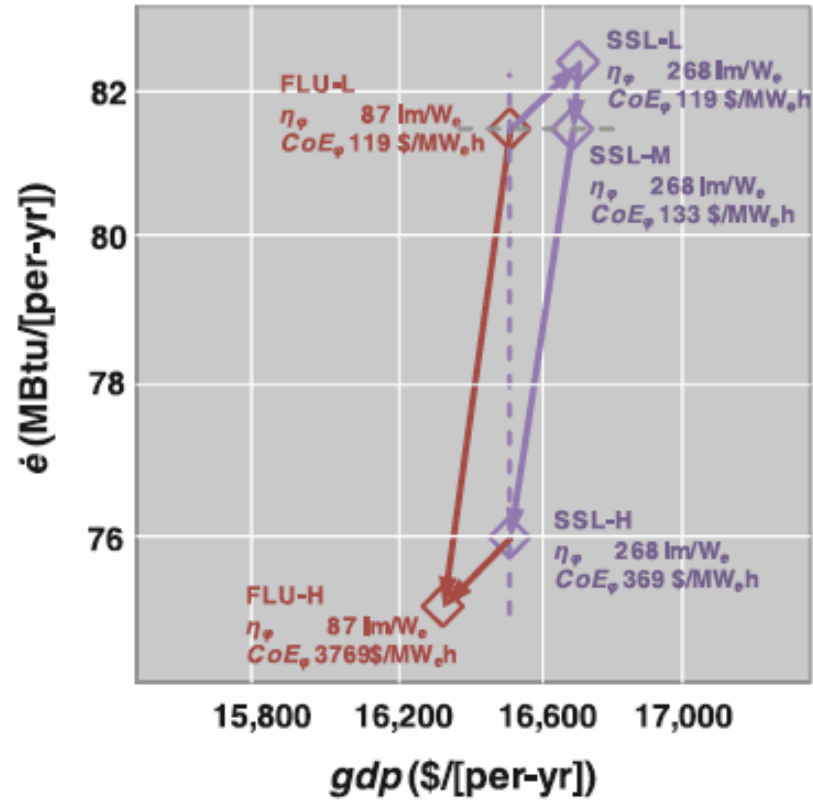


Figure 4. Projected world 2030 per-capita primary energy consumption and per-capita gross domestic product scenarios for various assumptions on luminous efficacy (η_{φ}) and cost of energy for lighting (CoE _{φ}). Both axes are gridded so that equal vertical or horizontal grid spacings represent equal percentage changes. The point labelled FLU-L can be considered the ‘reference’ values for (gdp, \dot{e}) from which the other values are calculated from equations (22) and (23).

Historical Efficiency

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JESSE H. AUSUBEL AND CESARE MARCHETTI

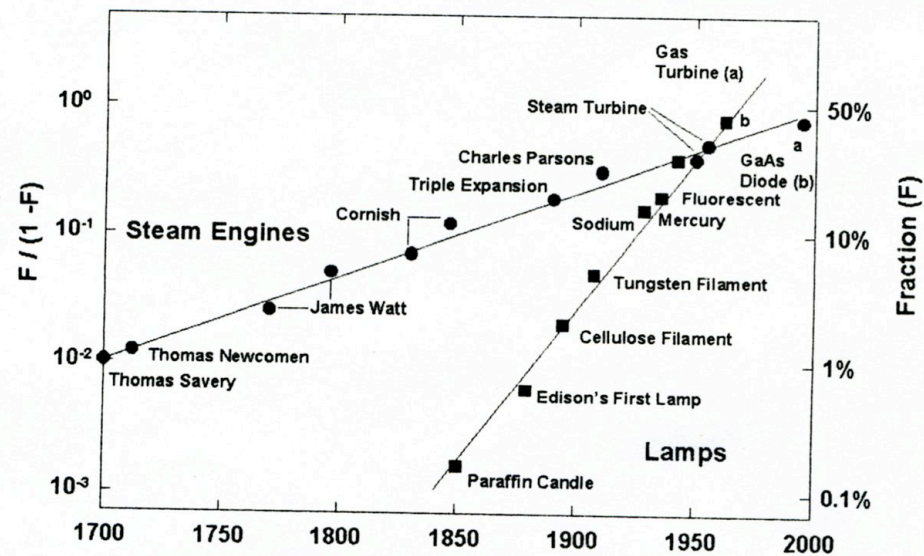


FIGURE 9 Improvement in the efficiency of motors and lamps analyzed as a sigmoid (logistic) growth process. NOTE: Shown in a linear transform that normalizes the ceiling of each process to 100 percent. MAIN DATA SOURCES: for lamps, *Encyclopaedia Britannica* (1964); for motors, Thirring (1958).

Efficiency \neq Conservation

More efficiency usually means an increase in the services provided!