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Manuel Frondel and Steffen Lohmann[1]

The European Commission's Light Bulb Decree: Another Costly Regulation?

Abstract

Since September 2009, Regulation 244/2009 of the European Commission enforces the gradual phase-out of incandescent light bulbs. As of September 2012, only energy-efficient lighting sources will be allowed for sale. Among these are halogen light bulbs, light-emitting diodes (LED), or compact fluorescent light bulbs- often referred to as energy-saving light bulbs. The Commission's justification for the phase-out of conventional light bulbs maintains that a reduction in the electricity consumed will not only lead to lower energy cost for private households and industrial consumers, but at the same time lead to a decrease in greenhouse gas emissions. This article discusses possible reasons for the slow market diffusion of energy-saving light bulbs and shows that the investment in energy-efficient light bulbs does not necessarily lead to significant cost reductions. Drawing on some illustrative examples, we demonstrate that the use of cheaper incandescent bulbs instead of energy-saving light bulbs can be economically rational in cases of rather low usage times, in which the higher initial purchasing price might only pay off after very long time spans. Furthermore, due to the coexistence with the European Emissions Trading Scheme (ETS), this regulation attains no additional emission reductions beyond those achieved by the ETS alone. We thus conclude that the general ban of incandescent light bulbs is inappropriate and should be abolished by the Commission.

JEL Classification: D12, Q41

Keywords: Energy efficiency; rebound effect

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1 Manuel Frondel, RWI and Ruhr-Universität Bochum; Steffen Lohmann, RWI and Tinbergen Institute. *– We are grateful to Christoph M. Schmidt for valuable comments and suggestions and are particularly indebted to Colin Vance. We furthermore thank Fabian Scheffer for discussions in the context of his bachelor thesis. Finally, we are very grateful for the highly constructive comments and suggestions of two anonymous reviewers.* *– All correspondence to Manuel Frondel, RWI, Hohenzollernstr. 1-3, 45128 Essen, Germany, E-Mail: manuel.frondel@rwi-essen.de.*

1 Introduction

Invented around the end of the 19th century, the days of the incandescent light bulb are numbered, at least in countries such as the Member States of the European Union and the U.S. While the more efficient energy-saving light bulbs still struggle to crowd the incandescent bulbs out the market, a provision of the U.S. Energy Independence and Security Act of 2007 requires the phase-out of today's bulbs in 2014. Likewise, the European Commission gradually prohibits the usage of incandescent light bulbs via decree. Starting September 1, 2009, Regulation 244/2009 introduced a gradual phase-out for almost all kinds of incandescent bulbs until September 2012. While frosted bulbs were immediately banned without exception, the timing of the phase-out of clear bulbs depends on their wattage: The sale of the clear 100 watt bulb was prohibited at once, but the 60 watt bulb, which enjoys highest popularity in European households, is still allowed to be manufactured and sold until end of August 2011. As of September 2012, only energy-efficient lighting sources will be allowed for sale.[1] Among these are halogen light bulbs, light-emitting diodes (LED), or compact fluorescent light bulbs− often referred to as energy-saving light bulbs.

The Commission's intervention into individual consumption decisions was justified by two key arguments. First, the promotion of more energy-efficient light bulbs would enable private households, as well as industrial companies and businesses, to save energy and thus lower their electricity bill. Second, according to the Commission, these reductions in electricity consumption lead to a decrease in greenhouse gas (GHG) emissions, which are caused by the conventional production of electricity based on the burning of fossil fuels. According to figures from the Commission, Europe’s electricity saving potential due to directive 244/2009 amounts to 40 bn kilowatt hours (kWh) per year. In Germany, where circa 10 % of total electricity consumption originates from lighting (DPG 2010a), the estimated reduction in electricity consumption is up to 7.5 bn kWh (DPG 2010b). This is equivalent to some 1.5 % of annual electricity consumption, which added up to roughly 539 kWh in 2009 (Schiffer 2010:82). In light of this insubstantial energy saving potential, the German Society of Physics asks in a recent study from June 2010 why the energy-saving lamp has attracted such political attention (DPG 2010a). 7.5 bn kWh is roughly the amount of electricity that is generated by a single coal-fired power plant over one year (DPG 2010b).

Based on the Commission’s estimates on electricity savings, the annual potential to cut back carbon dioxide (CO2) emissions is gauged at about 15 million tons (EC 2009a). This would be equivalent to a share of less than 0.3 % of the total GHG

[1] Exceptional regulations were introduced for special lamps, e.g., for household applications like ovens or sewing machines. The regulation applies to incandescent bulbs manufactured by European companies or imported into the European Union. Remaining warehouse stocks are still eligible for sale after the respective deadlines.

emissions in EU-27 states in 2005 (EEA 2009). Due to the coexistence of the European Emission Trading Scheme (ETS), however, the ban of incandescent light bulbs attains no additional emission reductions beyond those achieved by the ETS alone (Mennel, Sturm 2009:25), presuming that the ETS is binding and, therefore, the price of CO2 is positive: The phase-out triggers a drop in electricity demand and, hence, CO2 emissions, thereby putting downward pressure on prices of CO2 certificates. Consequently, the incentives for other sectors participating in the ETS to invest into emission abatement are weakened. What follows is an increase in carbon emissions in all other ETS sectors, offsetting the reductions achieved by the light bulb decree. In effect, a relocation of carbon emissions, rather than a reduction of emissions, is the ultimate result; in other words, the net GHG effect of the light bulb decree is zero under the ETS regime.

Furthermore, the Commission's second argument that the ban of incandescent light bulbs will cut electricity costs is also questionable. After all, if the saving potential of energy-saving light bulbs was really as significant as it is presumed by the Commission, it has to be asked why the overwhelming majority of European consumers has not yet massively installed energy-saving light bulbs in their homes on a voluntary basis. This argument is all the more relevant for industrial consumers, for which one can safely expect that competition may foster the cost saving behavior of firms and companies.

This article discusses possible reasons for this apparent so-called energy conservation paradox and argues that there are cases in which energy-saving light bulbs do not lead to lower overall cost than incandescent bulbs. As we exemplify, investments in energy-saving light bulbs may not pay off if the lamp is used rather seldomly, as for instance in cellars or attics. Given the lack of empirical evidence on the lamp type composition and the time spans they are switched on in European households, we draw on illustrative examples to show that the purchase of conventional bulbs instead of energy-saving lamps can be economically rational in many cases.

The subsequent Section 2 presents an example that is typically used to demonstrate the electricity and cost saving potential of energy-saving lamps relative to conventional light bulbs. Section 3 discusses the key role of usage times in the cost-effectiveness of investments in energy-saving light bulbs. In Section 4, it is argued that economic reasons may largely explain the slow diffusion of energy-saving light bulbs, casting doubt on the prevalence of an energy conservation paradox in this instance. The last section summarizes and concludes.

2 Saving Potential of Energy-Saving Light Bulbs

Recent figures for Germany suggest that lighting appliances comprise roughly 22 % of total electricity cost for a typical household with three to four members, assuming that only conventional incandescent light bulbs are employed (Stiftung Warentest 2009). A key rationale behind the promotion of energy-saving light bulbs is to cut back this cost significantly. While their purchase price is currently around 6.5 times higher than that for comparable incandescent bulbs (Table 1), the higher energy efficiency of energy-saving light bulbs may result in a substantial cost advantage over time, presuming intensive usage. Additionally, energy-saving light bulbs are expected to feature a longer lifetime than incandescent light bulbs. On average, energy-saving light bulbs last for 6,000 hours (h), six times longer than incandescent bulbs.

The efficiency gain lies in a similar range: incandescent light bulbs typically transform only about 5 % of the energy input into light. Energy-saving light bulbs reach a notably higher lighting efficiency of 20 to 25 % (Öko-Institut 2004). Thus, while a clear incandescent lamp with 60 watt emits a lighting current of 12 lumina per watt, the corresponding 15 watt compact fluorescent lamp yields 48 lumina per watt.[2] In spite of these different wattages, both bulbs emit a lighting current of 720 lumina, a figure that reflects the light energy radially emitted per second.

Table 1: Comparison of Incandescent and Energy-Saving Light Bulbs[3]

	Incandescent Bulb	Energy-Saving Bulb
Wattage (W)	60	15
Total life time (h)	1,000	6,000
Purchase price (€)	0.60	4.60

Sources: Prices: VITO (2009:160), Total life time: VITO (2009:139, 143).

Calculations as presented in Table 2 are frequently used to point out the economic advantages of energy-saving light bulbs. The table shows that the investment in a 15 watt energy-saving lamp, which is comparable to the use of six 60 watt incandescent bulbs both with respect to overall average lifetime and the lighting current, can reduce electricity cost by some 70 % over the total lifetime of 6,000 hours. While the purchase price of 3.60 € for six incandescent bulbs is slightly lower than the 4.60 € for the energy-saving lamp (Table 2), the lifetime electricity cost of the more efficient lamp only amounts to 18 €, when an electricity tariff of 0.2 € per kWh is assumed (BMWi, 2010).[4] By comparison, the incandescent bulbs will incur electricity cost of some 72 € over 6,000 hours, resulting in a difference in variable cost of 54 €.

Yet, the calculation presented in Table 2 suffers from several drawbacks. First, such calculations are simplified to the extent that expenses and benefits of the investment are assumed to coincide. In fact, however, the cost savings during the usage

[2] The actual lighting current varies among manufacturers and lamp types.

[3] The figures apply to clear incandescent bulbs; deviations for frosted lamps are insignificant.

[4] The energy demand of one 15 watt energy-saving lamp amounts to 90 kWh during its average lifetime of 6000 hours. Assuming an electricity tariff of 0.2 € per kWh, this causes an electricity cost of 18 € (=90*0.2) over the lifetime of the lamp. By comparison, the energy demand of one 60 watt incandescent bulb amounts to 60 kWh during its shorter average lifetime of 1000 hours, yielding an electricity-cost of 12 €. As 6 incandescent bulbs are required to match the lifetime of the energy-saving lamp, the corresponding electricity cost is 72 €.

phase are mainly realized over the long run. Second, these calculations ignore potential changes in consumer behavior due to energy efficiency improvements, such as the replacement of incandescent bulbs with more energy-efficient light bulbs. It is indeed likely, though, that households – with knowledge of the lower electricity cost of energy-saving light bulbs - react by more careless use of lighting and the extension of switch-on times. In a similar vein, households might install additional light bulbs to reap the benefits of higher energy efficiency.

Table 2: Cost Comparison of One 15 Watt Energy-Saving Lamp and Six Comparable 60 Watt Incandescent Bulbs over 6,000 Hours of Usage.

	6 Incand. Bulbs (60 W)	1 Energy-Saving Lamp (15 W)
Electricity cost (€)	72.00	18.00
Purchase cost (€)	3.60	4.60
Total cost (€)	**75.60**	**22.60**
Source: Own calculations.		

Such so-called rebound effects measure the behaviorally induced offset in the reduction of energy consumption following efficiency improvements (Frondel, Peters, Vance 2008). This effect, which is well-known in the energy economics literature, is not only of theoretical nature, but takes on some practical relevance in the discussion around the Commission's phase-out decree. In a 2007 survey, 15 % of the surveyed German households indicated that they would extend the usage times of their lighting applications as a response to lower energy cost (Remodece 2008). Moreover, an empirical study by Greening, Greene and Defiglio (2000:398) estimates the rebound effect in household lighting to be 5-12 %. In other words, 88-95 % of the theoretical energy saving potential is actually realized, the rest is lost due to behavioral changes.

As long as this is an intentional decision by the household and thus contributes to increasing household utility, the rebound is a desired effect. "Wasted energy" due to a careless use of lighting and negligent behavior when switching off lamps, however, has a counterproductive effect and deserves a more critical assessment: if there is no market failure, then "wasted energy" only occurs when people's behavior is not perfectly rational. If, on the other hand, people are rational, then careless use of lighting and negligent behavior are just expressions of hidden cost of action.

3 The Role of Usage Times

Purchasing an energy-saving lamp is an investment, paying off over time: higher initial purchasing cost than for conventional bulbs are compensated by lower electricity cost. Yet, these cost savings are typically realized in later time periods and feature a lower net present value today. We account for this difference by introducing a discount rate of 5 %

per annum, a figure that is used by Arrow et al. (1996) as a lower bound for real returns on financial investments in the Second Assessment Report of the Intergovernmental Panel of Climate Change (IPCC). While the size of the appropriate discount rate is clearly contentious, the non-zero, but conservative discount rate of 5 % is applied here to emphasize the existence of a temporal difference between cost and benefits of the investment.

Ultimately, though, amortization critically depends on the intensity with which the energy-saving lamp is used and in many cases, it may take years for the investment to pay off. On the other hand, for frequently-used lighting applications, as typically found in living rooms or kitchens of multi-person households, pay-off periods may be as short as a few months. Burning, say, about 1.5 hours per day on average, as in the example of bathroom light bulbs (Table 3), the purchase of an energy-saving lamp pays off after almost one year, as is demonstrated now.

Table 3: Lighting Equipment of a Typical 3 to 4-Person Household[5]

	Average Usage per Day	Number of Light Bulbs
Living room	3 h 30 min	5
Kitchen	4 h	4
Home office	2 h	2
Bathroom	1 h 30 min	3
Hall	1 h 45 min	3
Outdoor	30 min	1
Bedroom	15 min	3
Storage room	10 min	1
Attic/Cellar	10 min	3
Total		**25**

Source: Adapted from Öko-Institut (2004) and Remodece (2008).

To account for holidays and sundry absences, we assume the lamp is used 350 days per year. Multiplying this value with the average daily use of 1.5 hours yields the annual usage time of 525 hours. With an electricity tariff of 0.2 € per kWh (BMWi, 2010), the annual electricity cost amounts to 6.30 € for the 60 watt incandescent bulb and slightly less than 1.58 € for the equivalent energy-saving lamp with 15 watt.[6] Hence, the annual reduction in electricity cost is 4.72 € per bathroom bulb. If we invoke the simplifying assumption – to the detriment of the energy-saving lamp – that this saving is

[5] The total number of lamps has been chosen in line with the value of 25 lamps per household, as obtained by ISI et al (2004:73) and Remodece (2008:57).

[6] The annual electricity cost of 6.30 € for the 60 watt incandescent bulb can be obtained by multiplying 0.2 € per kWh by 31.5 kWh, which result from multiplying 525 hours and 60 watt and dividing the product by 1,000.

realized as a lump sum after one year, the discounted saving at the point of time when the investment decision has to be made is 4.50 €. This amount is roughly equal to the purchase price of the energy-saving lamp and exceeds the difference of purchase prices between the incandescent bulb and the energy-saving lamp by far.

Similar calculations for lighting applications that are not that frequently used paint a less optimistic picture. Assuming a daily use of ten minutes for light bulbs in the attic, cellar, or storage rooms, the annual saving potential in electricity cost amounts to as little as 53 cents. Given a discount rate of 5 %, it would take more than a decade until the investment in an energy-saving lamp pays off. The figures presented in Table 3 can be expected to be much lower for single or two-person households, whose share is constantly increasing in the European population. As a consequence, pay-off periods for lighting applications in less frequently-used rooms will be much longer for these household types. Moreover, there is undoubtedly a higher probability that a single or two-person household moves within such a long period and that a light bulb breaks during the move. This calls for introducing an additional risk factor into the investment calculations.

Finally, along with the necessity of a higher regional mobility of labor market participants, the number of households with two residences is increasing. While this will lower the daily use of light bulbs on average, the cost of investments in lighting appliances are larger than for other households and are additionally increased by the light bulb decree: The pressure to exclusively use energy-saving light bulbs, as enforced by the Commission, causes a considerable amount of investment for these households that may only pay off after a long time, if at all. This is particularly relevant for those with a heavy workload, spending rather long hours in the office or on business trips. Their ability to reap the benefits of energy-saving light bulbs will be significantly lower than for those who spend more time at home.

4 The Energy Conservation Paradox

All these examples illustrate that there might be economic reasons for the so-called energy paradox, a phenomenon that has been discussed in the energy economics literature for decades. The notion of energy conservation paradox reflects the puzzle about the slow-moving - and to the minds of many, insufficient - diffusion of seemingly cost-efficient technologies like energy-saving light bulbs, thermal insulation material, or other energy-efficient household appliances (Jaffe, Stavins 1994a:92). It seems questionable, however, to call this phenomenon a paradox, as superior technologies typically diffuse gradually, and not overnight.

For energy-saving light bulbs, empirical evidence confirms that their diffusion has evolved rather slowly. As a 2002 survey among 20 000 German households reveals, on average, only 3.6 out of 25 bulbs in total were of the energy-saving type (ISI et al.

2004:73). 45 % of the households responded to never or only rarely buying an energy-saving lamp. By the end of 2007, incandescent bulbs still featured a share of 50 % in all household lamps, while compact fluorescent light bulbs reached a share of only 11 % (Remodece 2008). More than 40 % of the surveyed German households indicated hardly ever buying an energy-saving lamp when it comes to purchase decisions. Among the most frequently quoted factors that prevented consumers from purchasing energy-saving light bulbs were size and aesthetics, named by 26 % and 22 %, respectively. High initial cost and deficiencies in lighting quality were named by 20 % and 15 % of the survey respondents, respectively. This drawback is due to an uncomfortable lighting atmosphere and an undesired heat-up phase of up to several minutes after the switch-on.

Jaffe and Stavins (1994b) provide a thorough analysis of reasons why energy-efficient technologies, such as energy-saving light bulbs or other electric appliances, are used less frequently than efficiency gains would propose. These authors divide impediments for market diffusion into market and non-market failures. Impediments related to market-failures typically include a lack of general information on cost and benefits of consumption alternatives. Although sufficient information is a crucial precondition for a rational decision process, gathering information on energy efficiency measures may cause significant cost for private households – not least because households invest in such measures on a rare and irregular basis.

From an economic perspective, general information about energy efficiency measures, for example that heat pumps can cut back a household's energy bill considerably, often feature characteristics of public goods (Mennel, Sturm 2009:18). Public goods are characterized by non-excludability and non-rivalry: Nobody can be excluded from the dissemination of information and nobody suffers from others receiving it. As the cost of providing such information is not compensated, private institutions have hardly any incentive in incurring such cost. This kind of market failure calls for government intervention to provide and disseminate general information on energy conservation measures. In the case of energy-saving light bulbs, though, it can be argued that most households should be well-informed about their efficiency gains. After all, it is for many years now that EU legislation requires the energy efficiency class of the light bulb to be printed on the package. Against this background, lack of information can hardly be blamed for the rather slow diffusion of energy-saving light bulbs.

Impediments that do not reflect market failure include factors that explain why the observed behavior might actually be optimal from the consumer's individual perspective (Jaffe and Stavins 1994b:805). Uncertainty about future energy prices and cost savings due to the use of modern, energy-efficient technology represents such an impediment. In combination with the mostly irreversible nature of energy efficiency investments (McDonald and Siegel 1986), the inherent uncertainty requires a higher discount rate than is usually employed in calculations that suggest the existence of the energy conservation paradox. In fact, it can be adequate and economically rational to account for uncertainty through higher discount rates, compared to investments that provide a guaranteed flow of returns.

Another explanation for the energy conservation paradox that is not rooted in market failure is the possibility that new energy-efficient technologies feature some undesired qualitative attributes. Energy-saving light bulbs, for instance, are frequently said to be not always dimmable.[7] Jaffe and Stavins (1994b:805) furthermore identify transaction cost prior to the installation of energy-efficiency measures as another obstacle, an issue that has been taken up in recent US press reports on energy-saving bulbs (e.g. Brandston, 2009; Vestel 2009). Clearly, gathering information on which technology and appliances fit the personal living situation best causes monetary cost and may require a considerable amount of leisure.

As the previous discussion has shown, another major reason for the slow market diffusion of energy-saving light bulbs rests on the fact that, although new technologies might be cost-efficient on average, they need not to be for each purpose and circumstance (Jaffe, Stavins 1994b:806). In fact, as presented in Table 3, switch-on times among different lighting appliances are rather heterogeneous and differ significantly. In the case of a less frequent use of only some minutes per day, the investment in an energy-saving bulb only pays off after years or even decades. In the end, the use of cheaper incandescent instead of energy-saving light bulbs can be economically rational.

5 Summary and Conclusion

The ban of incandescent light bulbs via Regulation 244/2009 is part of the Commission's broader strategy to combat climate change and increase energy security within the EU Member States. As stipulated in the European Climate and Energy Package that became law in June 2009, the so-called "20-20-20" targets, to be met by 2020, play a key role in the Commission's strategy. These targets imply a reduction of greenhouse gas emission of at least 20 % below the 1990 level, a share of 20 % for renewable energy in total energy consumption, and cutting primary energy consumption by 20% of projected 2020 levels - by improving energy efficiency. To comply with these targets, EU-wide policy instruments, such as the EU Emissions Trading Scheme and numerous market regulations, have been implemented. One of these regulations is the Directive 2006/32 on energy end-use efficiency and energy services, better known as the "Energy Services Directive". It calls on each Member State to design and implement a National Energy Efficiency Action Plan to achieve the indicative target of an efficiency improvement of

[7] Another disadvantage that is often raised in public discussions relates to environmental and health effects of energy-saving lamps (DPG 2010b:22). Compact fluorescent lamps contain mercury and need a special disposal treatment. However, as electricity production from coal also emits mercury, the total mercury balance is still better than for the incandescent bulb. VITO (2009) finds that the mercury emission per lumen and hour of usage for incandescent bulbs is 8 % higher than for a comparable compact fluorescent lamp.

9 % between the nine years of 2008 and 2016 and, hence, an increase in energy efficiency by about 1 % per year.

Furthermore, the Commission promoted an action plan for energy efficiency (EC 2006), stipulating concrete EU-wide measures in sectors with the highest energy-saving potential, most notably residential and commercial buildings with a saving potential of 27 to 30 %, transport (26 %), and the manufacturing industry (25 %). These measures encompass energy performance requirements for products and buildings, "green" power generation, labeling standards, and a new legislation under the auspices of Regulation 443/2009 to limit CO2 emissions from cars to 120 g/km on average (Frondel, Schmidt, Vance 2010).

Finally, this action plan also laid ground for the amendment of the directive on the eco-design of energy-using products in 2009 (Directive 2009/125), currently covering more than 40 product groups. According to the so-called top-runner approach, pursued to push market diffusion of the most environmental-friendly and energy-efficient products, minimum energy efficiency standards for various appliances in households and industry are required. Contemporary examples for appliances falling under the eco-design regulation include refridgerators, dish washers, washing machines, TVs, as well as other appliances running in stand-by mode. Nine product groups became subject to the eco-design regulation in 2009 alone, with household lamps certainly attracting most public attention.

Referring to a psychological barrier, the Commission justifies the ban of incandescent light bulbs as follows: "The market has clearly failed to move towards the alternatives to conventional incandescent bulbs, even though they cost much less to the consumers over their entire life cycle. […] This is due to the fact that the purchase price difference between conventional incandescent bulbs and more efficient alternatives constitute a psychological barrier, even if the higher initial investment pays off within a year and brings substantial (but much less visible) savings over the life cycle" (EC 2009b:10). Thus, according to the Commission, the regulation is the necessary corrective to a failure of the market's invisible hand, thereby presuming that households behave irrationally.

In this article, we have demonstrated that the observed consumer behavior of a high preference for incandescent bulbs needs not to be a consequence of market failure or irrational decisions, as presumed by the Commission. Rather, it may be an outcome of rational economic reasoning that the energy-saving lamp still struggles to crowd the incandescent bulb out of the market, even though it allows for significant cost reductions when frequently used. After all, energy-saving light bulbs still suffer from several drawbacks, such as inferior light quality and switch-on behavior (DPG 2010b:22).

We have highlighted another important reason for the slow diffusion of the energy-saving light bulb that rests on the fact that its less frequent use does not lead to a substantial reduction in total electricity cost. Instead, the higher initial investment only pays off after a long time span, if at all. This argument alone should be enough to show that the general ban on incandescent bulbs is inappropriate and should be rescinded by the Commission.[8] After all, this ban is a harsh attack on consumers' sovereignty on purchase decisions that is hardly warranted on environmental and welfare grounds. As the most common 60 watt incandescent bulb is to be banned as of September 2011, European consumers would still save a lot of money if the light bulb decree were to be abolished immediately.[9]

This would be all the more important, as the disposal of energy-saving light bulbs will never be perfectly organized, even if retailers are obliged to install recycling boxes. In Germany, for instance, only about one third of the 120 million energy-saving bulbs that are defect per year is collected and correctly disposed of (WEKA 2010). Yet, energy-saving light bulbs that are out of order represent hazardous waste, as they contain toxic mercury that evaporates when the light bulbs break into pieces. Worrywarts may wonder what will happen when a lazy or careless, say, 50 percent of almost 500 million Europeans put their worn-out bulbs in the trash. As a consequence, instead of prescribing the use of energy-saving light bulbs for consumers, a brighter move would be for the Commission to more intensively urge the producers to successively and strongly reduce the mercury content of this kind of bulb.

[8] Not surprisingly, on the demand side people have reacted to the Commission's ban by hoarding conventional light bulbs. On the supply side, a creative idea to circumvent the ban that received a lot of attention in Germany was to declare conventional light bulbs as "heat balls", whose main purpose is to produce heat, rather than light (see http://heatball.de/en/).

[9] Estimates of potential welfare gains are unavailable given the lack of empirical evidence on the lamp type composition and the time spans they are switched on in European households.

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