



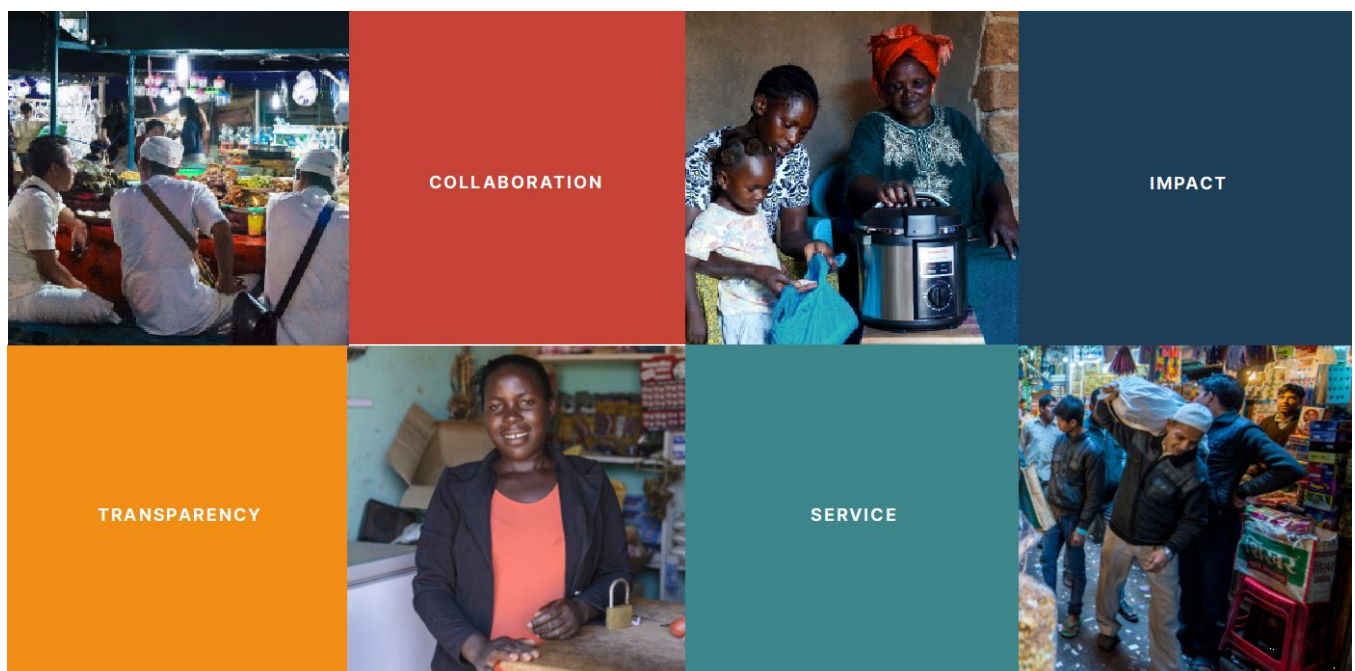
How Many Years Does It Take the European Commission to Change a Toxic Lightbulb?

CALCULATING THE COST OF DELAYS TO THE LIGHTING AMENDMENTS TO THE ROHS DIRECTIVE
9 JULY 2021

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Executive Summary

Mercury is a toxic substance that poses high-risk to human health and the environment. Mercury exposure can affect the nervous, cardiovascular, immune and reproductive systems in populations at all ages, and result in a permanent neurological development alteration in fetuses, babies and children.

The EU regulates mercury through the Restriction of Hazardous Substances Directive (RoHS), however this regulation exempts certain widely used mercury containing light bulbs like compact fluorescent lamps (CFLs) and linear fluorescent lamps. These RoHS exemptions were based on limited availability of alternatives to fluorescent lighting when the directive was drafted in the early 2000s. However, technology advancements over the last decade have established light emitting diode (LED) retrofit bulbs as a cost-effective, mercury-free alternative to fluorescent. Today, LED bulbs are twice as efficient as fluorescent, meaning they produce the same or improved light using half the energy, and LEDs last 2-3 times longer than fluorescent.

Considering the rapidly changing lighting market, the European Commission asked the Öko-Institut in Germany to analyse the costs and benefits of the RoHS fluorescent lighting exemptions in 2015, 2017 and then again in 2020 with a view to ending the exemptions, but in both cases the Commission did not take action. The 2020 analysis focused on the three most common types of fluorescent lighting and concluded that eliminating the RoHS exemption for these by June 2021 would save €29.9 billion for European households, businesses and institutions by 2035. It would have also avoided 310 Terawatt-hours (TWh) of electricity use and 2.88 tonnes of mercury in the lamps themselves.

CLASP built on the published Öko-Institut analysis and calculated that the longer these RoHS exemptions for fluorescent lamps are maintained, the larger the cost for the European people and businesses. The net savings that are lost by European consumers and businesses if product exemptions are delayed by two years (to June 2023) is € 12.2 billion – which equates to **€16.8 million Euro in savings per day being thrown away**. Similarly, an additional 1060 kg of mercury pollution from fluorescent bulbs will cause long-term harmful effects on peoples' health and the environment.

The European Commission must act now to remove RoHS exemptions to mercury-based lighting as soon as possible to stop causing unnecessary harm to people's health, delaying the European economic recovery, and contaminating the environment. Any further delay in eliminating exemptions on fluorescent lighting is preventing the European Union from advancing a resilient and sustainable economic development. As a result, the European Commission should remove the RoHS exemption to mercury-based lighting now.

1. Losses to European Countries from Delays

The continued use of inefficient, mercury-based lighting for an additional two years wipes out economic savings across the EU of 12.2 billion Euros.

The following figures reflect the expected cost of the continued use of inefficient, mercury-based lighting in terms of cost (million Euro), additional mercury pollution (kilograms mercury), carbon dioxide emissions (kilotonnes of CO₂), and excess electricity use (gigawatt-hours, GWh). The impact of two-year delay wipes out economic savings across the EU of 12.2 billion Euros, with the four largest economies - Germany, Italy, France and Spain representing 77% of the lost financial savings. And in terms of avoided mercury in lamps, these four countries represent 63% of the lost mercury savings shown in Table 1.

TABLE 1: IMPACT OF TWO YEAR DELAY ON EUROPEAN UNION COUNTRIES

Impact of Two Year Delay...	Lost Economic Savings by Country (million Euro)	Lost Mercury Savings by Country (kilograms mercury)	Lost CO ₂ savings (kilotonnes CO ₂)	Lost Electricity Savings (GWh)	Lost Economic Savings per Person (Euros/person)
Country					
Austria	€219	24.6	398	2,784	€25
Belgium	€265	25.4	508	2,872	€23
Bulgaria	€43	8.1	538	919	€6
Croatia	€44	5.6	160	631	€11
Cyprus	€33	1.8	98	208	€37
Czechia	€85	23.4	1,422	2,653	€8
Denmark	€54	17.5	500	1,985	€9
Estonia	€14	2.3	206	262	€10
Finland	€35	13.3	262	1,505	€6
France	€1,359	171.5	2,057	19,406	€20
Germany	€4,010	230.9	10,218	26,134	€48
Greece	€158	18.1	986	2,053	€15
Hungary	€134	19.7	592	2,233	€14
Ireland	€163	11.9	325	1,347	€33
Italy	€2,986	160.8	4,894	18,194	€50
Latvia	€25	3.0	64	341	€13
Lithuania	€28	4.6	119	518	€10

Luxembourg	€15	2.6	60	292	€24
Malta	€14	1.1	59	122	€27
Netherlands	€352	53.0	1,421	5,995	€20
Poland	€487	65.8	4,527	7,446	€13
Portugal	€237	22.8	726	2,585	€23
Romania	€135	19.6	786	2,214	€7
Slovakia	€143	11.6	285	1,318	€26
Slovenia	€35	5.1	204	578	€17
Spain	€1,043	101.8	2,915	11,521	€22
Sweden	€117	30.7	240	3,477	€11
Total (EU-27)	€12,231	1,056.8	34,570	119,596	€27

In Table 1, the national estimates of lost financial savings offer a more accurate calculation than our previous study published in [January 2021](#) which had used average EU electricity prices. The calculations presented in this study use the national electricity prices from EuroStat and thus offer a more refined quantification of the costs at the national level (please see Section 5 for a discussion on the methodology followed).

The overall cost of a two year delay, calculated using the spreadsheet prepared for the Commission by their contractors, is €12,231 million Euros. If one were to divide that total cost by the number of days in two years – 730 days – it works out to **€16.8 million Euros per day** of potential savings which are being lost due to the on-going delays. At the personal level, the €12,231 million Euro of lost savings equates to an **average lost savings of €27 per EU Citizen**.

2. Introduction

Fluorescent lighting is a significant route of mercury exposure for people and the environment, and is especially dangerous to babies and children.

Mercury is a toxic substance that is dangerous to human health. For babies, young children, and infants in utero, it can permanently limit neurological development. Exposure among people of all ages can lead to brain, heart, and other organ damage. The health effects of mercury have been well-known for decades, but not enough action has been taken to address the problem: research shows that 1.8 million babies are born in Europe every year with methylmercury levels in their blood of 0.58 µg/g and approximately 200,000 births exceed the higher level (2.5 µg/g) proposed by the World Health Organisation.¹



¹ Bellanger, M., Pichery, C., Aerts, D. et al. Economic benefits of methylmercury exposure control in Europe: Monetary value of neurotoxicity prevention. *Environ Health* 12, 3 (2013). <https://doi.org/10.1186/1476-069X-12-3>

Fluorescent bulbs and tubes are a common source of lighting found in tens of millions of homes and office buildings across Europe, but they all contain mercury which is a hazardous neurotoxin. Fluorescent lighting technology was first commercialized in the 1930's, and at its peak around 2014 was responsible for approximately 70% of the artificial light produced worldwide.² It was once an environmentally preferred lighting option thanks to its lower electricity use compared with technologies like incandescent bulbs.

However, with efficiency developments in mercury-free light emitting diode (LED) technologies over the past decade, fluorescents are now a comparatively wasteful technology and the mercury contained in fluorescent lights poses a risk to people and the environment. The vast majority of fluorescent lamps are not disposed of properly, which contributes to further mercury contamination of the soil and water, compounding the threat to public health, especially for developing foetuses, infants and children.

The EU regulates mercury in lighting through the Restriction of Hazardous Substances Directive (RoHS), but the RoHS regulations for lighting are out of date.

The [RoHS Directive](#) limits the use and sale of products with mercury and other toxic substances. For mercury-added products for which there are no substitutes available, RoHS makes exemptions with the requirement that those exemptions end as soon as possible:

"The decision on exemptions and on the duration of possible exemptions should take into account the availability of substitutes and the socioeconomic impact of substitution. [...] Exemptions from the restriction for certain specific materials or components should be limited in their scope and duration, in order to achieve a gradual phase-out of hazardous substances in [electrical and electronic equipment] (EEE), given that the use of those substances in such applications should become avoidable."³

Currently, nearly all types of fluorescent lighting are exempted from control under the RoHS directive on this basis – however, careful examination of the exemption criteria shows that these exemptions no longer apply. Today, safe and efficient alternatives to fluorescent lighting are widely available. Bulbs LED technology can cost-effectively substitute for the common shapes and types of fluorescent bulbs.

² United for Efficiency, Global Lighting Market Model, 2015.





³ RoHS Directive available at: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02011L0065-20210401>

3. Background

Over the past decade, the RoHS Directive has not kept pace with changes in the lighting market. Cost-effective, energy-efficient and mercury-free retrofit LED bulbs can replace fluorescents in all applications.

Light bulbs based on light-emitting diode (LED) technology were first introduced around 2005 and after achieving technological breakthroughs over the intervening 15 years, are now widely available in all shapes, wattages, colour temperatures, colour rendering indices and price points. The biggest companies in the lighting industry, as well as a wide range of smaller companies, have introduced LED products designed to replace older, more energy-intensive incandescent and halogen lighting options, as well as all shapes and types of fluorescents serving 100% of European market needs. These new lighting products have quickly gained market share because they produce high quality light, cost less to operate due to energy savings, last twice as long as fluorescents, and require no special handling because they do not contain toxic mercury.

TABLE 2: COMPARISON OF COMMON FLUORESCENT LIGHTING TO LED OPTIONS

				
Bulb Type	Typical household CFL bulb	Replacement LED	Typical workplace T8 linear fluorescent bulb	Replacement LED
Watts for equivalent light	15W	7.5W	36W	16W
Energy efficiency	Low	High	Low	High
Typical lifespan*	4.8 years	10.3 years	5.5 years	13.7 years
Yearly electricity cost*	€4.70	€2.30	€16.50	€7.30
Contains mercury	Yes	No	Yes	No

* Assumes 4 hours per day for CFL and LED bulbs, and 10 hours per day for linear bulbs; average EU-27 electricity prices, 2021: Domestic €0.2134/kWh and Non-Domestic €0.1254/kWh (Eurostat, 2021)

First Öko-Institut Review (2016)

The European Commission has a process, delegated to its environmental department (DG Environment), to periodically review the products that are exempt from controls under RoHS, and update those exemptions to keep pace with market change. In 2015, DG Environment requested that the independent research group Öko-Institut review the exempted lighting products to guide an update to the exemptions in 2016. The [Öko-Institut review](#) concluded that mercury-free substitutes for certain types of fluorescent lighting (including CFLs and T5, T8 and T12 linear fluorescent lamps) were easily available on the market, with cost savings for consumers and public health benefits from mercury reduction. The Öko-Institut recommended that several of these fluorescent lamp categories be phased out of the European market through the RoHS Directive. DG Environment, however, did not act on the recommendation from this review. Instead, they contracted the Öko-Institut to update specifically the socio-economic impact assessment part of its 2016 report, which started in 2017 and finally concluded, after being revised twice in July 2020.

Second Öko-Institut Review (2020)

In July 2020, the Öko-Institut [published an update](#) to its analysis for three of the most widely used fluorescent lighting products, using [new market data](#) published by the Swedish Energy Agency and CLASP. The new analysis found significant socioeconomic benefits from phasing-out three common fluorescent lighting products by 2021 (i.e., CFL pin-base, and T5 and T8 linear fluorescent lamps) which can all now be easily replaced by readily available LED bulbs. The analysis calculated €29.9 billion in savings for European households, businesses and institutions by 2035.⁴ Phasing-out these lamps would also avoid 310 Terawatt-hours (TWh) of electricity use – equivalent to the total annual electricity consumption of Italy⁵ – and 2.88 tonnes of mercury in the light bulbs, all very significant financial and public health benefits.

Publication of draft Amendments to RoHS

Nearly a year after the last socio-economic impact assessment was published by the Öko-Institut, DG Environment proposed updates to its requirements for mercury-based lighting products in the “Have Your Say” public comment area of their website. This further delay in the policy process has allowed lower-efficiency fluorescent lighting to persist in the market for longer than is justified, resulting in significantly higher costs for European households and businesses.

⁴ Öko-Institute focused on these three lamp types at the Commission’s direction, because updated market data provided by CLASP and the Swedish Energy Agency in 2019 showed that the market data used in the previous analysis of these lamp types was outdated, resulting in overly high estimates for the costs of replacing fluorescent lamps. This was especially true in cases where the old market data showed that like-for-like replacements were not commercially available, but more recent market data showed product availability.

⁵ Statistics report: [Key World Energy Statistics 2020](#), the International Energy Agency, Paris, France. Published August 2020.

In our view, the following are five of the most important draft Delegated Acts that were proposed by the Commission in June 2021 and [we suggest stakeholders submit feedback](#) on:

- [Double-capped linear fluorescent lamps for general lighting purposes](#) – proposes to phase out linear fluorescent lamp categories 2(a)(1) Tri-band T2, 2(a)(4) Tri-band T12 and 2(a)(5) Tri-band long-life (>25k hour) in 12 months; and proposes to phase out categories 2(a)(2) Tri-band T5 and 2(a)(3) Tri-band T8 in 18 months. Comment period closes on 16 July.
- [Single capped \(compact\) fluorescent lamps for general purposes](#) – proposes to phase out all compact fluorescent lamps (CFLs) including both screw-base and pin-base (categories 1(a) through 1(e) in 12 months. Comment period closes on 21 July.
- [General Lighting Lamps with a lifetime of 20,000 hours or more](#) – proposes to phase out this category of long-life CFL, category 1(g), in 18 months. Comment period closes on: 16 July.
- [Non-linear tri-band phosphor lamps](#) – proposes a 3 year extension period for category 2(b)(3), non-linear tri-band lamps, thus there is no phase-out proposed for this product category. Comment period closes on 12 July.
- [Cold Cathode and External Electrode Fluorescent Lamps](#) – proposes a 5 year extension period for categories 3(a) through 3(c), which includes cold cathode fluorescent lamps and external electrode fluorescent lamps in Electrical and Electronic Equipment (EEE). Comment period closes on 12 July.

DG Environment's proposals address the key fluorescent products included in the Öko-Institut's updated report – CFLni, T5 and T8 linear fluorescent – calling for a phase-out 12 to 18 months from publication in the Official Journal of the European Union. We note, however, that even with the draft amendments proposed, it could take two years for these proposals to become law, and it is no longer possible to capture the full benefit of the scenarios modelled by Öko-Institut.

A two-year delay beyond the Öko-Institut's initially considered 2021 phase-out date seems inevitable, unless the Commission can fast-track the process. In light of this anticipated two-year delay, CLASP analysed the cost to European households and businesses from the continued use of higher-cost, mercury-based fluorescent lighting.

4. CLASP's 2021 Analysis

With new product exemptions announced in June 2021, the anticipated phase-out is July 2023.

CLASP's study calculates the lost benefits to the EU from a two-year delay to the Öko-Institut scenario.

This study updates the cost-benefit analysis for banning major categories mercury-based lighting, if new product exemptions announced this year, take effect in July 2023. Our analysis assumes the continuation of an ongoing steady but slow market transition from the use of fluorescent lighting to LED, driven by factors including better product performance and lower lifecycle costs by LED products. Factors that inhibit that transition include slightly higher initial purchase costs for some types of LEDs (though any initial cost difference is recovered through lower energy costs for LED operation within a matter of months), and the continued availability of fluorescent lighting – the status quo replacement option for some buyers – within the European market.

Types of Lighting Addressed in this Report

Annex III of the RoHS Directive lists more than a dozen varieties of fluorescent lamps, many of them with narrow use cases and small market shares. We focus here on the three major types of fluorescent lamps that the Öko-Institut addressed in its July 2020 report, and which account for most fluorescent bulbs sold in Europe: one type of compact fluorescent lamp (CFL) and two types of tubular fluorescent lamps (see table below). For each of the three fluorescent lighting types in question, the July 2020 Öko-Institut report shows that a RoHS exemption is no longer warranted because mercury-free LED retrofits exist today which are cost-effective (see below) and can be installed directly into the same fixtures by a non-expert and without the need to rewire. It's a simple plug and play solution, installing a new LED lamp where the same fixture was previously operating a fluorescent lamp.







There are thousands of mercury-free LED replacement lamps available today to replace fluorescent lamps – different sizes, lengths, ballast types (i.e., magnetic/starter and high frequency electronic), colour temperatures, and regular, high output and ultra-high light output levels. Lamps are also available which are “universal” and can operate on a variety of input power configurations. Many of these LED products are designed as direct retrofits into existing fluorescent fixtures to avoid the need to rewire. For example, Philips/Signify states⁶ that there is “No need to change drivers or rewire”, noting that they offer a “plug and play solution that works straight out of the box”. OSRAM/LEDvance state⁷ that their “SubstiTUBE” product is a “Quick, simple and safe lamp replacement without rewiring.” Sylvania lighting advertises that their SubstiTUBE product is “engineered to operate on existing instant start and select programmed

⁶ <https://www.lighting.philips.com/main/support/support/tools/ledtube-selectortool>

⁷ <https://www.ledvance.com/professional/products/product-stories/led-tubes-online-special/index.jsp>

rapid start electronic T8 ballasts, these lamps minimise labour and recycling costs.”⁸ Tungfram reports that in addition to “the 2.5-3x longer life (compared to T8 fluorescent lamps operated on electro-magnetic gear) and lower wattages, Tungfram LED T8 tubes provide lower system loss while existing fixtures remain intact.”⁹

TABLE 3 TYPES OF LAMPS INCLUDED IN CLASP’S 2021 ANALYSIS

Lamp type description	Fluorescent Examples	Mercury-free LED Alternatives
Pin-based CFL These are a type of compact fluorescent lamp (CFL) where the ballast that drives the lamp is in the fixture instead of being part of the bulb. These include bulbs that can be a few parallel bars, a circular shape or a “2-D” shape.		
T5 Linear Fluorescent Lamps Linear fluorescent lamps (LFLs) are the long, tubular strip lights that are used in residential, commercial and industrial buildings. These have a diameter of 5/8 inch, hence the name “T5”.	<p>T5 5/8" diameter</p> 	
T8 Linear Fluorescent Lamps Another type of linear fluorescent lamp used in the same applications as T5. This lamp has a diameter of one inch (or 8/8 inch), hence the name “T8”.	<p>T8 1" diameter</p> 	

⁸ <https://assets2.sylvania.com/media/bin/asset-1377974/asset-1377974>

⁹ <https://tungfram.com/en/products/led-retrofit/led-tubes>

Cost-effectiveness of mercury-free LED replacement lamps

Replacing fluorescent lamps with LED retrofit tubes is highly cost-effective. According to the [website of OSRAM/LEDvance](#), “Payback of acquisition and replacement costs possible after only four months.”

To check this claim, Table 4 calculates the payback period replacing a 36W T8 linear fluorescent lamp in a typical European office installation with two different LED retrofit lamps – an economy grade LED tube and a high-quality LED tube. The results indicate that the payback period is between 4 and 10 months, even without taking into consideration the labour savings from not needing to change the LED tubes as often as the fluorescent.¹⁰

Table 4 compares a €3.68 OSRAM 36W T8 linear fluorescent lamp (declared 20,000 hours lifetime) with Philips’ CorePro (entry-level, 30,000 hours lifetime, 18 watts) LED replacement and Philips’ MasterLED (professional-grade, 50,000 hours lifetime, 12.5 watts) LED retrofit models. In a typical one-shift office operation, the lights will be on for an average of 10 hours per day – allowing for one eight-hour shift and a few hours before and after for cleaning and flexi-time.

¹⁰ LED retrofit lamps last 1.5 to 2.5 times longer than fluorescent, offering even more savings on replacement costs.

TABLE 4: ECONOMIC ANALYSIS OF T8 FLUORESCENT VS. LED LAMPS IN EUROPE, EQUIVALENT LIGHT OUTPUT¹¹

Economic indicator description	T8 LFL	T8 LED-1	T8 LED-2	Units
Price for one lamp:	€3.68	€6.77	€12.74	Euros/lamp
Rated lamp wattage:	36	18	12.5	Watts
Rated lamp lifetime:	20,000	30,000	50,000	Hours
Annual electricity consumption (10 hr/day):	131	66	46	kWh/yr
Annual cost of electricity:	€16.48	€8.24	€5.72	Euros/year
Payback period in years:		0.38	0.84	years
Payback period in months:		4.5	10.1	months
Life-Cycle Cost, 13 years, net present value:	€223.40	€118.82	€87.12	Euros (NPV, 2021)
Life-Cycle Cost savings (net present value):		€104.58	€136.28	Euros (NPV, 2021)

The table shows that the entry-level LED (T8 LED-1) offers a payback period of 4.5 months compared to the fluorescent (and will last 1.5 times longer than the fluorescent lamp) and the professional grade lamp (T8 LED-2) offers a payback period of 10.1 months (and will last 13 years, which is 2.5 times longer than the linear fluorescent lamp). These calculations reflect energy costs and bulb costs only, and do not incorporate labour costs to change the lamp which are avoided due to the reduced frequency of bulb changes (which would make the payback period even shorter). Considering the life-cycle costs of this installation over a 13 year period (from 2023-2035 as per initial study examined period) and discounted to today's net present value, **end-users will save €105 for each T8 fluorescent lamp they replace with a T8 LED-1 (CorePro) or €136 with the T8 LED-2 (MasterLED) for each T8 fluorescent lamp replaced.**

RoHS Directive Exemption Criteria

Under the RoHS Directive, Article 5(1)(a) sets out the criteria that must be met in order to justify maintaining product exemptions:

Article 5. Adaptation of the Annexes to scientific and technical progress

1. For the purposes of adapting Annexes III and IV to scientific and technical progress, and in order to achieve the objectives set out in Article 1, the Commission shall adopt by means

¹¹ For this calculation, it is assumed the lamps operate on average 10 hours per day (3650 hours/year), non-domestic electricity costs are €0.1254/kWh (EuroStat, 2021a), that there is an annual increase in electricity price of 4.0% and a discount rate of 4.0% (VHK, 2019).

of individual delegated acts in accordance with Article 20 and subject to the conditions laid down in Articles 21 and 22, the following measures:

(a) inclusion of materials and components of EEE for specific applications in the lists in Annexes III and IV, provided that such inclusion does not weaken the environmental and health protection afforded by Regulation (EC) No 1907/2006 and where any of the following conditions is fulfilled:

- their elimination or substitution via design changes or materials and components which do not require any of the materials or substances listed in Annex II is scientifically or technically impracticable,*
- the reliability of substitutes is not ensured,*
- the total negative environmental, health and consumer safety impacts caused by substitution are likely to outweigh the total environmental, health and consumer safety benefits thereof.*

Decisions on the inclusion of materials and components of EEE in the lists in Annexes III and IV and on the duration of any exemptions shall take into account the availability of substitutes and the socioeconomic impact of substitution. Decisions on the duration of any exemptions shall take into account any potential adverse impacts on innovation. Life-cycle thinking on the overall impacts of the exemption shall apply, where relevant;

(b) deletion of materials and components of EEE from the lists in Annexes III and IV where the conditions set out in point (a) are no longer fulfilled.

The Swedish Energy Agency and CLASP published a study in February 2020 titled “Assessing Annex III Fluorescent Lamp Exemptions in the Light of Scientific and Technical Progress”¹² which evaluated in detail each of the criteria against the three types of fluorescent lamps. The study concluded that for these three high sales volume mercury-containing fluorescent lamps – CFLni, T5 and T8 linear fluorescent – none of the six criteria for granting an exemption are met.

¹² To view the Sweden-CLASP report assessing each of the three fluorescent lamp types against the RoHS criteria for exemptions, please click on this link: <https://www.clasp.ngo/research/all/assessing-annex-iii-fluorescent-lamp-exemptions-in-the-light-of-scientific-and-technical-progress/>



5. Methodology

The results presented in this report use the same [spreadsheet](#) published by the Öko-Institut as part of their [Update report](#) to the Socio-Economic Impact Assessment. This methodology and spreadsheet have been widely accepted by all stakeholders, including industry. In this spreadsheet, the Öko-Institut default scenario considered the starting year of the phase-out to be 2021 – however this year can be adjusted to start later, such as in 2022 or 2023, thereby calculating the impacts of the phase-out in these later years.

In order to calculate the national-level impacts presented in Table 1 of this report, CLASP followed these steps:

- 1) Apportioned Lamp Shipments – the Öko-Institut spreadsheet starts with a forecast of fluorescent lamp shipments across the EU for each of the three types analyzed (i.e., CFLni, T5 and T8). CLASP used a [database of building floorspace](#) purchased from GuideHouse Insights to apportion these EU-wide shipments to each of the 27 countries. Shipments were scaled according to the total interior building floorspace in each Member State.
- 2) National Level Data – CLASP obtained national average electricity prices from Eurostat ([household](#) and [non-household](#)) as well as the [carbon intensity rates](#) (average CO₂/kWh) for electricity in each of the 27 countries.
- 3) Conduct Individual Runs - CLASP then used the spreadsheet to conduct separate runs for each of the 27 countries, taking into account the national shipments, electricity price and emission factors. These model runs calculated the cost of delay for each Member State in terms of: lost economic savings nationally and per citizen, lost mercury savings and lost electricity and CO₂ savings. The results are presented in Table 1 of this report.

Thus, the model and results published in this report reflect, to the best of our ability, the national-level impacts of the on-going delay to phasing-out of the fluorescent lamp exemptions in RoHS, based on a model on which the European Commission consultants have been using already.