Clean Lighting Coalition

Technical & Economic Assessment of Mercury-Free Lighting: Global Overview

Global Overview

The Minamata Convention on Mercury, a United Nations Convention aiming to 'Make Mercury History', maintains exemptions for some fluorescent lighting, despite significant advancements in LED technology and progress to end the manufacture, export and import of other mercury-containing products.

Phasing-out inefficient, mercury-based lighting is the lowest hanging fruit in cutting mercury from the market, as the mercury-free LED technology is widely available across the globe at affordable prices. An all LED transition is also critical in achieving global climate goals. Replacing fluorescents with efficient LEDs significantly cuts energy use and related emissions - bringing the world closer to vital Net Zero emission targets.

The accessibility and affordability of mercury-free LED retrofit lamps available today makes the Minamata Convention's exemption as outdated and unnecessary as the fluorescents themselves.

At the Minamata Convention Fourth meeting of the Conference of Parties (COP4) in March 2022, 137 Parties agreed to phase-out compact fluorescent lamps by 2025, per the COP4 Lighting Amendment. This decision avoids 34.8 metric tonnes of mercury pollution, 263 million metric tonnes CO_2 emissions, 754 TWh of energy consumption, and will result in $105.6 billion energy bill savings from 2025-2050.

However, last-minute interventions delayed a decision on linear fluorescent lamps (LFLs), the long tubes commonly found in offices and stores and the largest contributor to lighting-based mercury pollution in the world, until the upcoming Fifth meeting of the Conference of Parties (COP5) in October/November 2023. Linear fluorescents comprise the largest share of installed fluorescent lamps in the world – a move to make them history has significant and cross-cutting benefits for people and the planet.

The COP5 Lighting Amendment

In April 2023, the Africa Region proposed another Amendment to Annex A of the Minamata Convention to remove the exemptions for all remaining fluorescent lamps, including for all wattages of LFLs, by 2026.

If a 2025 LFL phase out date is negotiated and adopted at COP5 – reflecting the position of the Clean Lighting Coalition – it would result in the following cumulative benefits (2025-2050):

1. avoid **183 metric tons of mercury pollution** from leaking into the environment between 2025-2050, both from the lamps themselves and from avoided burning of coal in power plants.
2. avoid **3.2 gigatons of CO_2 emissions** which is equivalent to getting ALL passenger cars (globally) off the road for a whole year.
3. **US $ 1.33 trillion** in financial savings
4. **9,300 TWh** in energy savings

The health benefits through avoided mercury pollution, economic benefits through financial savings, and the climate mitigation benefits via reduced energy consumption and averted carbon emissions offer compelling incentives to countries to make the switch to all LEDs. **Eliminating toxic fluorescent lighting will bring about positive outcomes for public and environmental health, and help to realize a sustainable, healthy and climate-friendly lighting market moving forward.**

Our 2023 Analysis

To better understand the feasibility of an LFL phase-out in line with the COP5 Lighting Amendment, the Clean Lighting Coalition worked with partner organizations in 66 countries across Africa, Latin America and Caribbean and Asia-Pacific to collect lighting market data. The organizations gathered price and performance (wattage and lifetime) information for mercury-containing fluorescents and LED alternatives from wholesalers, specialist lighting shops and professional consumers such as supermarkets, office buildings, hospitals, municipalities, and airports in those markets.

The research confirmed that there is widespread availability of cost-effective, energy-efficient LED alternatives to LFLs across all regional markets. Indeed, **the time to switch to mercury-free LED lighting is now.**

The following sections provide a summary of the country and regional findings.

Energy Efficiency Comparison

The energy efficiency of a light bulb is measured in lumens/watt and is typically referred to as efficacy. That is, the service provided which is measured in lumens of light, divided by the power consumption measured in watts. In all markets, LED lamps consume approximately half the wattage of fluorescent lamps yet produce an equivalent amount of light when installed in a fixture.

On average, LED efficacy is 40% higher than fluorescents.

The scale and range of efficacy values found for linear lamps is illustrated in Figure 1. Average efficacies are 100lm/W and 72lm/W for LEDs and fluorescents respectively.

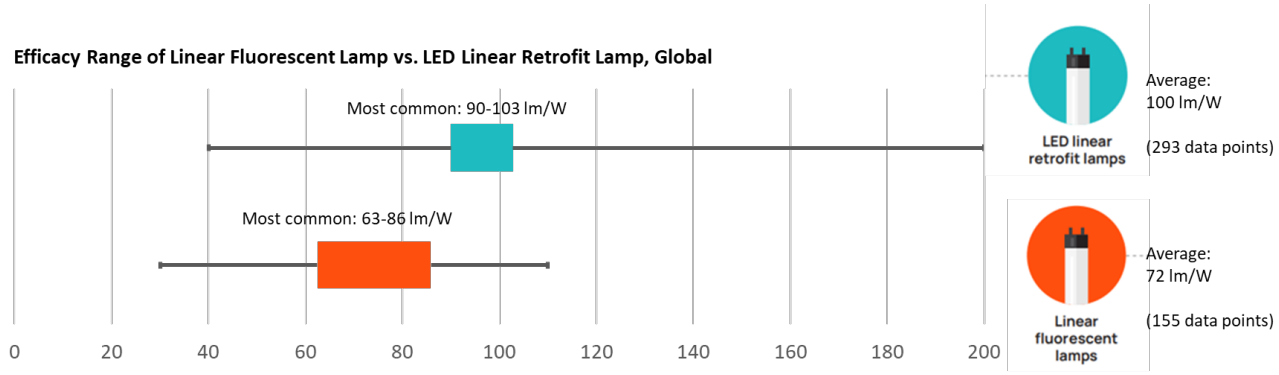


Figure 1 Efficacy Comparisons between LEDs and Fluorescents

The scatter plot in Figure 2 shows the efficacy (i.e., energy efficiency) of individual lamps collected across all regions. LEDs are approximately twice as efficient as fluorescent lamps. **LEDs produce the same light with less energy and therefore reduce electricity bills for users.**

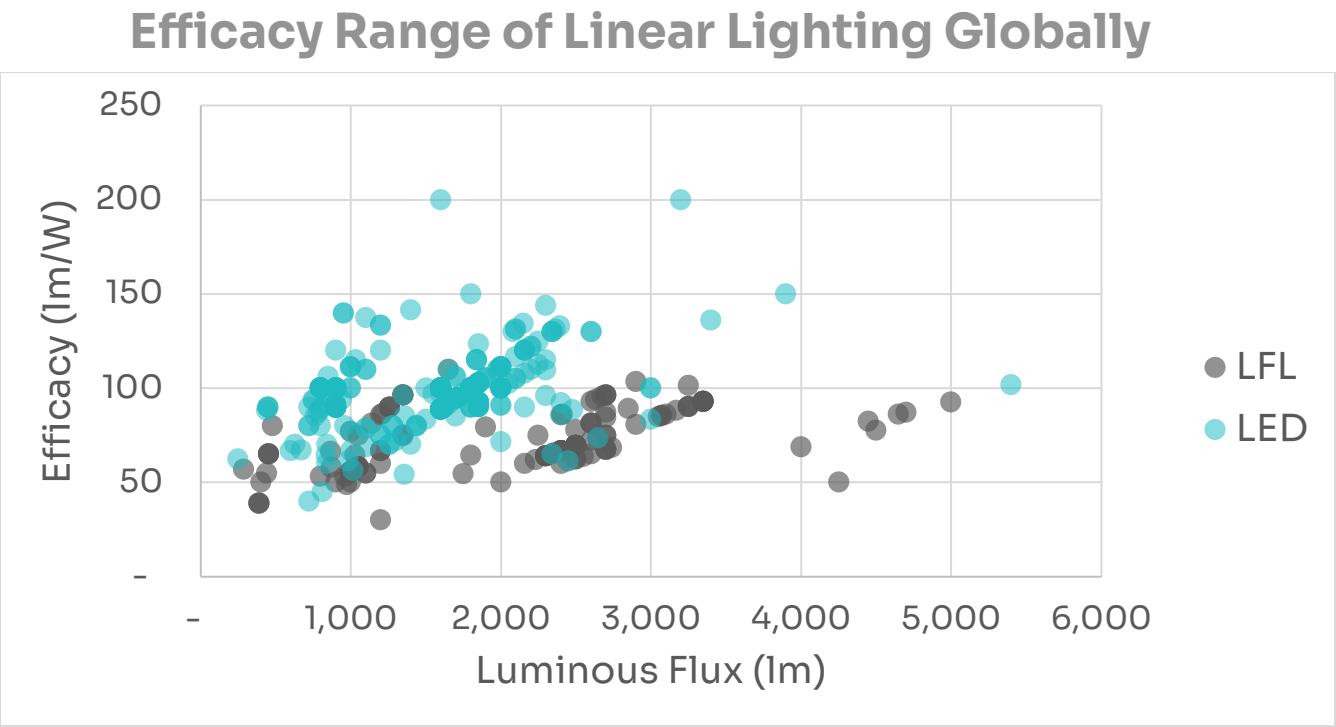


Figure 2 Global Efficacy Ranges of Linear Lamps

Comparing Costs: LEDs vs LFL

Transitioning to efficient LED lighting will result **in significant cost savings** for people, businesses and governments.

LEDs pay for themselves quickly, according to data from the over 400 lamps analyzed. The average payback periods[1] in all regions is less than 12 months, with T8s' paying back in less than 6 months. Additionally, the LED options result in 50%-70% in financial savings for consumers.

Figure 3 shows the average payback period of the most common linear lamp, T8s, across countries in Africa, Asia Pacific and Latin America and the Caribbean. Table 1, regional averages of LED payback periods. The payback period for different LED tube retrofits varied depending on differences in upfront costs from LFLs. In all cases, mercury-free LED lamps were found to be highly cost-effective, offering short pay-back periods and net savings to users over the lamps' lifetime. The full list of tables can be found in the Annexes to this report.

[1] the energy savings return for the incrementally higher price of the LED tube

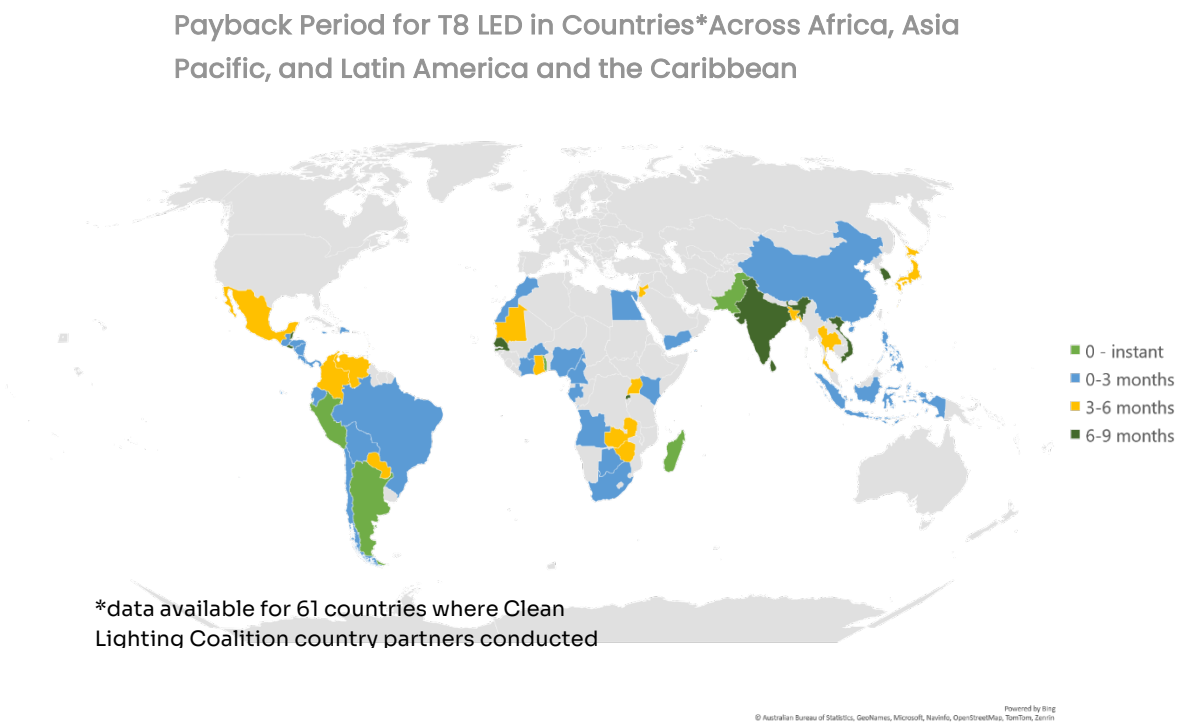


Figure 3 Global T8 LED Payback Periods in Assessed Countries

Table 1 Regional LED Payback Periods

Region	Payback Period in Months	
	T8	T12
Africa	2.9	0.9
Asia Pacific	4.1	7.0
Latin America	2.9	5.1

Given that costs of LED technology continue to improve and lower over time, the positive economic case observed in 2023 will be even more compelling in 2025/26 – when the COP4 amendment and COP5 Lighting Amendment proposal could go into effect.

Lighting Manufacture and Assembly

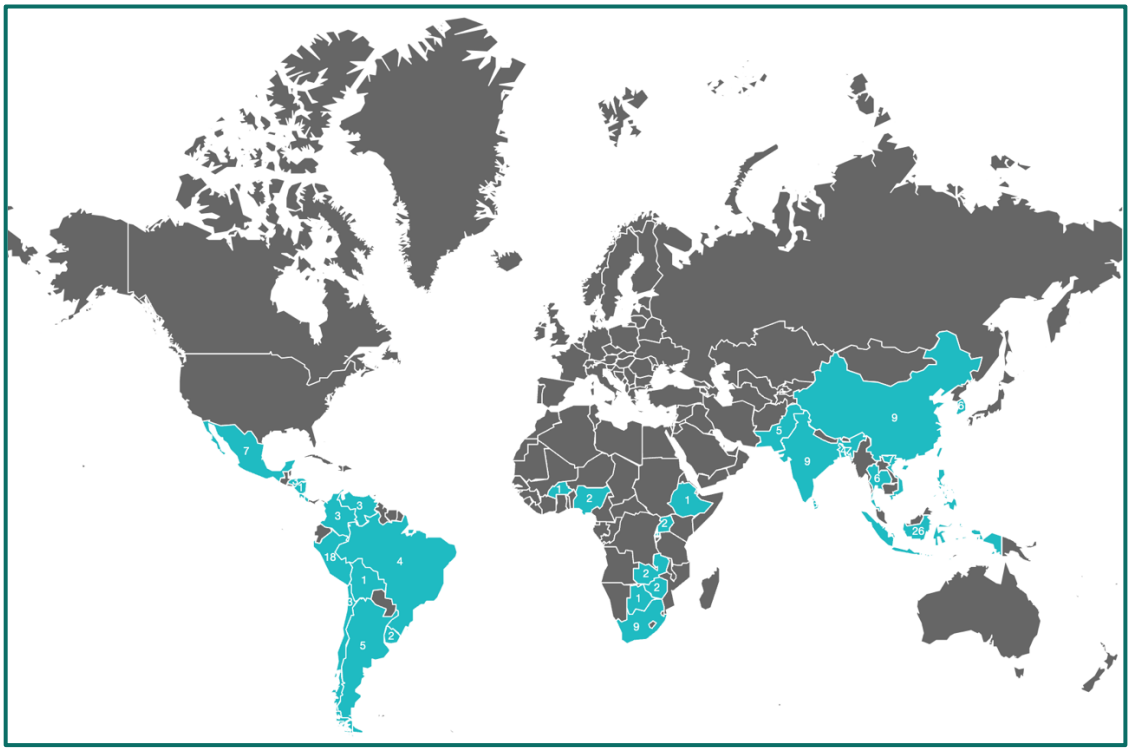
LEDS

The research found evidence of over 120 LED manufacturing and assembly companies in over 30 countries across the different regions.

Adopting the proposed COP 5 Lighting Amendment will ensure a necessary and equitable transition to an all-LED market globally by 2026 by bolstering new and existing opportunities for local LED manufacturers to supply domestic and regional demand.

The Clean Lighting Coalition developed a dashboard that provides a global overview of LED lighting technology manufacturers available within each country. The figure below is a snippet of the global LED manufacture and assembly footprint across countries assessed in the Global South.[2]

Global LED Manufacturer Map



[2] This interactive digital map provides more information on such companies by country.

Fluorescents

There is a rapid global decline in fluorescent manufacture - with most companies reporting simultaneous LED production. Additionally, many economies are adopting and implementing stringent standards that eliminate the use of fluorescents. However, environmentally harmful **dumping**[3] of mercury based fluorescent lighting products is a real risk and may continue for years in many markets if a global phase out date and proper regulation is not introduced.

Lighting Policy & Legislative Landscape

More than 60 countries globally, representing 70% of the fluorescent lighting market have initiated actions for a smooth transition to all LED lighting. We identified widescale policy and legislation efforts supporting LED transition efforts present in nearly all regions. They included, adoption of national energy efficiency strategies and products performance standards such as Minimum Energy Performance Standards (MEPS), bulk procurement programs and green product specifications for both domestic and municipal lighting products.

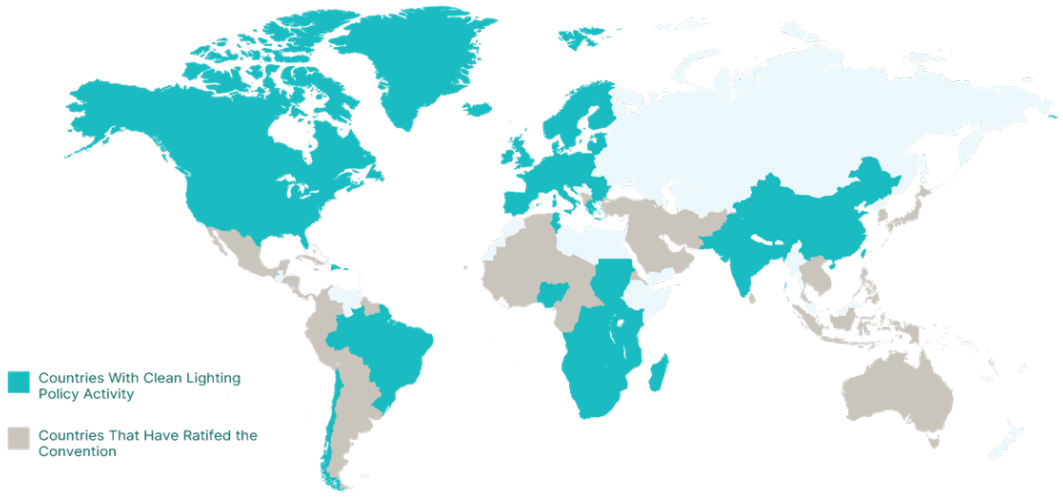


Figure 4 Global Policy Action to End Toxic Lighting

[3] Tthe practice of exporting products to another country or territory that: 1) Contain hazardous substances; 2) Have environmental performance lower than is in the interest of consumers or that is contrary to the interests of the local and global commons, or; 3) Can undermine the ability of the importing country to fulfill international environmental treaty commitment

Linear Lighting Product Compatibility and Availability

Compatibility

LED retrofits are widely available and have high rates of compatibility. LED lamps have been designed to have the same form, fit and function as the fluorescent lamps that they are replacing. In most of the markets researched, direct, drop-in replacement lamps were found that could be used in linear fluorescent lighting applications.

Developing and emerging markets have a higher share of magnetic (choke) ballasts which are 100% compatible with LED lamps. Using manufacturer literature published in both Europe and North America, LED retrofits are available for more than 90% of the applications in the field. There is a small percentage (6-9%) of fixtures where LED tubes are not compatible and require replacement or bypass. T12 fluorescent lamps can be replaced with T8 LED retrofit lamps as they have the same G13 caps.

Availability

Across all assessed markets the most common linear lamp category is the T8 and T12s. T5s and non-integrally (NI) ballasted lamps are available but in very low volumes in the emerging economies. Fluorescent T5 installations only took off in OECD countries making up less than 5% of the international market. T5s failed to capture more of the market due to the advent of LED lamp solutions entering the market soon after the development of T5 fluorescent lamps.

The manufacturing volumes of high wattage compact fluorescents and linear fluorescents are almost negligible. Fluorescent T12 & T5 manufacture is also negligible while nearly all known manufacturers are able to convert fluorescent production lines to LED technology.

End of Life Management for Lighting

Mercury released during the lifecycle of fluorescent lamps contaminates the atmosphere, land and water. Lamp breakage and the resultant mercury leakage may occur when old lamps are mixed with general household waste, during installation, collection or transport of discarded lamps, processing or recycling of spent lamps, or when lamps are landfilled, incinerated or otherwise disposed of. Each regional report discusses the very low rates of e-waste collection and management at end of life – for example only 4% of overall e-waste is recovered in Southern Africa, 1.3% in Eastern Africa and close to 0% in other parts of Africa.

A phase out of mercury containing lighting products means that all expired fluorescent lamps will be replaced with LEDs, and therefore, the quantity of fluorescent waste will reduce over time to zero. Delaying the fluorescent phase out means more manufacturing, import and export of mercury-containing products that will continue to contaminate landfills, pollute soil and water, and poison vulnerable communities. **There is no initial increase in mercury waste at the implementation of the ban.** If anything, it heralds the beginning of the accelerated reduction in mercury waste from fluorescent lamps. The best, lowest cost solution to end lighting-based mercury pollution is to hasten the transition to LEDs.

Annexes of Country Level Data

The body of this report is divided into three Annexes for each of the regions studied. Each Annex includes desegregated data on eight key areas of consideration. For each of the countries where data was gathered, there are 1-3-page summaries with more detailed national-level information. First, a table gives the mercury, energy, CO2 and financial savings associated with the proposed Lighting Amendment. Next, we provide relevant information on fluorescent and LED lamps in the country. Finally, 1-2 economic tables compare linear fluorescent lamps with mercury-free tubular LED retrofit lamps. In these tables, there are details on price in both local currency and USD, the running costs, the payback period and the total lifetime cost of light. These comparisons, based on 2023 LED prices and performance, find that across all markets, LED lighting is highly cost effective. In 3-4 years, when the proposed COP5 Lighting Amendment would take effect, LED lamps will be even cheaper and more efficient, meaning the economics will be even more attractive.

Our Partners

The Clean Lighting Coalition would like to thank and acknowledge the 66 partner organisations around the world that have supported us in the data collection for this report. Without their efforts, this analysis would not have been possible.

A full list of partners is provided below:

Regional Partners	
Climate Action Network, Africa	
Climate Action Network, Arab World	
Climate Action Network, South East Asia	
Climate Action Network, International	
In-country Partner	Country
AFRICA REGION	
Gouvernance Environnementale et le Développement Durable	Burkina Faso
CREPD	Cameroon
ok	Ethiopia
Centre d'Etudes et de Recherches Interafricaines en Santé-Environnement	Gabon
Ecological Restorations	Ghana
Centre Africain pour la Santé Environnementale CASE	Ivory Coast
CEJAD	Kenya
SRADeV	Nigeria
Bjorn Smidt-Hart	South Africa
Les Amis de la Terre-Togo	Togo
Bio Vision Africa (BIVA)	Uganda
David Kapindula	Zambia
African Coalition on Green Growth	Zimbabwe
BW Nama Development Trust	Botswana
MENOS, Lda	Angola

Rahajaharison Luc Faniry	Madagascar
LEAD Senegal,	Senegal
Youth for Development Human Rights	Rwanda

ASIA PACIFIC REGION	
Center for Renewable Energy and Sustainable Technology Inc.	Philippines
Janathakshan GTE	Sri Lanka
PXP Sustainability	Thailand
Katherine Hasasn	Indonesia
Environmental Protection Society Malaysia	Malaysia
SDPI	Pakistan
Individual	China
Individual	Vietnam
Hazel Chan (Individual)	Singapore
Rachel Choi	South Korea
Mohammod Ariful Haque	Bangladesh
Richard Gorkrun	Tuvalu
George Koran	Vanuatu
Association de volontariat touiza de la wilaya d'Alger	Algeria
Jordan health aid society international	Jordan
yaser althalja	Lebanon
عماد الأطرشEmad al, Atrash	Palestine
Tareq Hassan	Yemen
Haneen Shaheen	Egypt
sami Hussein Almabrok سامى حسين المبروك	Libya
مجمد المختار ابهMukhtar Abba	Mauritania
Abdellah AHJAM	Morocco

LATIN AMERICA & CARIBBEAN GROUP	
Asociacion Argentina de Medicos por el Medio Ambiente	Argentina
Euromonitor	Brazil

Ideambiente	Chile
Laboratorio de Eficiencia Energética	Costa Rica
Alianza Contaminación Cero	Panama
Red Social	Peru
Amalia Laborde	Uruguay
Integrated Health Outreach	Antigua & Barbuda
Cindy Egers	Suriname
Eden Corbin	Guyana
Rayon Walters	Jamaica
Flor Lynch	Saint Kitts and Nevis
Flavia Martial	Saint Lucia
Mario Paredes	Paraguay
Asociación Salvadoreña de Energía Renovable	El Salvador
ACCH	Guatemala
LIDEMA	Bolivia
Climalab	Colombia
Jean Baptiste Boudot	Nicaragua
Sustenta Honduras	Honduras
Pasoverde	Mexico
Altemar Portes	Dominican Republic
Jesús Mata	Venezuela
Pablo Ramírez	Ecuador

Clean Lighting Coalition

Technical & Economic Assessment of Mercury-Free Lighting: Africa Region

Africa Region

If a 2025 LFL phase out date is negotiated and adopted at Minamata COP5 – reflecting the position of the Clean Lighting Coalition – it would avoid the sale of 526 million linear fluorescent lamps in the Africa Region and result in the following cumulative benefits (2025-2050):

1. avoid **4 metric tons** of mercury pollution from leaking into the environment
2. avoid **189 million tons of CO2** emissions
3. save approximately **500 TWh of the region's total electricity consumption** and
4. save **$51 billion USD**

The data above reflects the benefits of a global fluorescent phase-out to all countries in Africa, not just parties to the Minamata Convention on Mercury and based on CLASP's MEPSy model[1]

Lighting Market Overview

The African region is a net importer of lighting products. There is no local manufacture of fluorescent lighting on the continent – all are imported from other regions. However, there are several LED assembly companies, providing local jobs and stimulating national economies. CLiC found 21 assembly companies across nine countries as listed below:

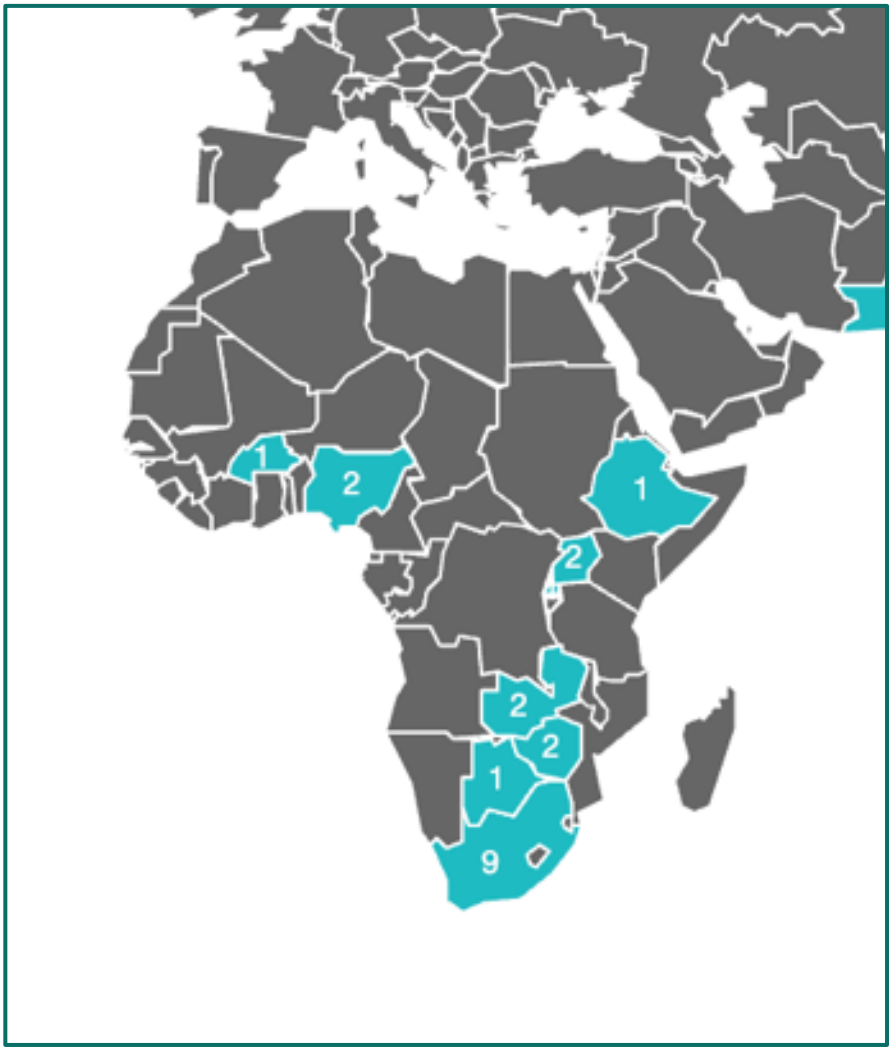
1. **Botswana** - The Bulb World focuses entirely on LED production.
2. **Burkina Faso-** Lagazel Kalo, focus on solar LED lamps
3. **Ethiopia-** Damatrade focuses on LED lamps and fixtures
4. **Nigeria** – Oretronics technology and Quadloop Technologies
5. **Rwanda** - Sahasra
6. **South Africa** - LEDwise Lighting and Beka Schreder focus on luminaires
7. **Uganda** – Pearl Light Technologies and Lumens Manufacturing Industries (U) Ltd.
8. **Zambia** – Savenda Electricals and Electrical Maintenance Lusaka
9. **Zimbabwe** – Muruwe and AE Electrical

[1] https://clasp.shinyapps.io/mepsy/

Phasing-out fluorescents would encourage local assembly of LEDs, aligning with regional efforts to accelerate economic growth, generate employment opportunities, and reduce reliance on lighting product importation.

The figure below shows the current LED assembly across Africa.[2]

Global LED Manufacturer Map



[2]The interactive map is available here

Comparing Costs: LEDs vs LFL

On average, LED lamps are more expensive than the fluorescent lamp on a first-cost basis, but pay for themselves quickly, 2.9 months and 0.9 months respectively for T8s and T12s. Figure 1 provides an inventory of the average payback periods across different countries in the region for T8s.

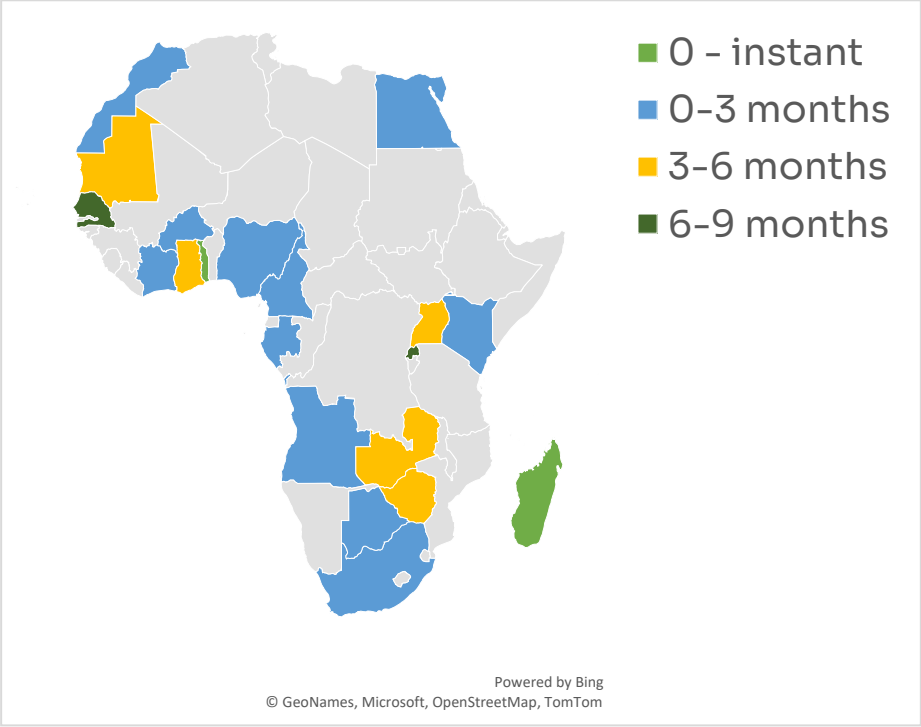


Figure 1 T8 Payback Periods in Assessed Countries

LED lamps consume half as much power as fluorescents – so electricity bills are halved over the lamp lifetime. On average, Africa consumers save 52% of lifecycle costs when they replace LFLs with LEDs. Figure 2 provides summarizes the cost savings for LED T8s.

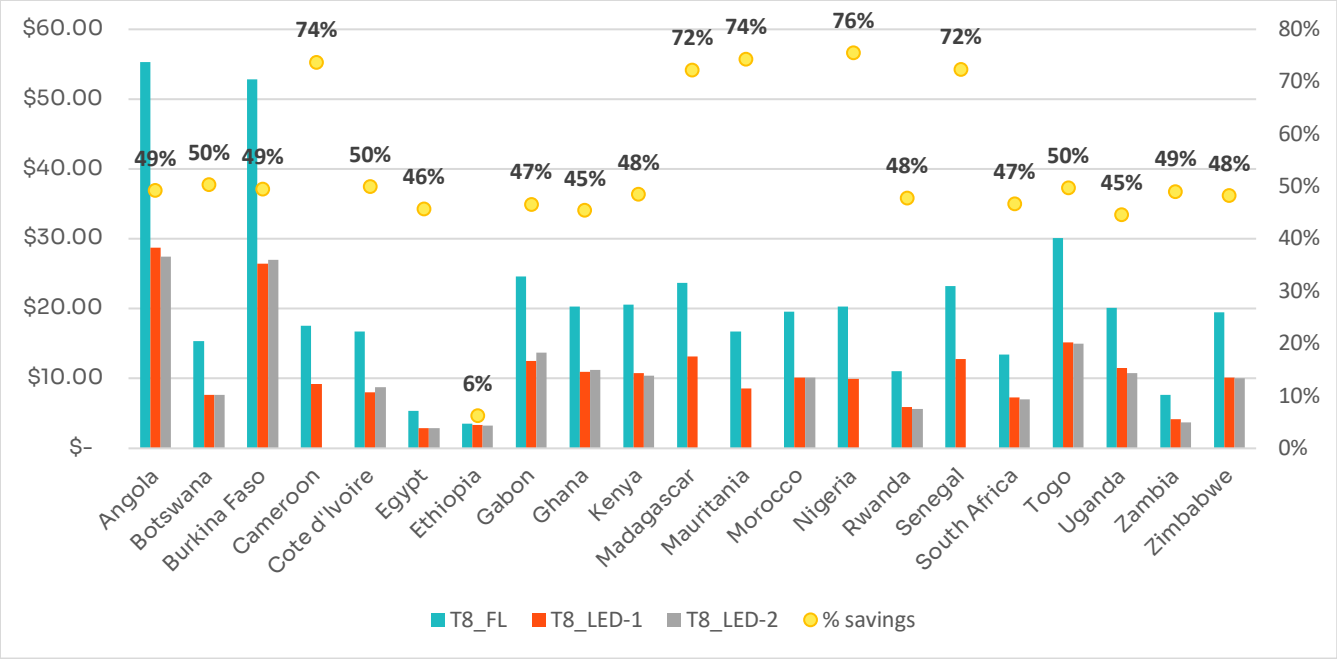


Figure 2 Life Cycle Savings of LEDS over Fluorescents

Tables 1 and 2 provides comparative information about the true costs of lighting with LFL vs LED lamps across countries in the region.

T8 linear lighting products were the most common in the selected countries in Africa. Suppliers and retailers were reported to recommend T8's to customers replacing their T12 fluorescent lamps. T12s and T8s products belong to the same family with the G13 base type and therefore direct replacement is possible. In Africa, the average payback period for T8 products was 2.9 months. The life cycle costs of LED T8s are half that of the fluorescent counterparts. In some countries, such as Ethiopia, the payback was substantially higher. This is a result of the subsidized cost of electricity in the country, 0.022 USD/kWh for commercial entities.

Table 1 True Cost of Light: T8 Lamps

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Angola	AOA 1519.9 (US$3.3)	AOA 1828.5 (US$3.97)	0.3 months	AOA 12476.43 (US$27.09)
Botswana	BWP 30.5 (US$2.47)	BWP 48.35 (US$3.91)	2.4 months	BWP 89.05 (US$7.2)
Burkina Faso	XOF 2200 (US$3.53)	XOF 4000 (US$6.41)	1.3 months	XOF 16118.84 (US$25.84)
Cameroon	XAF 374 (US$0.6)	XAF 1495 (US$2.4)	2.5 months	XAF 5380.83 (US$8.63)
Cote d'Ivoire	XOF 750 (US$1.2)	XOF 2000 (US$3.21)	2.9 months	XOF 5121.84 (US$8.21)
Egypt	EGP 45 (US$1.46)	EGP 95 (US$3.07)	7 months	EGP 86 (US$2.78)
Gabon	XAF 1150 (US$1.84)	XAF 2000 (US$3.21)	1.4 months	XAF 7487.63 (US$12)
Ghana	GHS 15 (US$1.81)	GHS 40 (US$4.84)	3.7 months	GHS 80.42 (US$9.72)
Kenya	KES 150 (US$1.27)	KES 250 (US$2.12)	1 months	KES 1193.24 (US$10.12)
Madagascar	MGA 50000 (US$12.21)	MGA 18200 (US$4.44)	instantaneous	MGA 36069.3 (US$8.81)
Mauritania	MRU 50 (US$1.18)	MRU 150 (US$3.53)	3.4 months	MRU 348.87 (US$8.2)
Morocco	MAD 10.9 (US$1.07)	MAD 25 (US$2.46)	1.7 months	MAD 97.65 (US$9.61)
Nigeria	NGN 1500 (US$3.54)	NGN 2190 (US$5.17)	1.8 months	NGN 4572.72 (US$10.79)
Rwanda	RWF 1500 (US$1.46)	RWF 5500 (US$5.34)	8.6 months	RWF 5558.22 (US$5.39)
Senegal	XOF 1000 (US$1.6)	XOF 5500 (US$8.82)	7.6 months	XOF 7087.32 (US$11.36)
South Africa	ZAR 43 (US$2.63)	ZAR 58 (US$3.55)	1.7 months	ZAR 104.07 (US$6.36)
Togo	XOF 1248 (US$2)	XOF 1248 (US$2)	instantaneous	XOF 9165.15 (US$14.69)
Uganda	UGX 7000 (US$1.9)	UGX 25000 (US$6.78)	6 months	UGX 36175.73 (US$9.8)
Zambia	ZMW 45 (US$2.66)	ZMW 60 (US$3.54)	3 months	ZMW 59.13 (US$3.49)

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Zimbabwe	ZWL 986.12 (US$2.63)	ZWL 1919.8 (US$5.12)	3.2 months	ZWL 3547.8 (US$9.46)

The average payback period for T12's in the selected countries in Africa was about 1.3 months. The product type was available in 7 out of the 18 countries with countries. Zimbabwe for example banned T12 products in 2017. It was reported that retailers recommend a switch to T8 to customers replacing their T12 fluorescents.

Table 2 True cost of Light: T12 Lamps

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Cameroon	XAF 960 (US$1.54)	XAF 1300 (US$2.08)	0.8 months	XAF 5380.83 (US$8.63)
Kenya	KES 150 (US$1.27)	KES 170 (US$1.44)	0.2 months	KES 1458.41 (US$12.37)
Madagascar	MGA 46700 (US$11.4)	MGA 12000 (US$2.93)	instantaneous	MGA 36069.3 (US$8.81)
Nigeria	NGN 4000 (US$9.44)	NGN 2190 (US$5.17)	instantaneous	NGN 5487.26 (US$12.95)
Rwanda	RWF 8500 (US$8.25)	RWF 4500 (US$4.37)	instantaneous	RWF 6793.38 (US$6.59)
Senegal		XOF 800 (US$1.28)		XOF -15749.6 (US$-25.25)
South Africa	ZAR 52 (US$3.18)	ZAR 72 (US$4.4)	1.9 months	ZAR 127.2 (US$7.77)
Zambia	ZMW 65 (US$3.84)	ZMW 35 (US$2.07)	instantaneous	ZMW 72.27 (US$4.27)

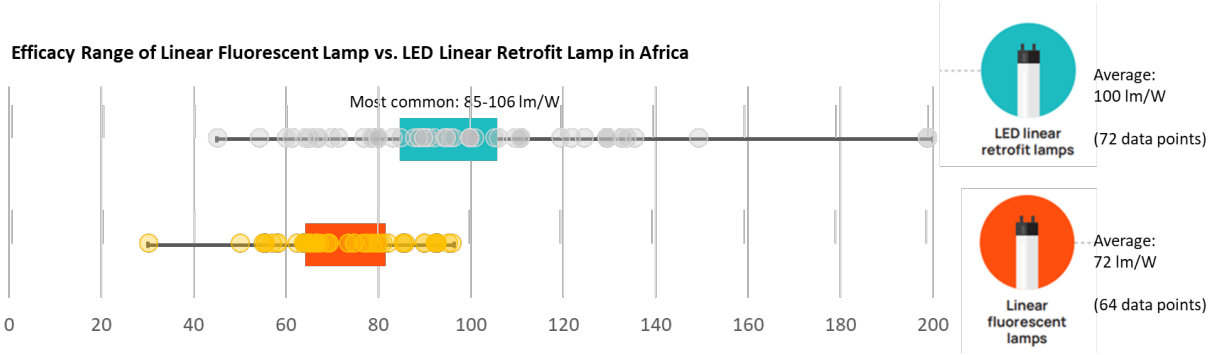
The displayed prices in columns 1-2 were recorded from commercial entities, wholesale shops, and suppliers in each country. Columns 3-4 illustrate the benefits associated with switching to mercury-free LED technology. The Payback Period column shows the amount of time needed for the energy savings from the LED lamp to pay for its higher cost. If the LED is less expensive than the fluorescent lamp, then the payback is **'instantaneous'**. The column labelled 'energy savings with LED' indicates the savings on energy bills over the lifetime of the LED lamp. The tables also detail comparative cost across countries. Please note that the value in brackets is the equivalent cost in US$.

Energy Efficiency Comparison

The energy efficiency of a light bulb is measured in lumens/watt. The graphic below depicts the ranges of energy efficiency of different types of bulbs available across African markets based on the collected data. It represents efficiency quartiles (0%,25%,50%,75%,100%) of the data we collected when sorted from lowest to highest efficiency. The box with numbers represents the 25th-75th quartile while the thin lines with the dots represent the lowest and highest efficiency per technology on either end.

The average efficacy of the LED lamps in the region is markedly higher than that of the fluorescent pairs: 100lm/W against 72lm/W

Table 3 Efficacy Comparison Between LED and Fluorescent Lamps



Lighting Policy & Legislative Landscape

Many countries in the region are shifting towards LED only markets through energy efficiency policy and/or mercury regulation. Some of the notable initiatives and regulations include:

1. **Southern Africa Development Community**: 16 countries adopted a harmonised standard SADC HT 109:2021 in Q2 2021 that is shifting markets to LEDs. In May 2023 South Africa formally adopted VC9109 and VC 9110 which will phase out inefficient and environmentally harmful lighting products. Other countries that have adopted the regional MEPS include Namibia, Eswatini and Mozambique.
2. **East African Community**: 6 countries adopted a harmonized standard EAS 1064 in Q2 2022 which shifts the markets to LED. Kenya, Uganda, and Rwanda have nationalized the regional MEPS.

3. **Ivory Coast:** After signing the Minamata Convention and developing the Decree of E-waste Management (adopted in 2017), the government has been supplying LED lamps for public lighting in all the country's major cities since 2019. The government is further promoting LED lamps by reducing taxes on these types of lamps.
4. **Nigeria:** Draft National Lighting MEPS, FDNIS 1209. Finalization is expected in Q3/Q4 2023, which will shift the market to LED.
5. **Burkina Faso:** Burkina Faso's National Energy Act has an entire chapter dedicated to Energy Efficiency. In support of this objective, one of the notable government interventions includes the installation of 3,000 LED streetlamps.
6. Many countries including **Angola, Cameroon, Ghana**, amongst others have adopted green public procurement practices for public lighting services. These efforts have enabled the countries to realize immediate energy savings and greenhouse gas (GHG) emissions reductions.
7. With an increasing focus on sustainable/ clean energy to meet SDG 7, the widespread adoption of solar LED lighting technologies in many African countries is inherently transitioning the markets to LED.

Compatibility/Retrofits for LED lamps

In all the studied African markets, LED retrofits were easily available for fluorescent lamps. LED retrofit lamps were designed as a retrofit product for fluorescent fixtures; therefore, no rewiring is required for installation.

Additionally, the economic cooperation between regions such as EAC and SADC is an indicator of the availability of retrofits in the other African countries, given that regions typically have harmonized standards for lighting products and source through the same import channels. In the few cases (6 - 9%) where the LED lamps available in the market are not compatible with the fixtures, the ballast can be 'by-passed' with mains voltage at the sockets, so that the fixture can remain in place.

End of Life Management for Lighting

Rates of collected and properly recycled e-waste (not just lighting products) are extremely low across Africa - 4% in Southern Africa, 1.3% in Eastern Africa and 0% in other regions. However, major e-waste recyclers across the continent are already sustainably disposing LED lighting products, including Enviroserve in Rwanda, WEEE Centre in Kenya, Hinckley Recycling in Nigeria, among others. While LED lamps are considered e-waste, they do not need to be treated as hazardous waste.

Accelerating the transition to LEDs would turn off the mercury tap – eliminating hazardous waste and mercury contents from new lighting products imported to Africa Region. The proposed African Lighting Amendment would therefore mitigate further environmental pollution and public health safety concerns.

ANNEX OF COUNTRY LEVEL DATA

Angola

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Angola

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	9,160,000	8,390,000	7,660,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	69	63	57	kg of mercury
National electricity savings	8.57	7.93	7.30	TWh of electricity
National financial savings from avoided electricity use	0.61	0.56	0.52	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	2.81	2.58	2.34	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Angola became a signatory to the Minamata Convention on 11 October 2013.
- The country has rolled out several solar LED street lighting projects in recent years.
- The transition to mercury-free lighting is expected to have both energy and cost-saving benefits to Angola.

Map of LED Companies in Angola

Angola does not have local assembly or manufacturing of LED lighting products[1]. Lighting products are imported from different countries including India, China, the UAE, and Germany.

[1] One mention of a company called Best was found, but the company did not have any digital presence.

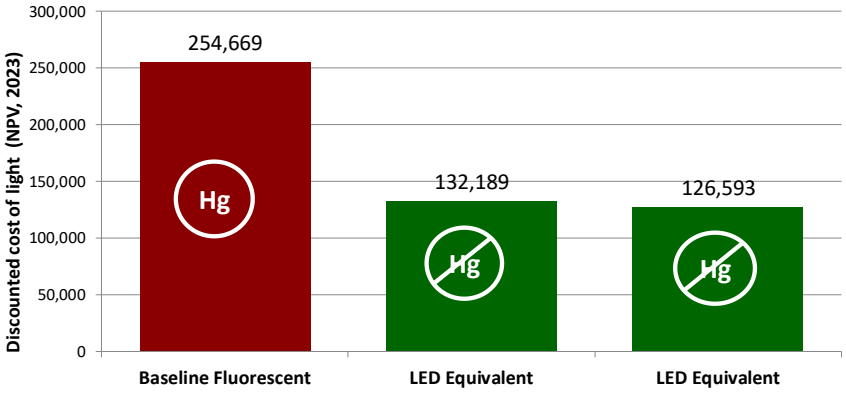
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Angola.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (AOA):	**1,520**	**4,219**	**1,829**	**AOA**
Price for one lamp (USD):	**3.30**	**9.16**	**3.97**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**10,000**	**25,000**	**50,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**254,669**	**132,189**	**126,593**	**AOA (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**2.6**	**0.3**	**months**
CO2 emissions due to electricity used for 15 years:	**503**	**252**	**252**	**kg CO2/10 yrs**

Burkina Faso

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Burkina Faso

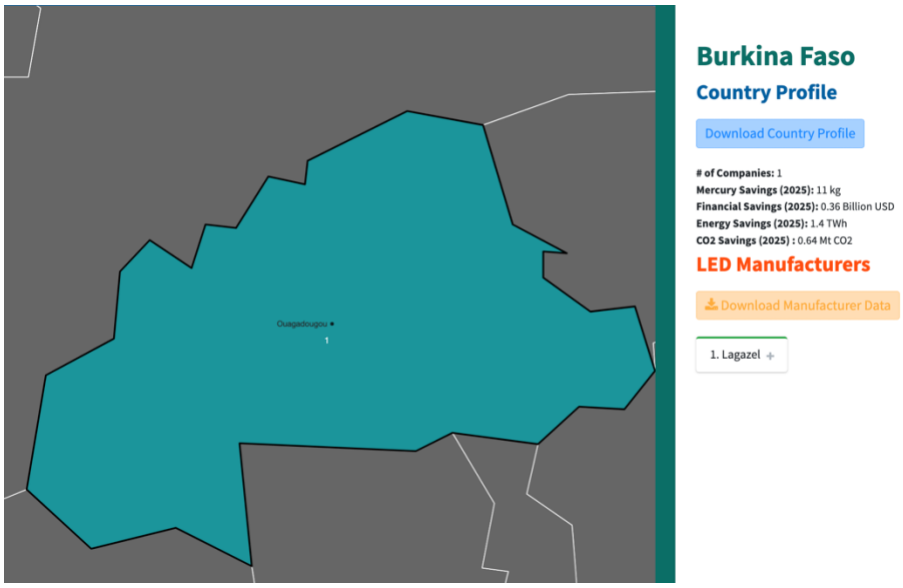
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	1,500,000	1,390,000	1,280,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	11	10	10	kg of mercury
National electricity savings	1.41	1.32	1.23	TWh of electricity
National financial savings from avoided electricity use	0.36	0.34	0.31	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.64	0.59	0.55	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The Burkinabe government is in the process of developing Minimum Energy Performance Standards (MEPS) for lighting products. These MEPS are expected to be aligned with those adopted by other African countries, including Nigeria, countries in the East African Community (EAC), and those in the Southern African Development Community (SADC).
- As a member of Economic Community of West African States (ECOWAS), Burkina Faso subscribes to ECOWAS' energy-efficiency plan to phase out incandescent lamps and replace them with high-efficiency alternatives.
- The Burkinabe government has rolled out several initiatives in recent years, including the replacement of 1,926 inefficient streetlamps in Burkina Faso's major cities and installing 3,000 LED streetlamps.
- According to Burkina Faso's Mercury Impact Assessment (MIA), mercury light sources contribute 26 kg Hg/year – resulting in air and soil pollution. It is estimated that around 573,000 (rough estimate) lamps are imported into the country annually. However, the lamp's low cost and improved efficiency, together with the country's porous borders, could mean that a greater number of mercury-containing lights are making their way onto Burkina Faso's market.

Map of LED Companies in Burkina Faso

Lagazel was established in Burkina Faso in 2015 and assembles solar LED lighting products in Dédougou. Apart from this local assembly company, other lighting products in Burkina Faso are imported from countries such as China.



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Burkina Faso.

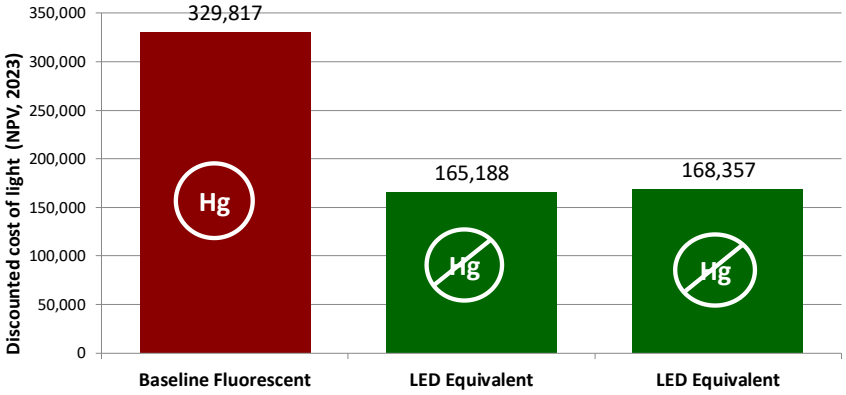
T12 lamps are a rare find on the market in Burkina Faso. Field visits and exchanges with traders revealed that this type of lamp is almost non-existent on the local market. The most used lamps are the T8s. Non-integrally ballasted lamps were also not commonly available on the Burkinabe market.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XOF):	2,200	4,000	4,073	XOF
Price for one lamp (USD):	3.53	6.41	6.53	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	10,000	40,000	25,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	329,817	165,188	168,357	XOF (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	1.3	1.4	months
CO2 emissions due to electricity used for 12 years:	752	376	376	kg CO2/10 yrs

Botswana

Table 1. Benefits of LFL Phase Out in 2025, 2026 & 2027 in Botswana

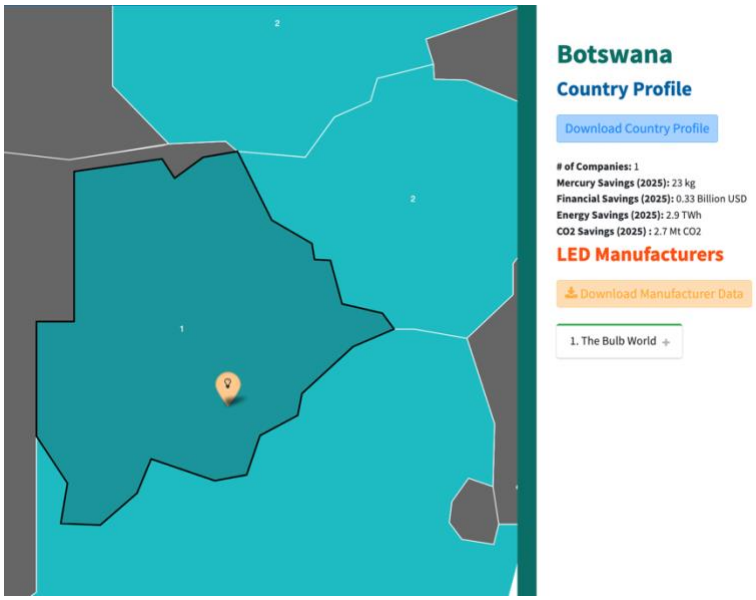
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	3,080,000	2,840,000	2,620,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	23	21	20	kg of mercury
National electricity savings	2.89	2.70	2.51	TWh of electricity
National financial savings from avoided electricity use	0.33	0.31	0.28	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	2.74	2.54	2.34	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Botswana became a signatory to the Minamata Convention on 3 June 2016.
- The government has rolled out several solar LED street lighting projects in recent years. In 2022, Bulb World, a local LED manufacturer, collaborated with the government to install solar lighting in several councils.
- Botswana and Burkina Faso, on behalf of the African Region, submitted a proposal to amend Part 1 of Annex A to the Minamata Convention to eliminate fluorescent lighting.
- The transition to mercury-free lighting will have both energy and cost-saving benefits for Botswana.

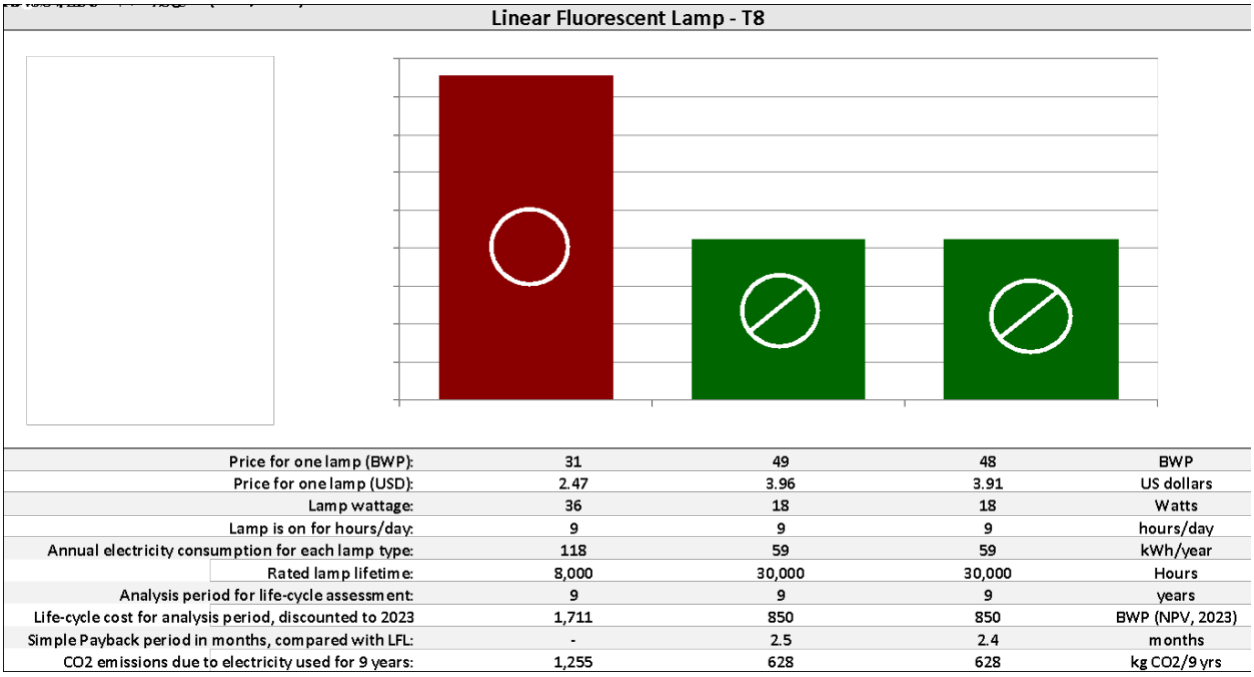
Map of LED Companies in Botswana

In Botswana, there is one company assembling LED lighting products, as shown in the map below.



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Botswana.

T8s are the most common lighting product in Botswana.



Price for one lamp (BWP):	31	49	48	BWP
Price for one lamp (USD):	2.47	3.96	3.91	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	8,000	30,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	1,711	850	850	BWP (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	2.5	2.4	months
CO2 emissions due to electricity used for 9 years:	1,255	628	628	kg CO2/9 yrs

Ivory Coast

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Ivory Coast

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	7,940,000	7,310,000	6,680,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	60	55	50	kg of mercury
National electricity savings	7.48	7.00	6.51	TWh of electricity
National financial savings from avoided electricity use	0.84	0.79	0.74	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	3.00	2.79	2.57	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Ivory Coast has banned the sale of incandescent lamps since January 2019.
- Ivory Coast has a Strategy for the Transformation of the Lighting Market, which is integrated into its National Development Plan. Additionally, as part of ECOWAS, the country is in alignment with the West African Economic and Monetary Union (*Union Economique et Monétaire Ouest Africaine* or UEMOA in French) labeling systems, which also cover lighting products.
- Ivory Coast has an Ecological Sound Management of e-waste regulation, which prohibits the design, manufacture, and sale of products containing mercury.
- The government has rolled out several market transformation activities, including the distribution of CFLs and supplying LED lamps for public lighting in the country's major cities since 2019. Additionally, LED lamps now enjoy reduced taxes.

Map of LED Companies in Ivory Coast

Ivory Coast does not have local assembly or manufacturing of LED lighting products.

The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Ivory Coast.

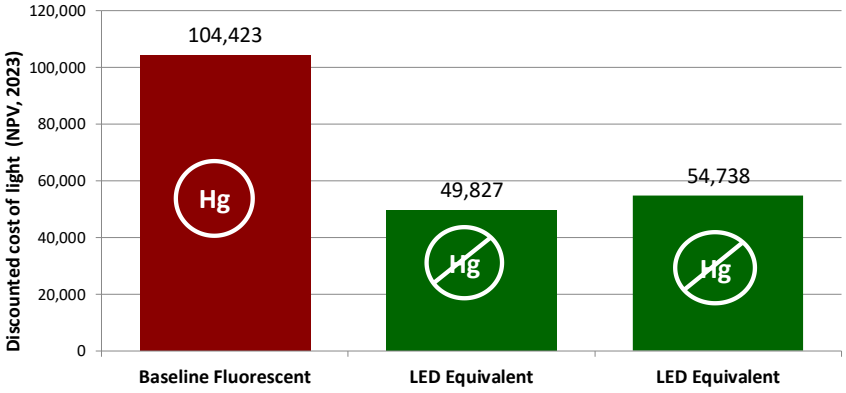
T12 tubes and non-integrated lamps are not available in the market. T8s and T5s, on the other hand, were found to be widely available.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XOF):	**750**	**4,300**	**2,000**	**XOF**
Price for one lamp (USD):	**1.20**	**6.89**	**3.21**	**US dollars**
Lamp wattage:	**36**	**16**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**53**	**59**	**kWh/year**
Rated lamp lifetime:	**12,000**	**50,000**	**25,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**104,423**	**49,827**	**54,738**	**XOF (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**7.5**	**2.9**	**months**
CO2 emissions due to electricity used for 15 years:	**515**	**229**	**258**	**kg CO2/10 yrs**

Cameroon

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Cameroon

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	6,080,000	5,510,000	4,940,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	46	41	37	kg of mercury
National electricity savings	5.86	5.37	4.88	TWh of electricity
National financial savings from avoided electricity use	1.16	1.07	0.96	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.41	1.29	1.15	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Cameroon has an emerging green technology business called Cameroon Energies that is looking to produce LED technologies in the future.
- Over 20% of the electricity used in Cameroon's residential sector goes toward lighting. Mercury-free LED retrofit bulbs result in energy- and cost-savings for Cameroon.
- The public lighting bill accounts for 55% of the State's total electricity expenditure. The government of Cameroon, in collaboration with other partners, has carried out training on the expansion and improvement of the energy efficiency of existing public lighting systems. Additionally, some municipalities have installed solar street lighting to reduce public lighting costs.
- There are currently no lighting policies, regulations, or standards implemented in Cameroon.

Map of LED Companies in Cameroon

Cameroon does not have any local manufacturing or assembly of lightbulbs or luminaires (light fixtures). All required stock is imported from China.

The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Cameroon.

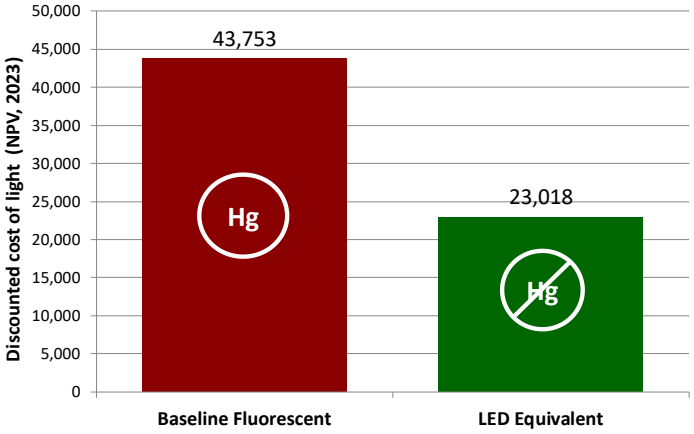
Tube fluorescent and LED lamps represent a very small portion of the lighting consumption in Cameroon. Customers mostly use LED bulbs. The more commonly available product was the T8.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



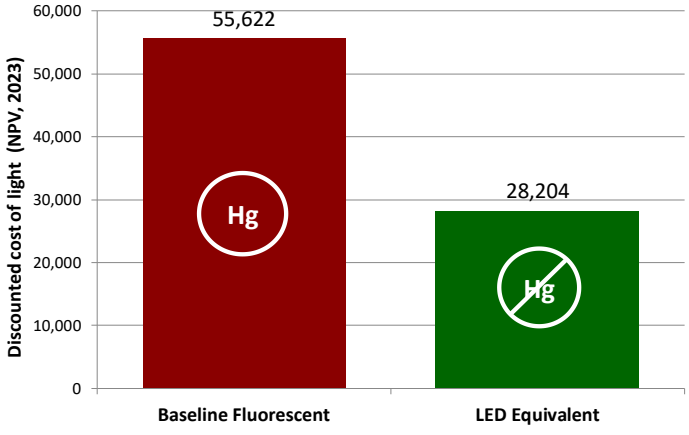
Price for one lamp (XAF):	**374**	**1,495**	***XAF***
Price for one lamp (USD):	**0.60**	**2.40**	***US dollars***
Lamp wattage:	**36**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**118**	**59**	***kWh/year***
Rated lamp lifetime:	**13,000**	**15,000**	***Hours***
Analysis period for life-cycle assessment:	**4**	**4**	***years***
Life-cycle cost for analysis period, discounted to 2023	**43,753**	**23,018**	***XAF (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**2.5**	***months***
CO2 emissions due to electricity used for 4 years:	**130**	**65**	***kg CO2/4 yrs***

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XAF):	**960**	**1,300**	***XAF***
Price for one lamp (USD):	**1.54**	**2.08**	***US dollars***
Lamp wattage:	**36**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**118**	**59**	***kWh/year***
Rated lamp lifetime:	**13,000**	**17,000**	***Hours***
Analysis period for life-cycle assessment:	**5**	**5**	***years***
Life-cycle cost for analysis period, discounted to 2023	**55,622**	**28,204**	***XAF (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**0.8**	***months***
CO2 emissions due to electricity used for 5 years:	**163**	**81**	***kg CO2/5 yrs***

Ethiopia

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Ethiopia

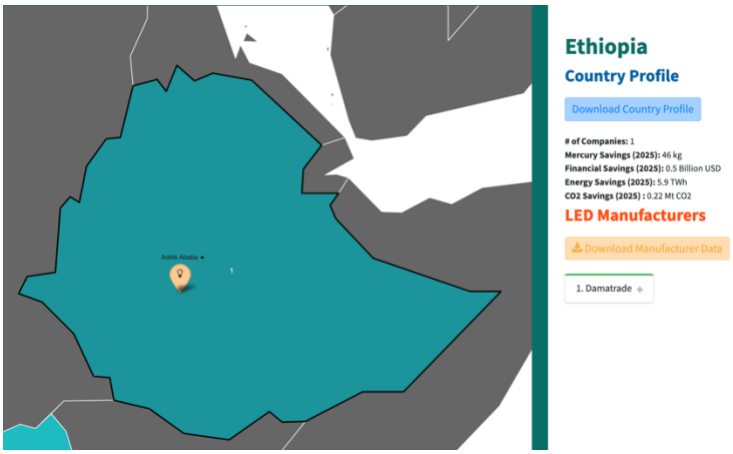
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	6,200,000	5,680,000	5,160,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	47	43	39	kg of mercury
National electricity savings	5.90	5.46	5.02	TWh of electricity
National financial savings from avoided electricity use	0.50	0.47	0.43	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.22	0.21	0.19	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Mercury-free LED retrofit bulbs are highly cost-effective in Ethiopia.
- Ethiopia currently has standards stipulating the performance and safety requirements for several lighting products, including self-ballasted lamps and double-capped fluorescents. It is, however, yet to adopt Minimum Energy Performance Standards (MEPS) for lighting products.
- Solar LED lighting is a growing market for serving communities that are yet to be connected to the grid.
- Electricity is heavily subsidized in Ethiopia, with businesses paying USD0.022/ kWh. A transition to LED lighting which is more efficient would reduce the subsidy burden on the government.

Map of LED Companies in Ethiopia

There are several local companies that assemble lighting technologies and accessories, including LEDs. However, Ethiopia still imports most of its LED lighting products from China, India, and Germany.



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Ethiopia.

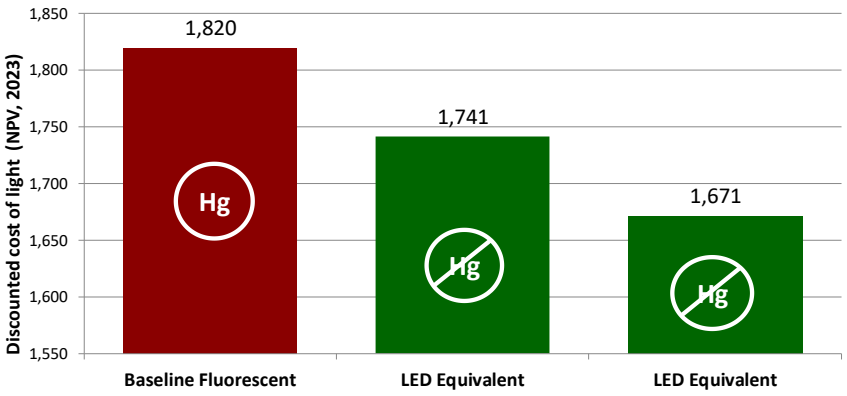
Despite the existence of T12 fluorescent lighting products in the market, retailers recommend the switch to T8 LEDS which are directly retrofitted. Additionally, non-integrated lamps are not widely available in the Ethiopian market, as there is no demand from customers. Customers tend to go for pin-less (screw-type) heads.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



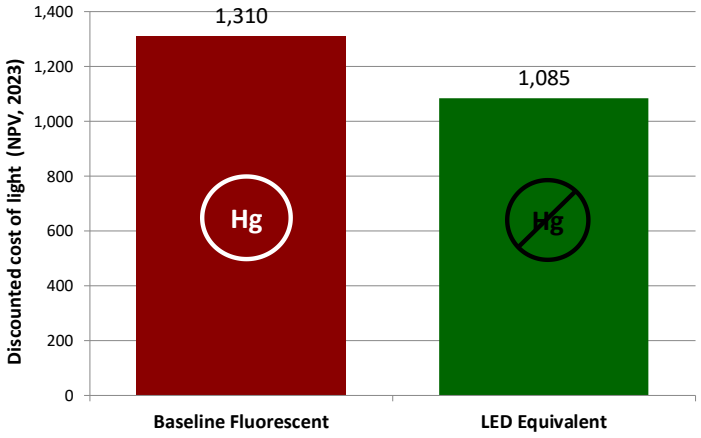
Price for one lamp (ETB):	**300**	**580**	**950**	**ETB**
Price for one lamp (USD):	**5.78**	**11.16**	**18.29**	**US dollars**
Lamp wattage:	**32**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**105**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**20,000**	**25,000**	**35,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**1,820**	**1,741**	**1,671**	**ETB (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**59.8**	**139.0**	**months**
CO2 emissions due to electricity used for 10 years:	**46**	**26**	**26**	**kg CO2/10 yrs**

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (ETB):	**300**	**580**	***ETB***
Price for one lamp (USD):	**5.78**	**11.16**	***US dollars***
Lamp wattage:	**36**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**118**	**59**	***kWh/year***
Rated lamp lifetime:	**24,000**	**25,000**	***Hours***
Analysis period for life-cycle assessment:	**7**	**7**	***years***
Life-cycle cost for analysis period, discounted to 2023	**1,310**	**1,085**	***ETB (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**46.5**	***months***
CO2 emissions due to electricity used for 7 years:	**36**	**18**	***kg CO2/7 yrs***

Gabon

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Gabon

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	2,940,000	2,700,000	2,480,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	22	20	19	kg of mercury
National electricity savings	2.76	2.57	2.38	TWh of electricity
National financial savings from avoided electricity use	0.74	0.69	0.64	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.01	0.93	0.86	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2019, the Gabon government rolled out a nationwide solar LED street lighting activity, installing nearly 5,000 solar streetlights.
- In February 2023, Gabon, alongside Jamaica and Sri Lanka, launched a multi-million-dollar project to eliminate the use of mercury in skin lightening products.
- Eliminating mercury lighting products has both cost- and energy-saving benefits.

Map of LED Companies in Gabon

Although Gabon's industrial sector is undergoing significant development, the local manufacturing and/or assembly of light bulbs is nonexistent.

Currently, lighting products are imported from countries such as Morocco, Tunisia, Turkey, Portugal, Spain, Italy, China, India, Taiwan, France, Belgium, etc.

The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Gabon.

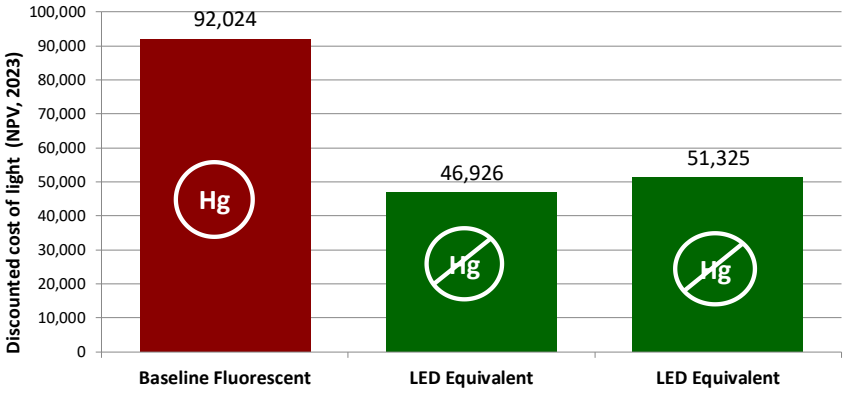
T12 fluorescent and retrofit LED tubes are not available in Gabon. Almost no public or private institutions, stores, buildings, or household dwellings use them – instead they use T8s.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XAF):	**1,150**	**2,000**	**3,450**	**XAF**
Price for one lamp (USD):	**1.84**	**3.21**	**5.53**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**12,000**	**20,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**6**	**6**	**6**	**years**
Life-cycle cost for analysis period, discounted to 2023	**92,024**	**46,926**	**51,325**	**XAF (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**1.4**	**3.7**	**months**
CO2 emissions due to electricity used for 6 years:	**312**	**156**	**156**	**kg CO2/6 yrs**

Ghana

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Ghana

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	9,210,000	8,240,000	7,300,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	69	62	55	kg of mercury
National electricity savings	8.90	8.07	7.24	TWh of electricity
National financial savings from avoided electricity use	3.64	3.32	2.97	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	2.91	2.62	2.33	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2017, Ghana adopted efficiency standards and labeling for LEDs and self-ballasted FLs. It is now mandatory for labels to indicate the energy efficiency of lighting products.
- Additionally, in 2022, Ghana adopted regulations to prohibit the manufacture, import, and sale of incandescent filament lamps.
- Import duty and VAT were waived on the importation of LED lamps in 2010.
- The government has implemented several retrofit programs replacing fluorescent lighting with LEDs in different government institutions, including hospitals and ministry buildings.

Map of LED Companies in Ghana

Ghana does not have local lighting manufacturing and assembly companies. It currently imports lighting products from China and India.

The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Ghana.

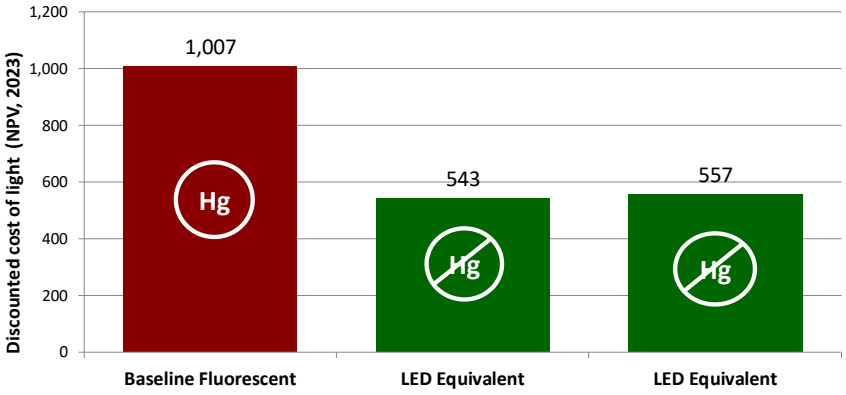
The T12 fluorescent tube has virtually been phased out in Ghana. The lighting market has recently adopted the T5 and T8 fluorescent tubes.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (GHS):	**15**	**60**	**40**	**GHS**
Price for one lamp (USD):	**1.81**	**7.25**	**4.84**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**8,000**	**20,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**6**	**6**	**6**	**years**
Life-cycle cost for analysis period, discounted to 2023	**1,007**	**543**	**557**	**GHS (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**6.7**	**3.7**	**months**
CO2 emissions due to electricity used for 6 years:	**255**	**128**	**128**	**kg CO2/6 yrs**

Kenya

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Kenya

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	7,560,000	6,870,000	6,220,000	units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	57	52	47	kg of mercury
National electricity savings	7.15	6.57	6.01	TWh of electricity
National financial savings from avoided electricity use	1.21	1.12	1.02	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.99	1.81	1.64	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Kenya has mandatory MEPS for general service lighting (GSL), directional and non-directional lamps, and LEDs, subsequently phasing out fluorescent lighting.
- Kenya also has mandatory labeling requirements for lighting and carries out compliance activities including conformity assessment and market surveillance.

Map of LED Companies in Kenya

No information was found on the local assembly or manufacturing of lighting products. The lighting market in Kenya is import-based with the majority of imports coming from India and China.

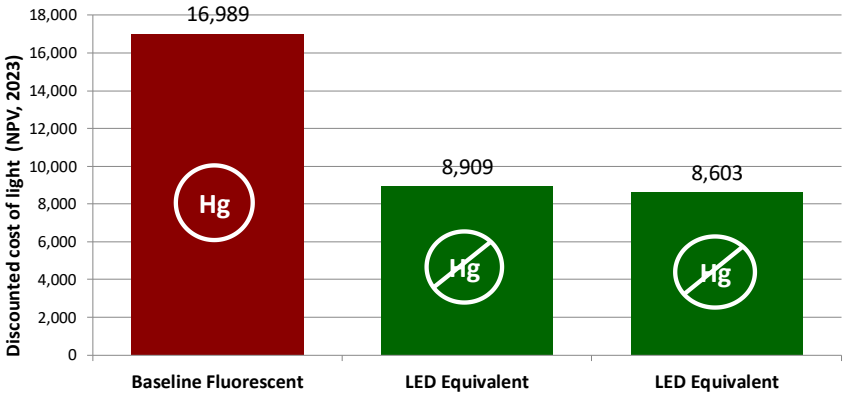
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Kenya.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



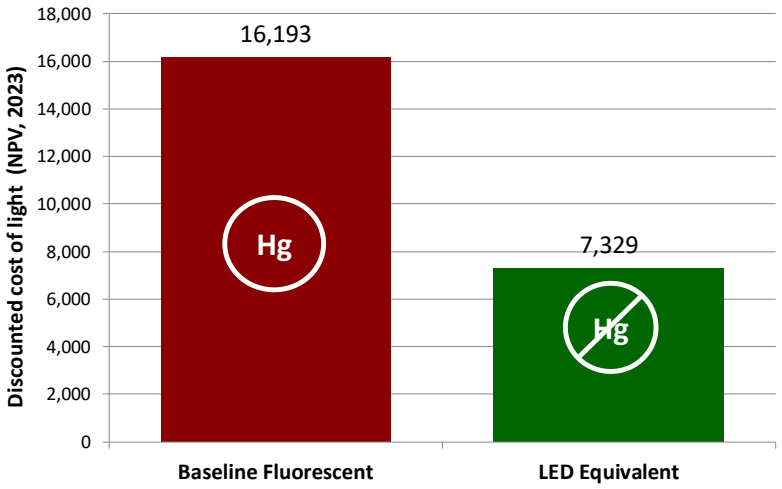
Price for one lamp (KES):	**150**	**300**	**250**	**KES**
Price for one lamp (USD):	**1.27**	**2.55**	**2.12**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**13,000**	**15,000**	**25,000**	**Hours**
Analysis period for life-cycle assessment:	**7**	**7**	**7**	**years**
Life-cycle cost for analysis period, discounted to 2023	**16,989**	**8,909**	**8,603**	**KES (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**1.5**	**1.0**	**months**
CO2 emissions due to electricity used for 7 years:	**262**	**131**	**131**	**kg CO2/7 yrs**

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (KES):	**150**	**170**	***KES***
Price for one lamp (USD):	**1.27**	**1.44**	***US dollars***
Lamp wattage:	**40**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	**59**	***kWh/year***
Rated lamp lifetime:	**13,000**	**20,000**	***Hours***
Analysis period for life-cycle assessment:	**6**	**6**	***years***
Life-cycle cost for analysis period, discounted to 2023	**16,193**	**7,329**	***KES (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**0.2**	***months***
CO2 emissions due to electricity used for 6 years:	**250**	**112**	***kg CO2/6 yrs***

Madagascar

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Madagascar

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	1,020,000	947,000	873,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	8	7	7	kg of mercury
National electricity savings	0.95	0.89	0.82	TWh of electricity
National financial savings from avoided electricity use	0.31	0.29	0.27	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.26	0.24	0.22	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Madagascar ratified the Minamata Convention in May 2015.
- Madagascar's electrification levels are currently at 33.7%. A key electrification strategy includes off-grid solutions, which are expected to increase the market share of off-grid solar LED lighting within the local market.
- Mercury-containing lighting products still make up a large portion of Madagascar's market. According to a 2013 assessment, these products ranked second only to mercury-containing batteries in annual consumer consumption.

Map of LED Companies in Madagascar

Madagascar does not have any local assembly or manufacturing of LED lighting products. The country imports most of its lighting products from India, Vietnam, and France.

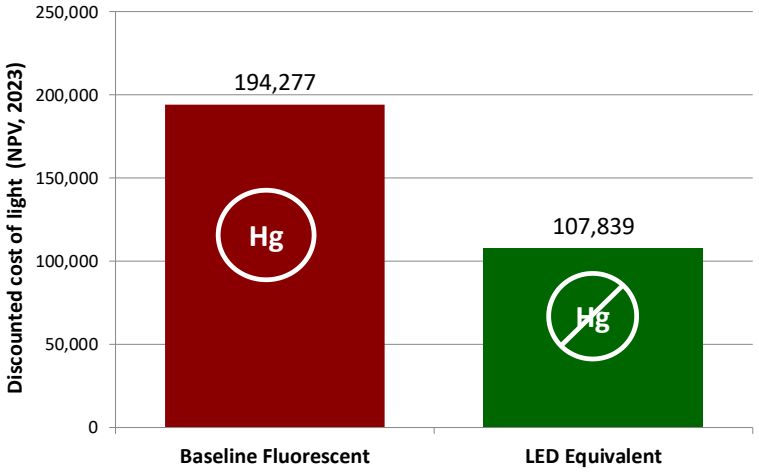
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Madagascar.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



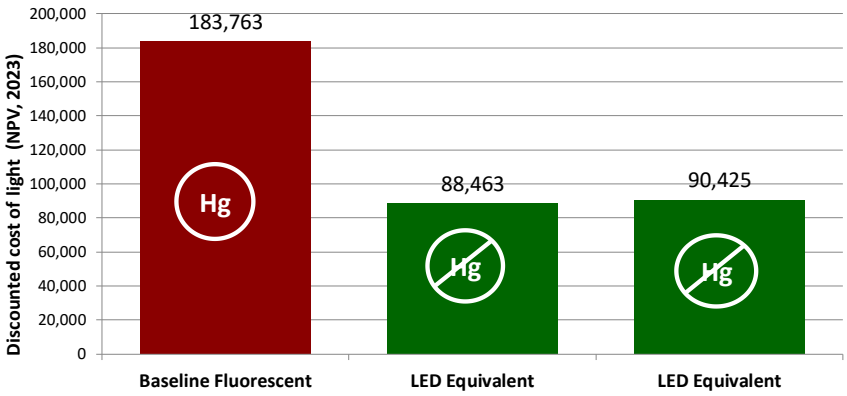
Price for one lamp (MGA):	**50,000**	**18,200**	***MGA***
Price for one lamp (USD):	**12.21**	**4.44**	***US dollars***
Lamp wattage:	**40**	**20**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	**66**	***kWh/year***
Rated lamp lifetime:	**8,000**	**6,000**	***Hours***
Analysis period for life-cycle assessment:	**2**	**2**	***years***
Life-cycle cost for analysis period, discounted to 2023	**194,277**	**107,839**	***MGA (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**instant**	***months***
CO2 emissions due to electricity used for 2 years:	**99**	**50**	***kg CO2/2 yrs***

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (MGA):	**46,700**	**12,000**	**13,000**	**MGA**
Price for one lamp (USD):	**11.40**	**2.93**	**3.17**	**US dollars**
Lamp wattage:	**38**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**125**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**7,500**	**5,000**	**6,000**	**Hours**
Analysis period for life-cycle assessment:	**2**	**2**	**2**	**years**
Life-cycle cost for analysis period, discounted to 2023	**183,763**	**88,463**	**90,425**	**MGA (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**instant**	**instant**	**months**
CO2 emissions due to electricity used for 2 years:	**94**	**45**	**45**	**kg CO2/2 yrs**

Nigeria

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Nigeria

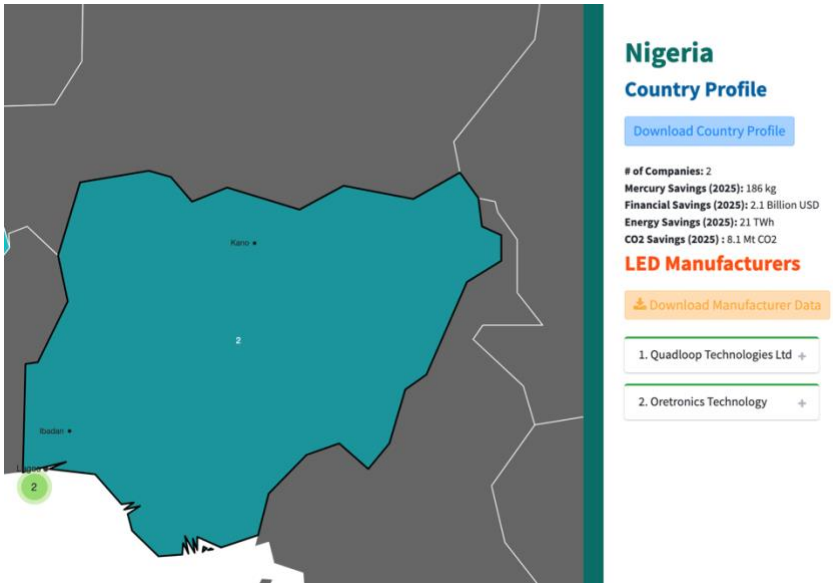
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	31,100,000	28,800,000	26,600,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	186	169	153	kg of mercury
National electricity savings	19	17	16	TWh of electricity
National financial savings from avoided electricity use	1.9	1.7	1.6	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	7.4	6.9	6.4	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Nigeria is currently in the process of adopting Minimum Energy Performance Standards (MEPS) for lighting products. Adoption of these MEPS will have extensive energy- and cost-saving benefits for the users and the country.
- Nigeria's Energy Policy prioritizes replacing all incandescent light bulbs in every home, industry, institution, and establishment in the country with LEDs and other energy-saving lamps by the year 2025. The Nigerian National Energy Efficiency Action Plan (NEEAP) also prioritizes the use of Energy Efficient lighting. Its 2020 target was for 40% of households to be using EE lighting, up to 100% by 2030.
- The Nigerian Clean Energy Access Program (NCEAP) plans to distribute 150 million energy efficient bulbs over the next five years under the Clean Development Mechanism (CDM).
- Several solar LED street lighting projects have been rolled out in major Nigerian cities. There are also multiple large projects to extend energy access to communities living off the grid through solar home systems and solar energy kits.
- In 2022, a successful LED retrofit program was carried out at the Folarin Coker Hospital in Lagos. This retrofit halved electricity bills for the hospital.

Map of LED Companies in Nigeria

Nigeria has several local LED assembly companies as shown in the map below[1]. Additionally, Nigeria imports lighting products from India, China, and Germany



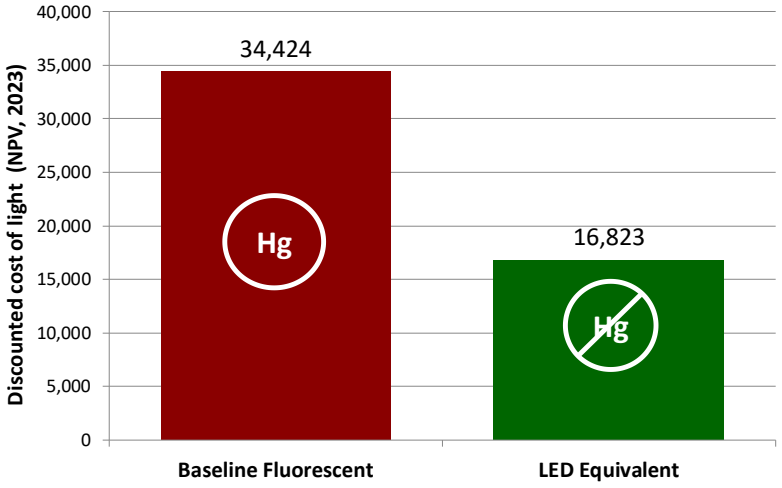
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Nigeria.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (NGN):	**1,500**	**2,190**	***NGN***
Price for one lamp (USD):	**3.54**	**5.17**	***US dollars***
Lamp wattage:	**36**	**16**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**118**	**53**	***kWh/year***
Rated lamp lifetime:	**15,000**	**15,000**	***Hours***
Analysis period for life-cycle assessment:	**4**	**4**	***years***
Life-cycle cost for analysis period, discounted to 2023	**34,424**	**16,823**	***NGN (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**1.8**	***months***
CO2 emissions due to electricity used for 4 years:	**187**	**83**	***kg CO2/4 yrs***

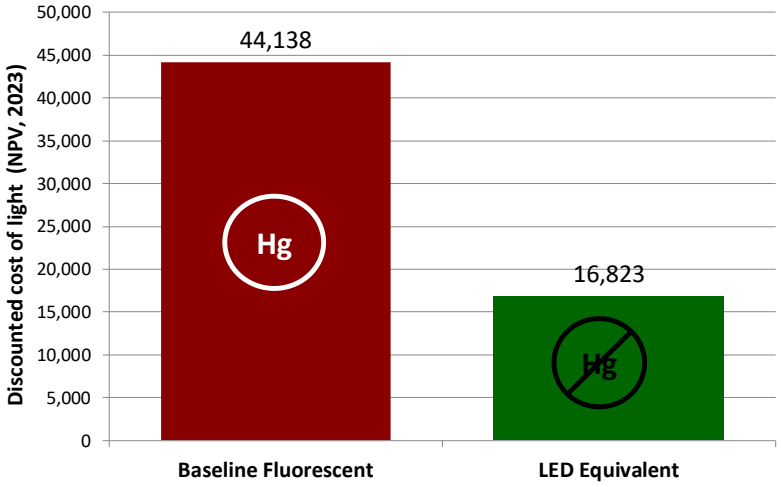
[1] Mega Benjamin & Eric Nigeria Limited and Chug Hang Inter-Continental Industrial Co. LTD were named as assemblers of lighting products but they do not have any digital presence (website, Facebook, etc.)

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (NGN):	**4,000**	**2,190**	***NGN***
Price for one lamp (USD):	**9.44**	**5.17**	***US dollars***
Lamp wattage:	**40**	**16**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	**53**	***kWh/year***
Rated lamp lifetime:	**10,000**	**15,000**	***Hours***
Analysis period for life-cycle assessment:	**4**	**4**	***years***
Life-cycle cost for analysis period, discounted to 2023	**44,138**	**16,823**	***NGN (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**instant**	***months***
CO2 emissions due to electricity used for 4 years:	**208**	**83**	***kg CO2/4 yrs***

Rwanda

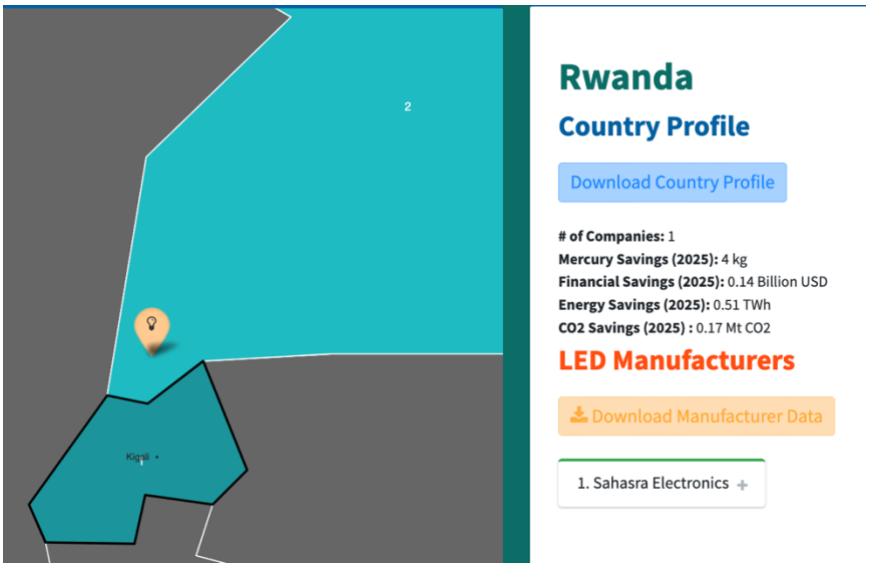
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Rwanda

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	530,000	476,000	425,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	4	4	3	kg of mercury
National electricity savings	0.51	0.46	0.42	TWh of electricity
National financial savings from avoided electricity use	0.14	0.13	0.12	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.17	0.15	0.14	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- As part of the East Africa Community, Rwanda has adopted the EAS 1064 Minimum Energy Performance Standards for lighting products.
- In a bid to meet green investment goals, the government has also rolled out solar LED street lighting projects across different parts of the country.
- In 2014, the government of Rwanda rolled out a bulk procurement scheme of 200,000 compact fluorescent lamps across the country to reduce power demand.
- A transition to mercury-free lighting products will result in both energy- and cost-savings for the country.

Map of LED Companies in Rwanda
Rwanda has a company assembling LED lighting products as shown in the map below.



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Rwanda.

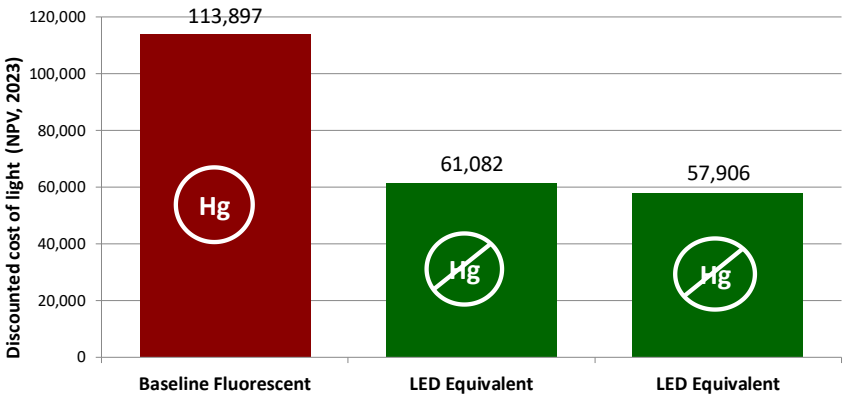
Non-integrated lamps are not available in the Rwandan market.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



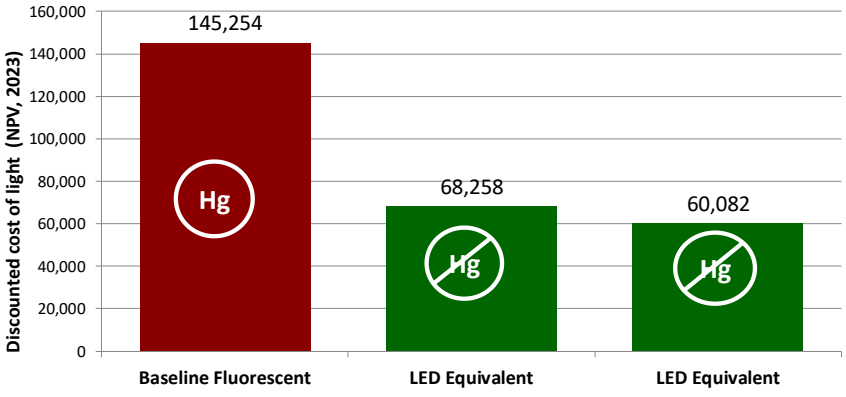
Price for one lamp (RWF):	**1,500**	**5,500**	**8,500**	**RWF**
Price for one lamp (USD):	**1.46**	**5.34**	**8.25**	**US dollars**
Lamp wattage:	**36**	**18**	**16**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**53**	**kWh/year**
Rated lamp lifetime:	**18,000**	**42,000**	**46,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**113,897**	**61,082**	**57,906**	**RWF (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**8.6**	**13.6**	**months**
CO2 emissions due to electricity used for 14 years:	**545**	**273**	**242**	**kg CO2/10 yrs**

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (RWF):	**8,500**	**6,500**	**4,500**	**RWF**
Price for one lamp (USD):	**8.25**	**6.31**	**4.37**	**US dollars**
Lamp wattage:	**40**	**20**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**131**	**66**	**59**	**kWh/year**
Rated lamp lifetime:	**15,000**	**45,000**	**45,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**145,254**	**68,258**	**60,082**	**RWF (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**instant**	**instant**	**months**
CO2 emissions due to electricity used for 13 years:	**606**	**303**	**273**	**kg CO2/10 yrs**

Senegal

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Senegal

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	2,500,000	2,280,000	2,060,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	19	17	16	kg of mercury
National electricity savings	2.38	2.19	2.01	TWh of electricity
National financial savings from avoided electricity use	0.61	0.56	0.51	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.11	1.02	0.92	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The government of Senegal has rolled out extensive solar LED street lighting projects across nearly 400 locations in the country.
- In 2021, the government launched a project to deploy 4.4 million LED bulbs to households, administrations, and small businesses.

Map of LED Companies in Senegal

Senegal does not have any local assembly or manufacturing of LED lighting products. The country imports most of its lighting from India, France, and Belgium.

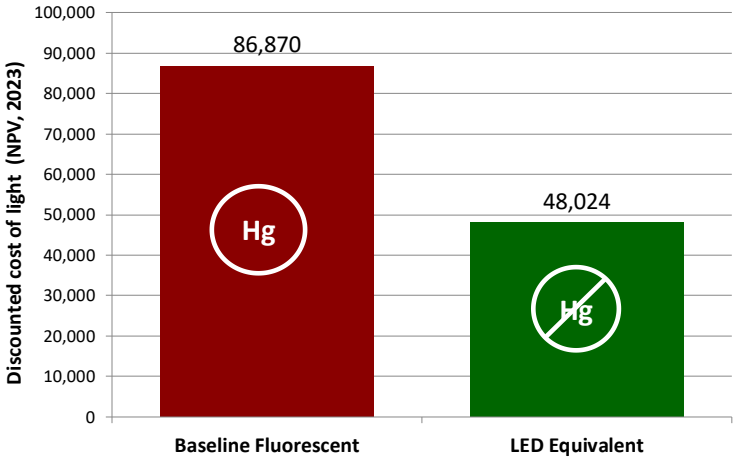
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Senegal.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



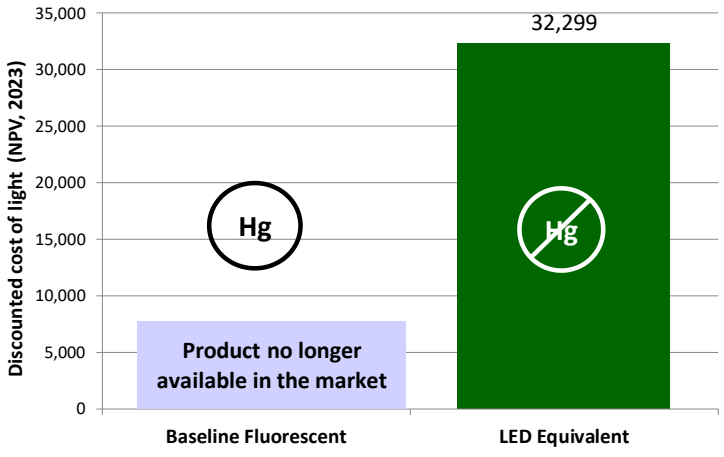
Price for one lamp (XOF):	**1,000**	**5,500**	***XOF***
Price for one lamp (USD):	**1.60**	**8.82**	***US dollars***
Lamp wattage:	**36**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**118**	**59**	***kWh/year***
Rated lamp lifetime:	**18,000**	**20,000**	***Hours***
Analysis period for life-cycle assessment:	**6**	**6**	***years***
Life-cycle cost for analysis period, discounted to 2023	**86,870**	**48,024**	***XOF (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**7.6**	***months***
CO2 emissions due to electricity used for 6 years:	**403**	**201**	***kg CO2/6 yrs***

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XOF):		**800**	***XOF***
Price for one lamp (USD):		**1.28**	***US dollars***
Lamp wattage:		**40**	***Watts***
Lamp is on for hours/day:		**9**	***hours/day***
Annual electricity consumption for each lamp type:		**131**	***kWh/year***
Rated lamp lifetime:		**8,000**	***Hours***
Analysis period for life-cycle assessment:		**2**	***years***
Life-cycle cost for analysis period, discounted to 2023		**32,299**	***XOF (NPV, 2023)***
Simple Payback period in months, compared with LFL:			***months***
CO2 emissions due to electricity used for 2 years:		**149**	***kg CO2/2 yrs***

Togo

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Togo

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	495,000	454,000	415,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	4	3	3	kg of mercury
National electricity savings	0.46	0.43	0.40	TWh of electricity
National financial savings from avoided electricity use	0.12	0.11	0.10	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.12	0.11	0.10	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2023, a project to electrify 12,100 households and install 1,858 solar LED streetlamps was launched by the World Bank in collaboration with the Togo government.
- In 2021, the Togo government rolled out a project to install 50,000 solar LED streetlamps across the country.
- In 2009, a bulk procurement scheme of 400,000 compact fluorescent light bulbs was launched to replace incandescent lamps.

Map of LED Companies in Togo

There is no local assembly or manufacturing of lighting products in Togo. Imports are mainly from India, France and Turkey.

The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Togo.

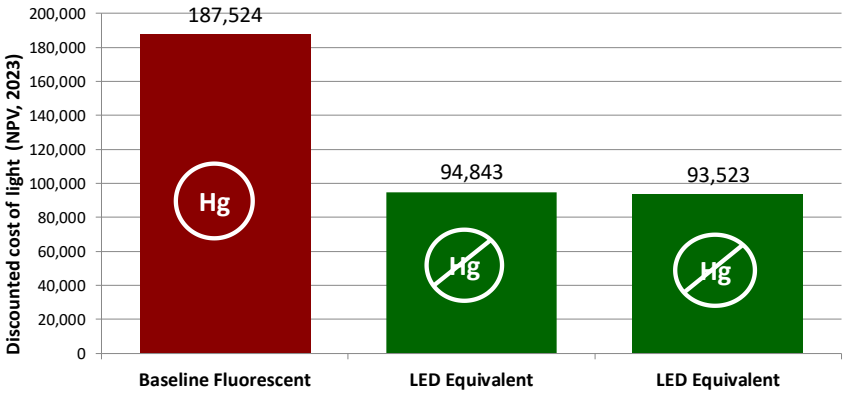
T12 and non-integrated lighting products are not commonly available in Togo. T8s and T5s, on the other hand, are widely available.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XOF):	**1,248**	**1,248**	**1,871**	**XOF**
Price for one lamp (USD):	**2.00**	**2.00**	**3.00**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**10,000**	**15,000**	**40,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**187,524**	**94,843**	**93,523**	**XOF (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**instant**	**0.8**	**months**
CO2 emissions due to electricity used for 12 years:	**403**	**202**	**202**	**kg CO2/10 yrs**

Uganda

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Uganda

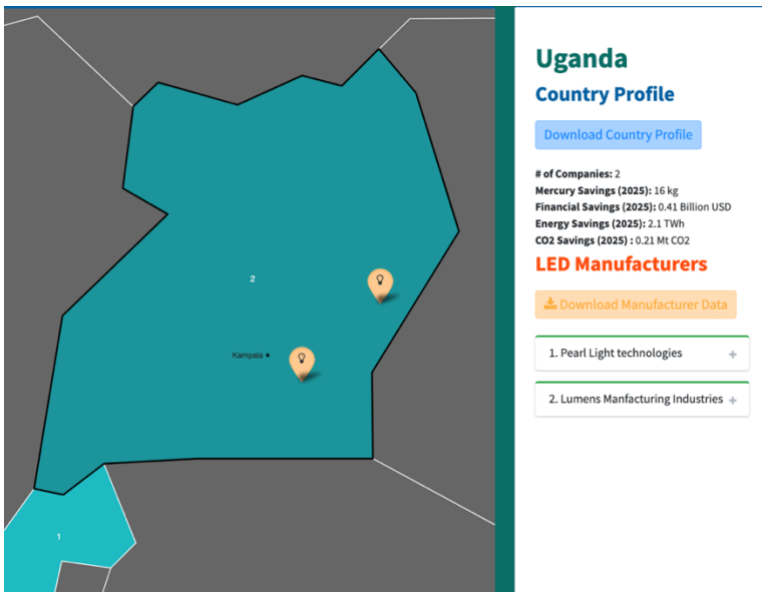
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	2,180,000	1,990,000	1,800,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	16	15	14	kg of mercury
National electricity savings	2.06	1.90	1.74	TWh of electricity
National financial savings from avoided electricity use	0.41	0.38	0.34	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.21	0.19	0.17	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Uganda has had mandatory Minimum Energy Performance Standards (MEPS) for tubular, fluorescent, and HID lighting products since 2011.
- Several major cities in Uganda, including Kampala and Jinja, have installed solar LED streetlights with immense energy- and cost-saving benefits.
- In 2015, the government of Uganda rolled out a bulk procurement and distribution scheme for 420,000 LED lamps to replace CFL (energy saving) lamps. The government had rolled out a similar program in 2007 to replace incandescent lamps with 800,000 CFL lamps.

Map of LED Companies in Uganda

Uganda has several companies locally assembling LED lighting products as shown below.



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Uganda.

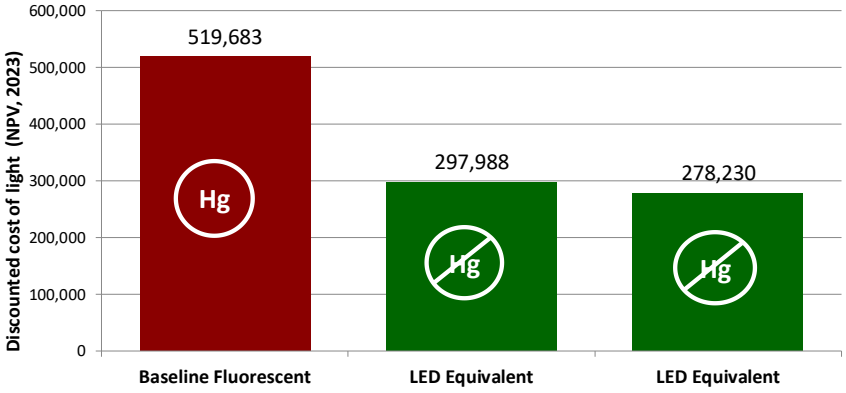
T12 lighting products are not available in the Ugandan market. Non-integrated lamps are also not commonly available.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (UGX):	7,000	25,000	25,000	UGX
Price for one lamp (USD):	1.90	6.78	6.78	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	13,000	20,000	25,000	Hours
Analysis period for life-cycle assessment:	7	7	7	years
Life-cycle cost for analysis period, discounted to 2023	519,683	297,988	278,230	UGX (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	6.0	6.0	months
CO2 emissions due to electricity used for 7 years:	116	58	58	kg CO2/7 yrs

South Africa

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in South Africa

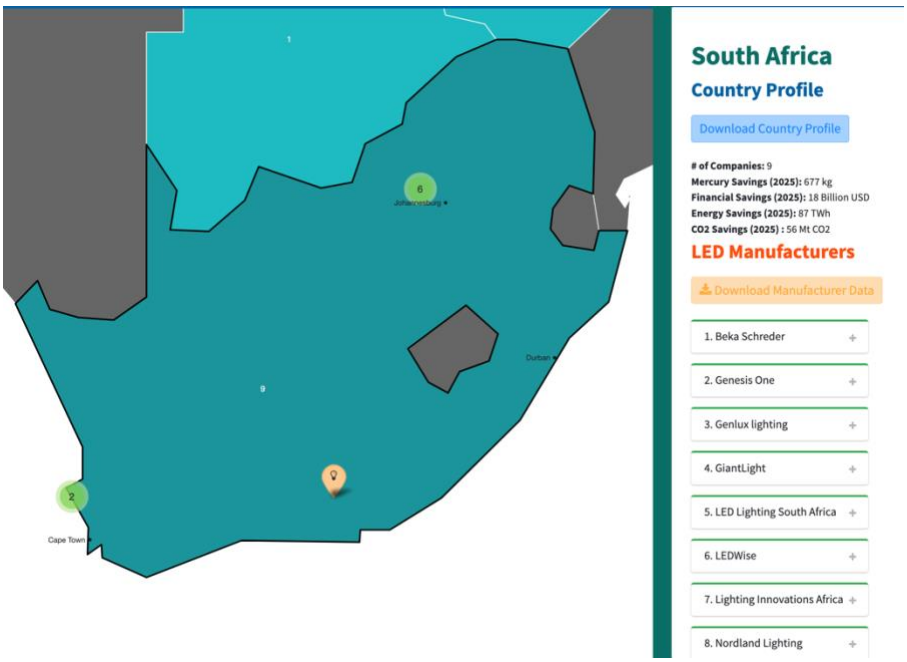
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	90,300,000	80,500,000	71,100,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	677	604	533	kg of mercury
National electricity savings	87.3	78.8	70.4	TWh of electricity
National financial savings from avoided electricity use	18.5	16.8	14.9	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	56.0	50.2	44.3	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In June 2023, South Africa adopted a compulsory specification policy for General Service Lamps (GSLs). Adoption of these MEPS are expected to result in immense annual electricity and carbon savings.
- Several municipalities are rolling out solar LED street lighting projects in South Africa.
- In June 2023, Shoprite, one of South Africa's largest retailers, reduced its electricity consumption by 11.8% following the installation of 1,001,932 energy-efficient LED lightbulbs across 1,647 stores.
- There are strong industry voices, including LEDVANCE and Massmart, who support consumer education on the benefits and availability of new lighting technologies.

Map of LED Companies in South Africa

South Africa has many companies manufacturing and assembling lighting products as indicated on the map below.



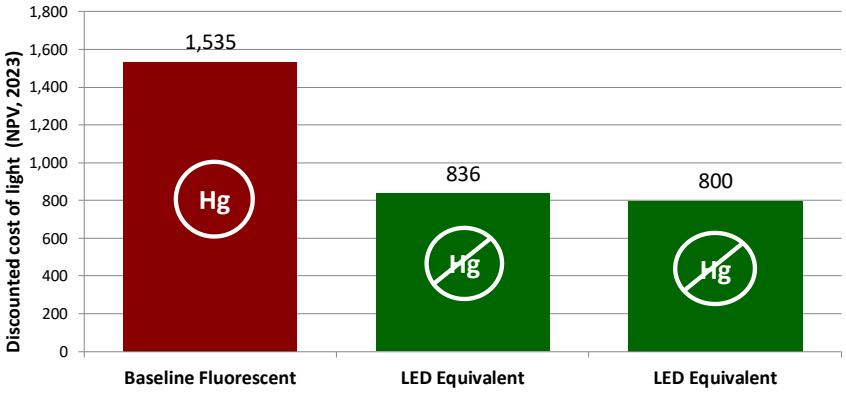
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in South Africa.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



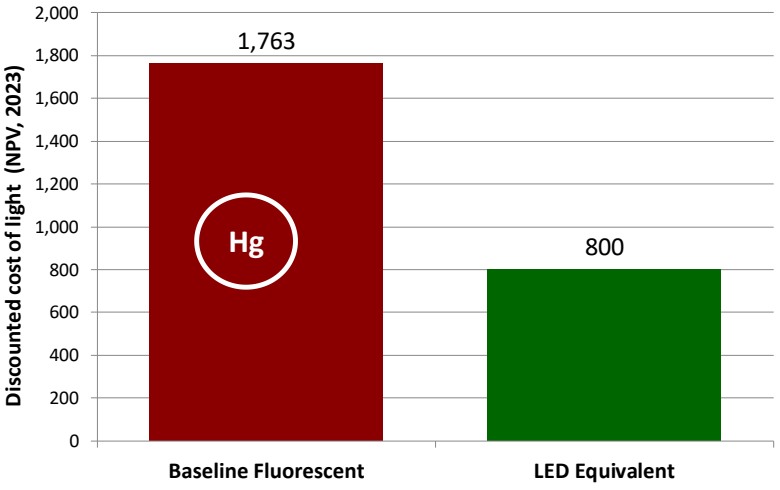
Price for one lamp (ZAR):	**43**	**58**	**72**	**ZAR**
Price for one lamp (USD):	**2.63**	**3.55**	**4.40**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**18,000**	**15,000**	**25,000**	**Hours**
Analysis period for life-cycle assessment:	**7**	**7**	**7**	**years**
Life-cycle cost for analysis period, discounted to 2023	**1,535**	**836**	**800**	**ZAR (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**1.7**	**3.3**	**months**
CO2 emissions due to electricity used for 7 years:	**688**	**344**	**344**	**kg CO2/7 yrs**

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (ZAR):	**52**	**72**	***ZAR***
Price for one lamp (USD):	**3.18**	**4.40**	***US dollars***
Lamp wattage:	**40**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	**59**	***kWh/year***
Rated lamp lifetime:	**8,000**	**25,000**	***Hours***
Analysis period for life-cycle assessment:	**7**	**7**	***years***
Life-cycle cost for analysis period, discounted to 2023	**1,763**	**800**	***ZAR (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**1.9**	***months***
CO2 emissions due to electricity used for 7 years:	**764**	**344**	***kg CO2/7 yrs***

Zambia

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Zambia

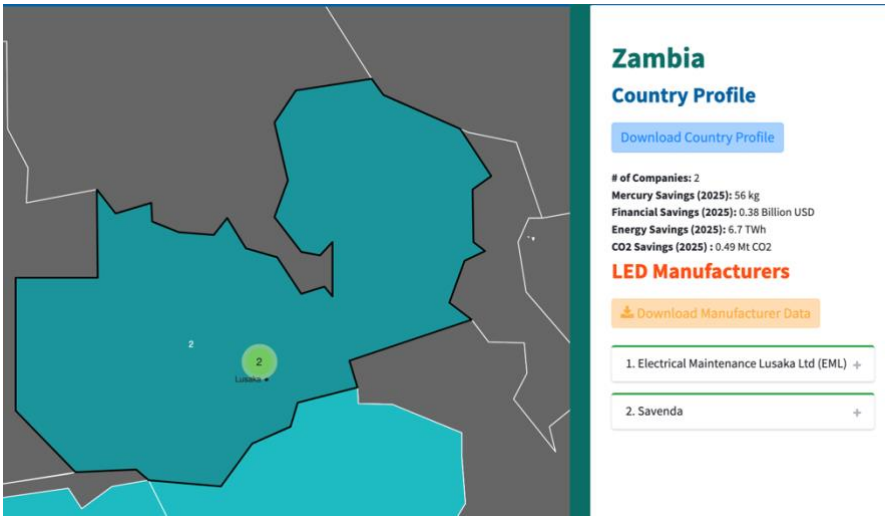
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	7,470,000	7,020,000	6,570,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	56	53	49	kg of mercury
National electricity savings	6.73	6.37	6.01	TWh of electricity
National financial savings from avoided electricity use	0.38	0.36	0.34	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.49	0.46	0.43	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- As part of the SADC community, Zambia is in the process of adopting the region's lighting MEPS – SADC HT 109:202. Adopting these MEPS should result in energy, carbon, and financial savings for the country.
- Since 2019, several solar LED lighting programs have been rolled out by different government agencies and local authorities.
- In 2017, the national utility ZESCO rolled out a national LED distribution program that made 5 million LED lamps available to the population. It was estimated that this transition would achieve 30% electricity savings and potentially reduce power shortages that ravaged the country.
- In 2016, Zambia banned the importation of incandescent bulbs.
- Zambia ratified the Minamata Convention in 2016.

Map of LED Companies in Zambia

Zambia has two companies manufacturing and assembling LED lighting products as indicated in the map below.



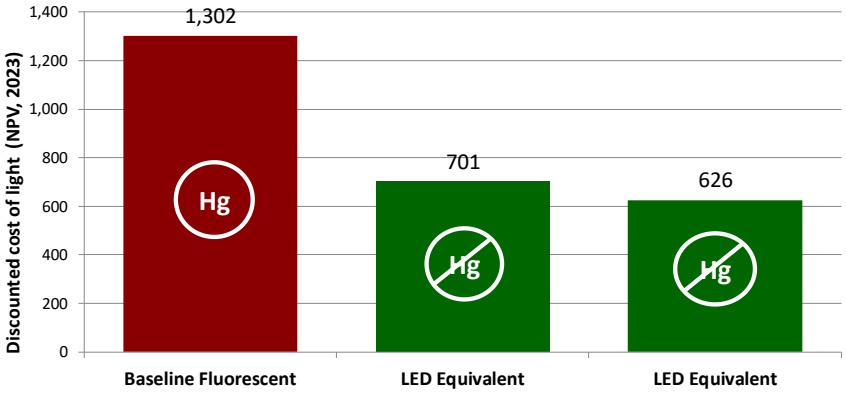
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Zambia.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



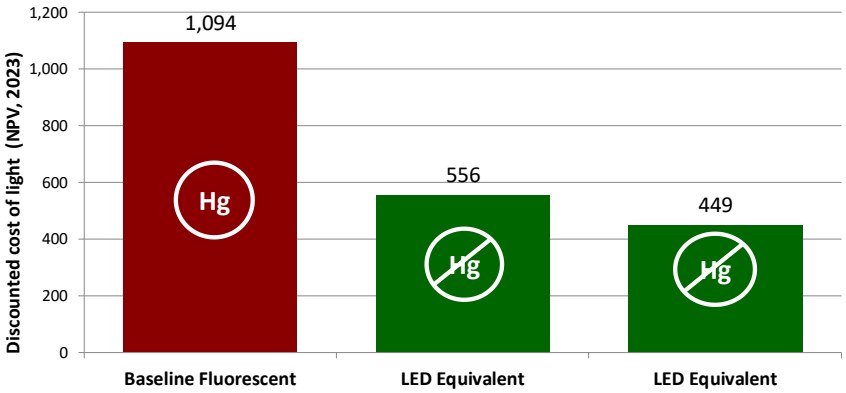
Price for one lamp (ZMW):	45	60	100	ZMW
Price for one lamp (USD):	2.66	3.54	5.90	US dollars
Lamp wattage:	36	18	16	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	53	kWh/year
Rated lamp lifetime:	13,000	18,000	50,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	1,302	701	626	ZMW (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	3.0	10.0	months
CO2 emissions due to electricity used for 15 years:	117	58	52	kg CO2/10 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (ZMW):	**65**	**50**	**35**	**ZMW**
Price for one lamp (USD):	**3.84**	**2.95**	**2.07**	**US dollars**
Lamp wattage:	**40**	**22**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**131**	**72**	**59**	**kWh/year**
Rated lamp lifetime:	**10,000**	**25,000**	**25,000**	**Hours**
Analysis period for life-cycle assessment:	**7**	**7**	**7**	**years**
Life-cycle cost for analysis period, discounted to 2023	**1,094**	**556**	**449**	**ZMW (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**instant**	**instant**	**months**
CO2 emissions due to electricity used for 7 years:	**91**	**50**	**41**	**kg CO2/7 yrs**

Zimbabwe

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Zimbabwe

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	7,360,000	6,710,000	6,090,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	55	50	46	kg of mercury
National electricity savings	6.96	6.41	5.87	TWh of electricity
National financial savings from avoided electricity use	0.98	0.91	0.83	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	5.15	4.70	4.26	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Zimbabwe has a statutory instrument (SI2018-208) that bans inefficient incandescent lighting products. The country is also in the process of adopting the SADC regional lighting MEPS (SADC HT 109:2021). Nationalization of the SADC HT 109:2021 is expected to result in energy and financial savings for the country.
- In 2022, the government rolled out a solar LED street lighting project in Harare.
- In 2011, the national utility rolled out a $12 million USD campaign to distribute millions of free energy-efficient bulbs.

Map of LED Companies in Zimbabwe

Zimbabwe has two companies manufacturing and assembling LED lighting products as indicated in the map below.

T8's are the most widely available lighting product in Zimbabwe

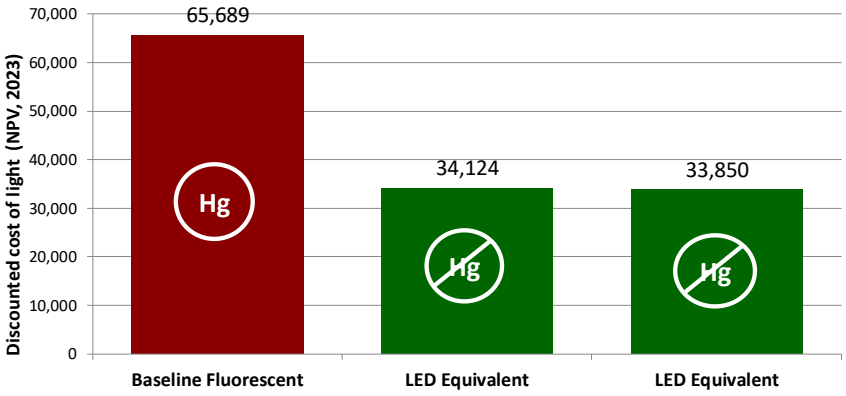
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Zimbabwe.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (ZWL):	**986**	**2,194**	**1,920**	**ZWL**
Price for one lamp (USD):	**2.63**	**5.85**	**5.12**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**15,000**	**30,000**	**30,000**	**Hours**
Analysis period for life-cycle assessment:	**9**	**9**	**9**	**years**
Life-cycle cost for analysis period, discounted to 2023	**65,689**	**34,124**	**33,850**	**ZWL (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**4.1**	**3.2**	**months**
CO2 emissions due to electricity used for 9 years:	**939**	**470**	**470**	**kg CO2/9 yrs**

Clean Lighting Coalition

Technical & Economic Assessment of Mercury-Free Lighting: Asia Pacific Region

Asia Pacific Region

If a 2025 LFL phase out date is negotiated and adopted at Minamata COP5 – reflecting the position of the Clean Lighting Coalition – it would avoid the sale of 8.38 billion linear fluorescent lamps in the Asia Pacific Region and result in the following cumulative benefits (2025-2050):

1. avoid **63 metric tons** of mercury pollution from leaking into the environment
2. avoid **2.8 gigatons of CO2** emissions
3. save approximately **7940 TWh of the region's total electricity consumption** and
4. save **$1,141 billion USD**

The data above reflects the benefits of a global fluorescent phase-out to all countries in Asia Pacific, not just parties to the Minamata Convention on Mercury and based on CLASP's MEPSy model[1]

Lighting Market Overview

The Asia Pacific region is a hub for manufacturing and exporting both fluorescent and LED lighting products.

China accounts for 73% of global production of fluorescent lamps. YaMing Lighting, Foshan, and Zhejiang Changhong Lighting Sources might be the only remaining large scale fluorescent producers in the world. The second largest manufacturer is India, with nine manufacturers registered as suppliers of fluorescent lamps, including Philips, Bajaj, Surya, Havells, Crompton, CEMA, Osram, HPL, and Ecolink. Out of these, nine plants also produce LEDs.

[1] https://clasp.shinyapps.io/mepsy/

Asia also dominated the LED manufacturing and export market. China is the main global exporter of LED lamps and luminaires, representing respectively 89% and 56% of the total exporting value (US$ 5.35 billion and US$ 15.52 billion).

Five Asia-Pacific countries export 91% of the total trade of LED die chips and packaging globally - valuing US$3.1 billion. Malaysia is the main exporting country for this market segment (25% of the global exports in Table 1).

TABLE 1: LED DIE/CHIPS AND PACKAGES EXPORTS - MARKET SHARE OF ASIAN COUNTRIES & VALUE IN USD

COUNTRY	TRADE VALE IN US$ BILLION	% GLOBAL EXPORTS
MALAYSIA	0.77	25%
JAPAN	0.66	21%
CHINA	0.55	18%
TAIWAN	0.42	14%
SOUTH KOREA	0.34	11%
VIETNAM	0.06	2%
TOTAL	**2.8**	**91%**

Phasing-out fluorescents in line with the COP5 Lighting Amendment would increase the accessibility and affordability of a safer lighting technology across Asia and drive the transition to clean lighting globally. The transition to LEDs has the added benefit of further stimulating the existing local manufacturing landscape.

The Clean Lighting Coalition developed a dashboard that provides a global overview of LED lighting technology manufacturers available within each country.

The figure below shows the current LED manufacturing and assembly across the Asia Pacific Region.

Global LED Manufacturer Map

Cost Comparison: LEDs vs CFL/LFL

LED lamps are, on average, more expensive than fluorescent lamps on a first-cost basis, but pay for themselves quickly, 4.1 months and 7.0 months respectively for T8s and T12s. Figure 1 provides an inventory of the average payback periods across different countries in the region for T8s.

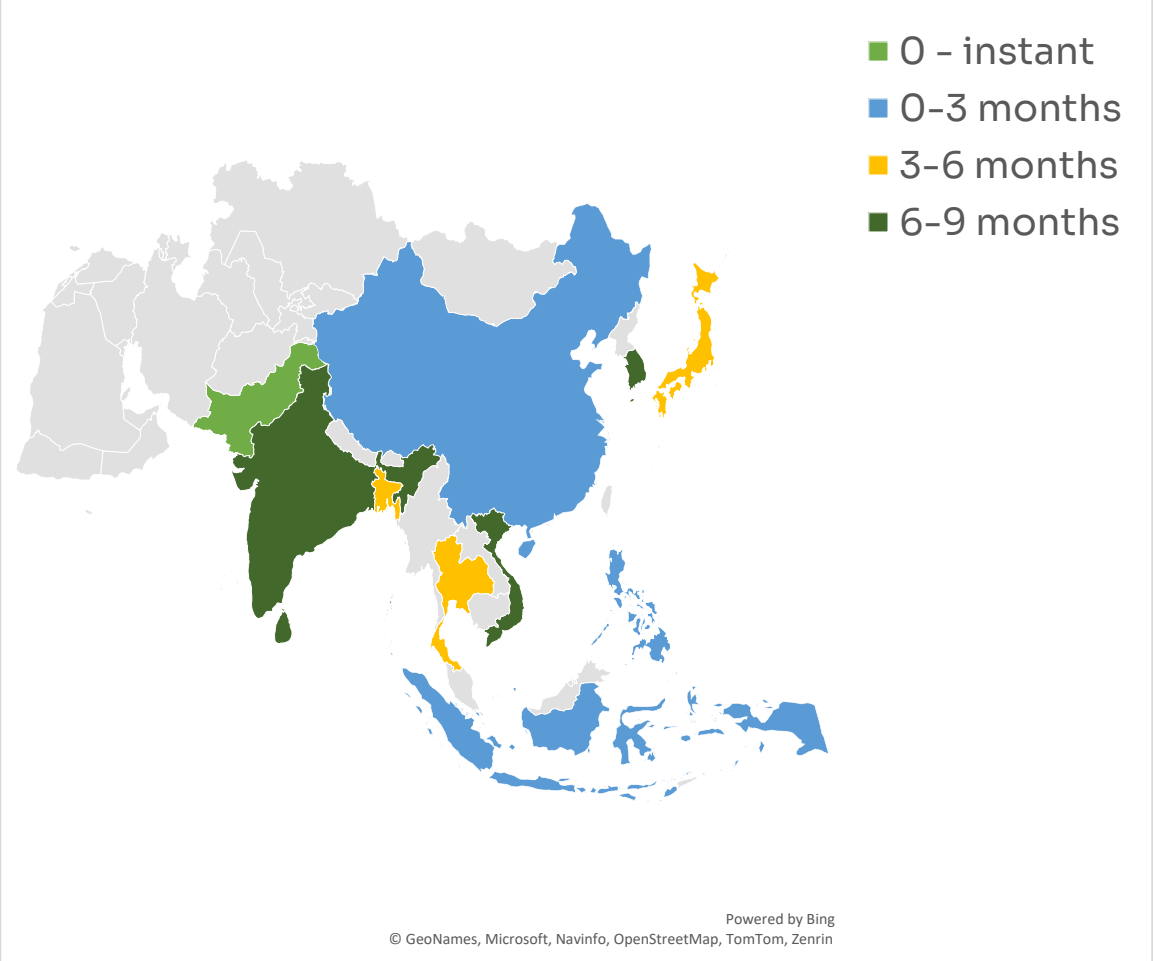


Figure 1 T8 Payback Period in Assesses Countries

Additionally, the LED lamp consumes half as much power as fluorescents– so electricity bills are halved over the lamp lifetime. Finally, on average, Asia consumers save 52% on lifecycle costs when they replace LFLs with LEDs. Figure 2 details this further.

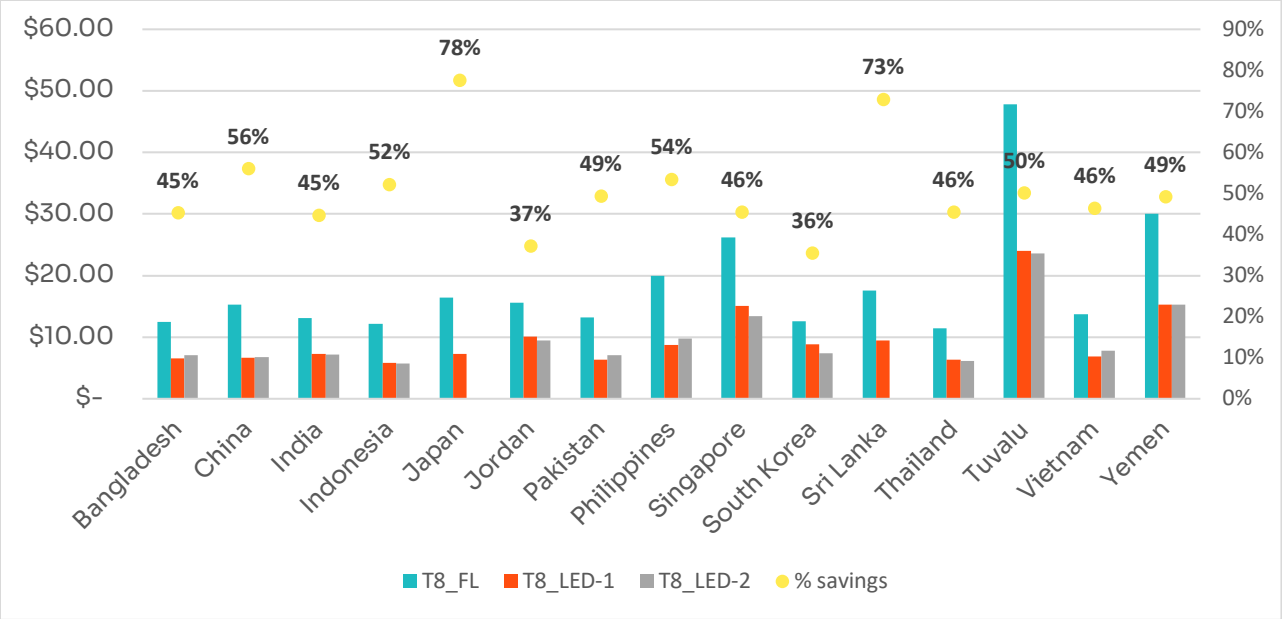


Figure 2 Life Cycle Savings of LEDS over Fluorescents

Tables 1 and 2 tables provide comparative information about the cost of light for LFL vs LED lamps across countries in the region.

T8 tubular lighting products were the most common in the selected countries in Asia Pacific. In Asia Pacific, the average payback period for T8 products was 4.1 months. The life cycle costs of LED T8s are half that of the fluorescent counterparts.

Table 1 True Cost of Light: T8 Linear Lamps

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Bangladesh	BDT 130 (US$1.42)	BDT 280 (US$3.05)	3.7 months	BDT 487.23 (US$5.31)
China	CNY 10.04 (US$1.49)	CNY 18.12 (US$2.69)	1.8 months	CNY 52.56 (US$7.8)
India	INR 37.5 (US$0.48)	INR 415 (US$5.28)	9 months	INR 502.6 (US$6.39)
Indonesia	IDR 20150 (US$1.36)	IDR 39000 (US$2.63)	2.4 months	IDR 94916.79 (US$6.39)
Japan	JPY 1466 (US$11.15)	JPY 1870 (US$14.22)	4.9 months	JPY 997.82 (US$7.59)
Jordan	JOD 1 (US$1.41)	JOD 2.25 (US$3.17)	3.3 months	JOD 4.57 (US$6.44)
Pakistan	PKR 600 (US$2.93)	PKR 450 (US$2.2)	instantaneous	PKR 1057.77 (US$5.16)
Philippines	PHP 120 (US$2.2)	PHP 190 (US$3.49)	1.4 months	PHP 600.26 (US$11.02)
Singapore	SGD 4 (US$2.9)	SGD 4.9 (US$3.55)	0.6 months	SGD 17.72 (US$12.84)
South Korea	KRW 2200 (US$1.7)	KRW 5400 (US$4.18)	7.1 months	KRW 5439.67 (US$4.21)
Sri Lanka	LKR 345 (US$1.06)	LKR 2100 (US$6.48)	7.6 months	LKR 2779.11 (US$8.57)
Thailand	THB 65 (US$1.85)	THB 119 (US$3.39)	3.5 months	THB 186.09 (US$5.31)
Tuvalu	AUD 7 (US$4.86)	AUD 6 (US$4.17)	instantaneous	AUD 33.11 (US$23)
Vietnam	VND 25300 (US$1.09)	VND 126000 (US$5.41)	7.7 months	VND 157088.7 (US$6.75)
Yemen	YER 900 (US$0.81)	YER 1100 (US$0.99)	0.1 months	YER 16556.4 (US$14.91)

The average payback period for T12's in the selected countries in Asia Pacific was about 7.5months. The fluorescent options were uncommon, found in only 7 out of the 15 countries. and retailers recommend a switch to T8 to customers replacing their T12 fluorescents.

Table 2 True Cost of Light: T12 Linear Lamps

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Bangladesh	BDT 130 (US$1.42)	BDT 280 (US$3.05)	3 months	BDT 609.04 (US$6.64)
China	CNY 12 (US$1.78)	CNY 66 (US$9.79)	11.2 months	CNY 57.82 (US$8.58)
Indonesia	IDR 175000 (US$11.78)	IDR 39000 (US$2.63)	instantaneous	IDR 113900.15 (US$7.67)
Pakistan	PKR 750 (US$3.66)	PKR 450 (US$2.2)	instantaneous	PKR 1511.1 (US$7.38)
Philippines	PHP 270 (US$4.96)	PHP 190 (US$3.49)	instantaneous	PHP 714.59 (US$13.12)
South Korea	KRW 35000 (US$27.1)	KRW 20000 (US$15.49)	instantaneous	KRW 10879.35 (US$8.42)
Sri Lanka	LKR 200 (US$0.62)	LKR 2100 (US$6.48)	6.7 months	LKR 3396.69 (US$10.48)

The displayed prices in columns 1-2 were recorded from commercial entities, wholesale shops, and suppliers in each country. Columns 3-4 illustrate the benefits associated with switching to mercury-free LED technology. The Payback Period column shows the amount of time needed for the energy savings from the LED lamp to pay for its higher cost. If the LED is less expensive than the fluorescent lamp, then the payback is 'instantaneous'. The column labelled 'energy savings with LED' indicates the savings on energy bills over the lifetime of the LED lamp. The tables also detail comparative cost across countries. Please note that the value in brackets is the equivalent cost in US$.

Energy Efficiency Comparison

The energy efficiency of a light bulb is measured in lumens/watt. The graphic below depicts the ranges of energy efficiency of different types of bulbs available across Asia-Pacific markets. It represents efficiency quartiles (0%, 25%, 50%, 75%, 100%) of the data we collected when sorted from lowest to highest efficiency. The box with numbers represents the 25th-75th quartile while the thin lines with the dots represent the lowest and highest efficiency per technology on either end.
The average efficacy of the LED lamp is markedly higher than that of the fluorescent pairs, 102lm/W against 71lm/W.

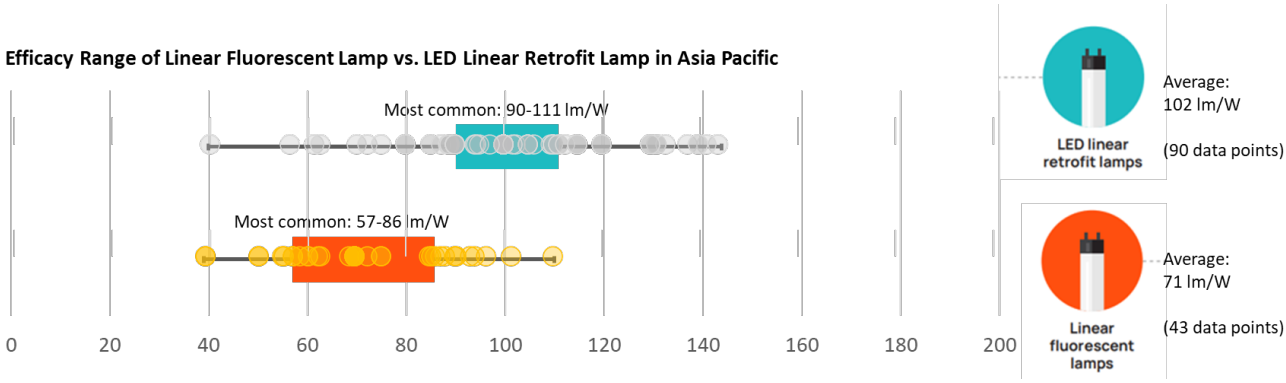


Figure 3 Efficacy Comparison of LEDS over Fluorescents

Lighting Policy & Legislative Landscape

Many countries in the region are shifting towards LED-only markets through energy efficiency policy and/or mercury regulation. Some of the notable initiatives and regulations include:

1. **India**: India's Electric Lamp and Component Manufacturers Association (ELCOMA) published Vision 2024 Roadmap to transition lighting market to LED by 2024.
2. **Indonesia**: In 2021, Indonesia approved a Roadmap for High Efficiency Lamps for Indonesia, which includes phasing out lamps that contain mercury in government agencies and state-owned enterprises' buildings by 2022. Ministerial Decree 35.K/EK.07/DJE/2022 was released by the Ministry of Energy and Mineral Resources in July 2022, stipulating MEPS for self-ballasted LED bulbs at 80 lumens per Watt, self-ballasted LED lamps 100 lumens per

watt, and LED luminaires (street lighting, high bay, floodlight, etc) at 120 lumens per watt., in line with the ASEAN harmonization target set for 2023. The first LED MEPS and labeling policy in Indonesia will come into force in July 2023.

3. **Pakistan**: Pakistan developed MEPS for LEDs in 2020 and a national efficient lighting strategy to accelerate the transition to LEDs, already at 70% penetration in Pakistan's domestic market. Additionally, in February 2023, the Pakistan Ministry of Science & Technology announced a law that prohibits the manufacture, sale & import of incandescent lamps & mercury-containing compact fluorescent lamps with effect from July 1.
4. **Philippines**: Philippines' House Bill No. 262 (pending approval) aims to require all government offices to use LEDs instead of incandescent and CFL bulbs and fluorescent lamps.
5. **Singapore**: Singapore's National Environment Agency is aiming for all bulbs sold to be minimally as efficient as LEDs from 2023 onwards.
6. **Sri Lanka**: Sri Lanka is implementing a project (2021-2023) under the Minamata Specific International Program to strengthen the national capacity for phasing out mercury-added products, including through alternatives to CFLs and LFLs. MEPS for LEDs were first adopted in 2016 and revised in 2019.
7. **Thailand**: Thailand's 2021 Long-term Low Greenhouse Gas (GHG) Development Strategy includes LEDs as part of the technologies for a successful transition to low GHG development. Voluntary MEPS for LEDs are in place since 2013.
8. **Vietnam:** In 2020 GEF approved a UNDP project that supports Vietnam's transition to non- mercury lighting (among others). In 2019 MOIT issued Circular No. 08/2019/TT-BKHCN that mandates certification requirements for domestically produced and imported LED products.

Compatibility/Retrofits for LED lamps

In virtually all Asia-Pacific markets where data was collected, cost-effective LED retrofits and replacements were readily available for linear lighting. This confirms that the markets are well-prepared to help consumers transition to LED lighting seamlessly, given the wide array of options the lighting industry provides in these markets.

Consumers who prefer using their old fluorescent lighting fixtures to its end-of-life may opt to install ballast-compatible LED retrofits, which are found to be widely available in the majority of Asia Pacific markets. These plug-and-play retrofits serve as an easy and simple solution to consumers, as there is no need for rewiring or ballast change.

Consumers may also opt to do rewiring to their old fluorescent fixtures to allow installation of wider variety of LED replacement options. Conversion of linear light fixtures to become LED-compatible is very common in nearly all Asia Pacific countries, given the affordability and the wide availability of electrician services. The exception to this option is Japan, where consumers are strongly encouraged to install LED tube replacements in LED-compatible fixtures only. In other words, rewiring or fixture modification is mandatory.

The other popular option is to install new LED fixtures or entirely new LED luminaries. CLiC's partners that conducted market data collection in the Asia Pacific region, shows that retailers would also recommend switching to the new LED fixture or the new LED luminaires if the old fluorescent fixture has deteriorated with time or nearly reached its end-of-life. These two options are widely available at affordable prices and are particularly useful for consumers that have other considerations in mind, for instance, aesthetic and increase or decrease in brightness.

Lighting industry in India has been actively promoting change in preference to LED fixtures and luminaires over conventional lighting fixtures, as mentioned in Electric Lamp and Component Manufacturers Association of India (ELCOMA) Vision 2024. This trend is also consistent for Japan, as the country transitions to linear lighting. Lighting Manufacturers Association (JLMA) fixtures trade statistics shows that from 2018 to 2022, new linear lighting fixtures sold in Japan are virtually all for LED fixtures.

End of Life Management for Lighting

Collection and safe recycling/disposal of fluorescent lamps is difficult – especially in regions with low levels of general e-waste collection and processing. For example, countries in the Association of Southeast Asian Nations (ASEAN) do not recycle mercury-containing lamps. The countries that have recycling facilities, such as Indonesia, Malaysia, Philippines, Thailand only dismantle or crush fluorescent lamps locally and export them to other countries, including Germany and Japan. In addition, statistics indicate that those countries with collection services do not do so effectively. In Sri Lanka for example, only 39% of fluorescent lamps are collected.

Accelerating the transition to LEDs would turn off the mercury tap – eliminating hazardous waste and mercury contents from new lighting products imported to the Asia-Pacific region. The proposed African Lighting Amendment would therefore mitigate further environmental pollution and public health safety concerns.

ANNEX OF COUNTRY LEVEL DATA

Bangladesh

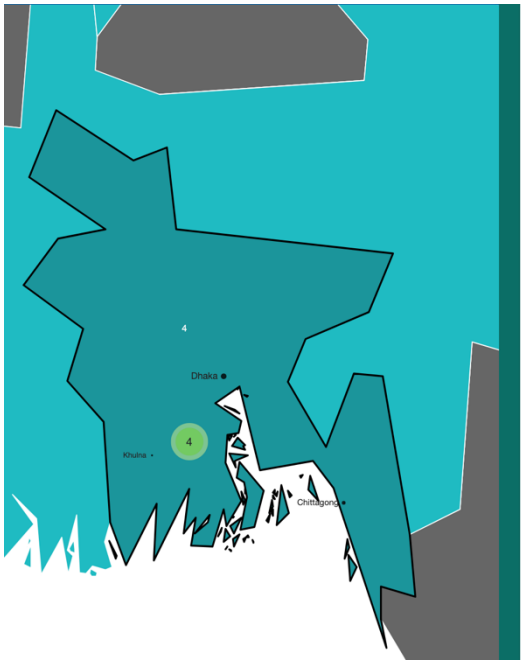
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Bangladesh

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	62,100,000	56,800,000	51,600,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	466	426	387	kg of mercury
National electricity savings	58.7	54.3	49.8	TWh of electricity
National financial savings from avoided electricity use	4.97	4.62	4.22	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	22.5	20.7	18.7	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Bangladesh's Minamata Initial Assessments (MIA) (2019) marks the phasing out of fluorescent lamps as a "high" priority plan.
- Mercury emissions from the use and disposal of mercury-containing lamps are estimated at 359 kg annually.
- Bangladesh's 8th Five-Year Plan (2020-2025) mentions mercury's harm to human and environmental health and sets a goal of energy-efficient and low-maintenance street and community lighting systems, in addition to overall energy efficiency objectives.

Map of LED Companies in Bangladesh



Bangladesh

Country Profile

Download Country Profile

# of Companies: 4
Mercury Savings (2025): 466 kg
Financial Savings (2025): 5 Billion USD
Energy Savings (2025): 59 TWh
CO2 Savings (2025) : 23 Mt CO2

LED Manufacturers

Download Manufacturer Data

1. Transcomp Sister concern: Bangladesh Lamps Limited +
2. Energypac Group Sister concern: Energypac Electronics +
3. Super Star Group Sister concern: Super Star Electronics Limited +
4. RFL Sister concern: Click Electrical Accessories +

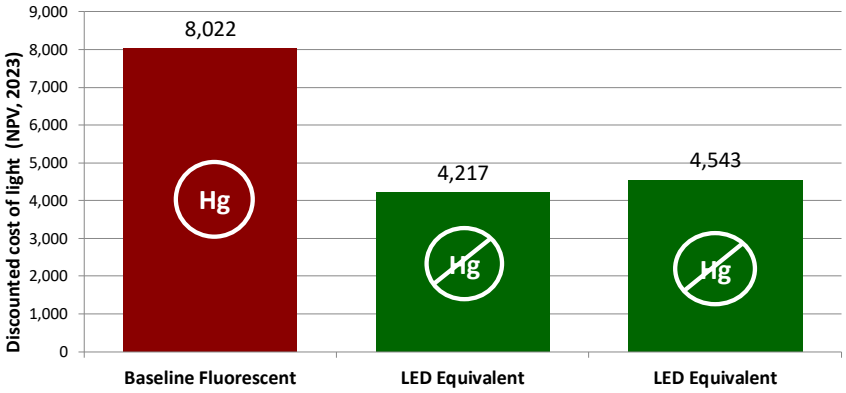
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Bangladesh.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (BDT):	**130**	**380**	**280**	**BDT**
Price for one lamp (USD):	**1.42**	**4.14**	**3.05**	**US dollars**
Lamp wattage:	**36**	**18**	**20**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**66**	**kWh/year**
Rated lamp lifetime:	**10,000**	**25,000**	**25,000**	**Hours**
Analysis period for life-cycle assessment:	**7**	**7**	**7**	**years**
Life-cycle cost for analysis period, discounted to 2023	**8,022**	**4,217**	**4,543**	**BDT (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**5.5**	**3.7**	**months**
CO2 emissions due to electricity used for 7 years:	**415**	**208**	**231**	**kg CO2/7 yrs**

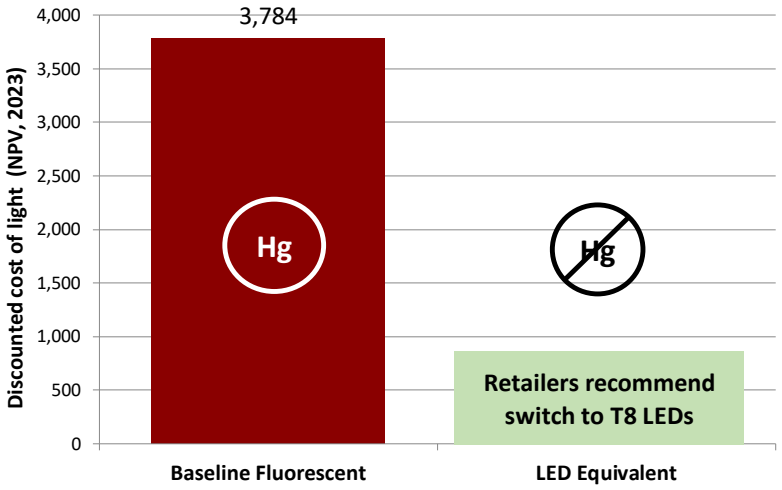
Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 13-May-2023

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (BDT):	**130**	***BDT***
Price for one lamp (USD):	**1.42**	***US dollars***
Lamp wattage:	**40**	***Watts***
Lamp is on for hours/day:	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	***kWh/year***
Rated lamp lifetime:	**10,000**	***Hours***
Analysis period for life-cycle assessment:	**3**	***years***
Life-cycle cost for analysis period, discounted to 2023	**3,784**	***BDT (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	***months***
CO2 emissions due to electricity used for 3 years:	**198**	***kg CO2/3 yrs***

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 13-May-2023

China

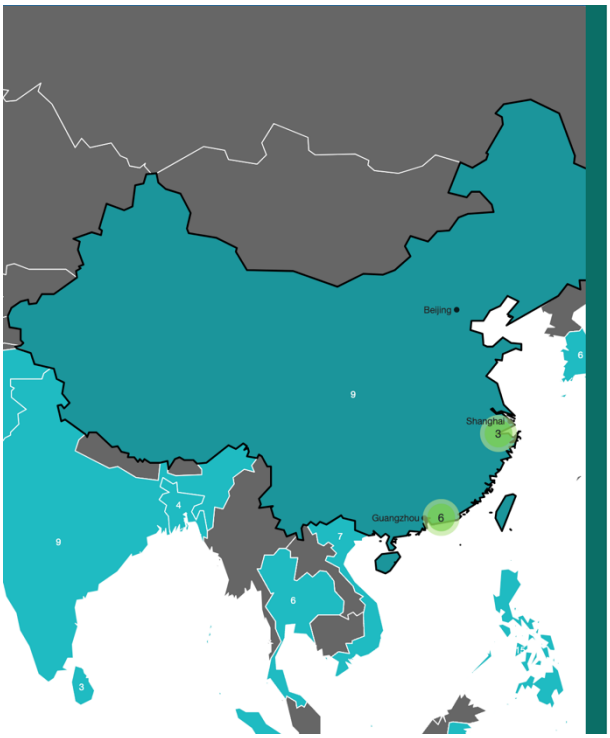
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in China

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	5,420,000,000	4,900,000,000	4,410,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	40,600	36,800	33,100	kg of mercury
National electricity savings	5,120	4,680	4,250	TWh of electricity
National financial savings from avoided electricity use	578	532	481	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1,830	1,660	1,490	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- LEDs have become the most common bulb in China, accounting for 75% of the general lighting market. China's production of fluorescent lamps remains low and continues to decline – the fluorescent market share dropped by 25% in 2021 alone. The majority of fluorescent bulbs produced in China were exported to international markets, with less than 20% being sold domestically. It is anticipated that fluorescent lamp production lines in China will be shut down within the next three to five years.
- China is the world's largest producer, consumer and exporter of LED lighting products, with ongoing policy initiatives moving their market towards 100% LED lighting. China has begun work on developing world-leading MEPS for LEDs, targeting policy adoption by the end of 2024. These MEPS will not cover non-LED products, as their market share is rapidly decreasing.
- The LED lighting market is projected to show a CAGR of 14.4% for the period from 2020 to 2030. China reportedly sold 8 billion lighting units in 2016, half of which were sold domestically. It is expected that China's LED lighting market will cross the $29 billion USD mark by the end of 2025.
- Many Chinese LED light manufacturers are increasing their production capacity thanks to favorable subsidies from both central and local governments. The National Semiconductor Lighting Project has helped to create seven national semiconductor lighting industrial bases (in Shanghai, Dalian, Nanchang, Xiamen, Shenzhen, Yangzhou and Shijiazhuang, and Guzhen).

Map of LED Companies in China



China

Country Profile

Download Country Profile

# of Companies: 9
Mercury Savings (2025): 40,631 kg
Financial Savings (2025): 578 Billion USD
Energy Savings (2025): 5,121 TWh
CO2 Savings (2025) : 1,831 Mt CO2

LED Manufacturers

Download Manufacturer Data

1. OPPLE Lighting Co,Ltd
2. Foshan Electrical And Lighting Co.,Ltd
3. Guangdong PAK Corporation Co,Ltd.
4. Huizhou CDN Industrial Development Co,Ltd.
5. Leedarson IOT Technology,Co,Ltd.
6. Zhejiang Yankon Lighting Lighting Appliances Group,Ltd.
7. Hengdian Group Tospolighting Co,Ltd
8. San'an Optoelectronics Co, Ltd

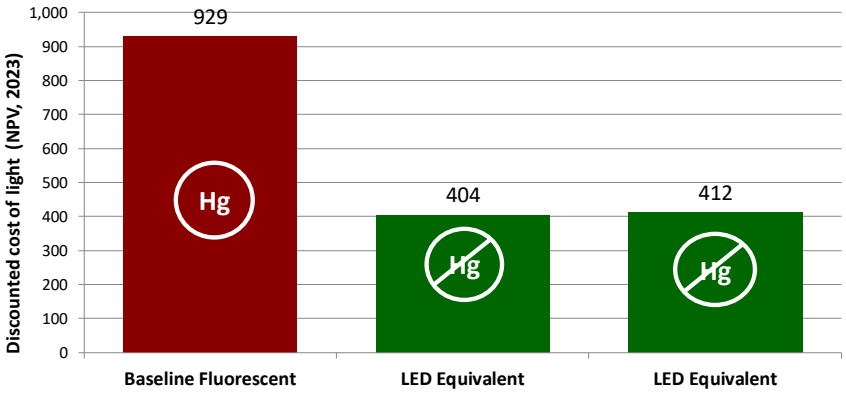
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in China.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (CNY):	**10**	**26**	**18**	**CNY**
Price for one lamp (USD):	**1.49**	**3.83**	**2.69**	**US dollars**
Lamp wattage:	**36**	**16**	**16**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**53**	**53**	**kWh/year**
Rated lamp lifetime:	**3,000**	**30,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**9**	**9**	**9**	**years**
Life-cycle cost for analysis period, discounted to 2023	**929**	**404**	**412**	**CNY (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**3.6**	**1.8**	**months**
CO2 emissions due to electricity used for 9 years:	**905**	**402**	**402**	**kg CO2/9 yrs**

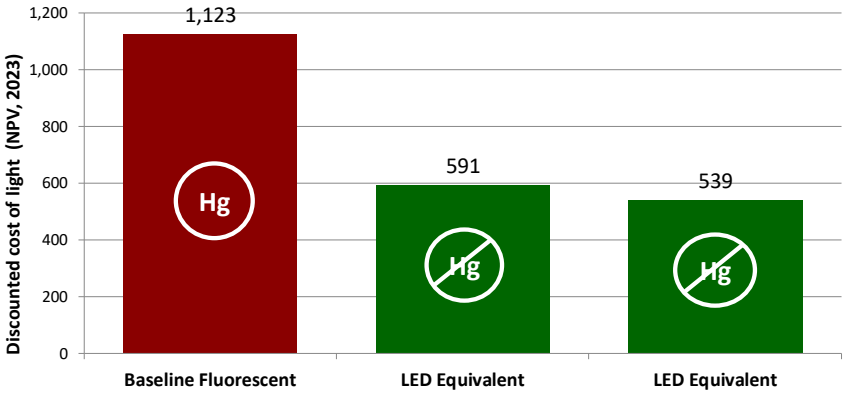
Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 15-Apr-2023

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (CNY):	**12**	**65**	**66**	**CNY**
Price for one lamp (USD):	**1.78**	**9.65**	**9.80**	**US dollars**
Lamp wattage:	**40**	**20**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**131**	**66**	**59**	**kWh/year**
Rated lamp lifetime:	**5,000**	**50,000**	**50,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**1,123**	**591**	**539**	**CNY (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**12.1**	**11.2**	**months**
CO2 emissions due to electricity used for 15 years:	**1,117**	**559**	**503**	**kg CO2/10 yrs**

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 15-Apr-2023

Indonesia

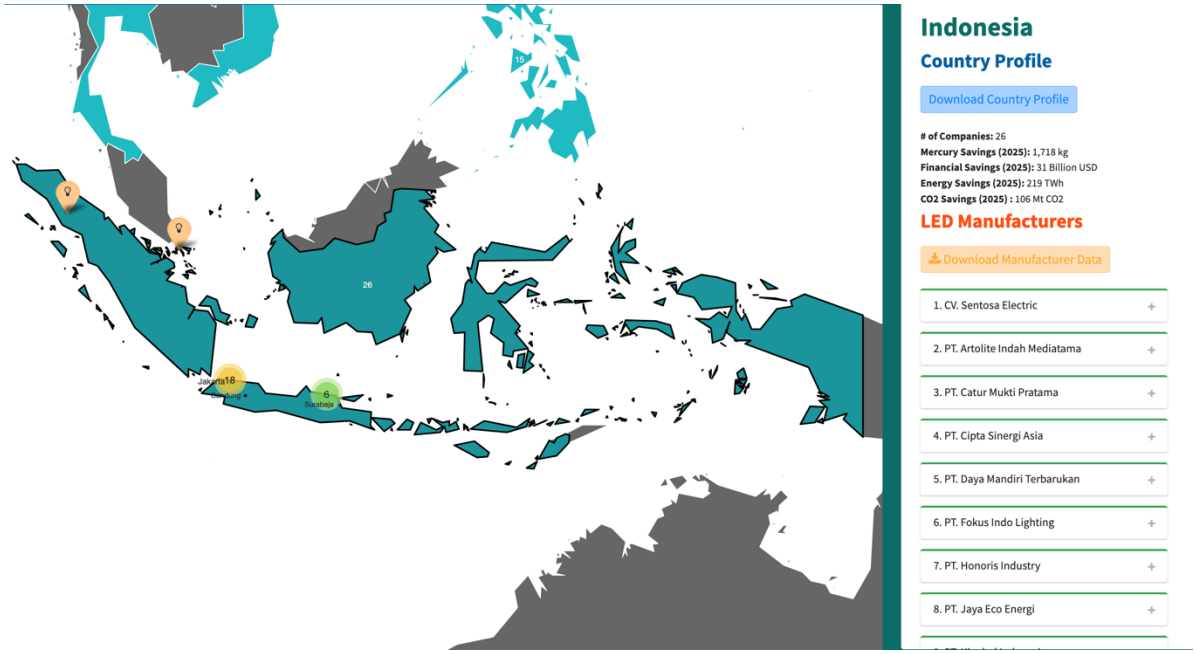
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Indonesia

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	229,000,000	207,000,000	186,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	1,720	1,550	1,390	kg of mercury
National electricity savings	219	200	182	TWh of electricity
National financial savings from avoided electricity use	30.9	28.4	25.6	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	106	96.2	86.2	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The National Action Plan to Eliminate and Reduce Use of Mercury from 2018 to 2030 (RAN PPM, Perpres 21/2019) aims to reduce mercury use in manufacturing (among others) by 50% by 2030 as compared to 2018 levels. According to the plan, the use of Mercury for lamp production was 163 kg per year in 2018.
- Indonesia hosted the fourth Conference of the Parties (COP4) in Bali. Due to the COVID-19 pandemic, the event had to be held in two parts – one online (November 2021) and one in-person (March 2022). Indonesia proposed the Bali Declaration on Combating Illegal Trade in Mercury. The proposed non-binding declaration invites all countries to join in the fight and form strong international cooperation in combating cross-border illegal mercury trade.
- In 2020, GEF launched the Advancing Indonesia's Lighting Market to High Efficient Technologies (ADLIGHT) project, a three-year (2020-2023) project aimed at reducing electricity demand and related greenhouse gas (GHG) emissions by transforming of the national market and promoting the increased use of high-efficiency lighting technologies.
- The local LED lighting industry shows strong growth. In 2021, Indonesia approved a Roadmap for High Efficiency Lamps for Indonesia, which includes, among others, phasing out mercury-containing lamps in the buildings of government agencies and state-owned enterprises by 2022.
- In July 2022, Ministerial Decree 135.K/EK.07/DJE/2022 was officially approved by the Minister of Mineral and Energy Resources, specifying the scope of the MEPS and energy labels applicable to self-ballasted LED lamps of types E40, E27, and E26 with a rated power of up to 60 W and a rated voltage of more than 50 V AC (up to 250 V AC). The decree stipulates a minimum luminous efficacy of 80 lumens per Watt, in line with the ASEAN harmonization target set for 2023.

Map of LED Companies in Indonesia



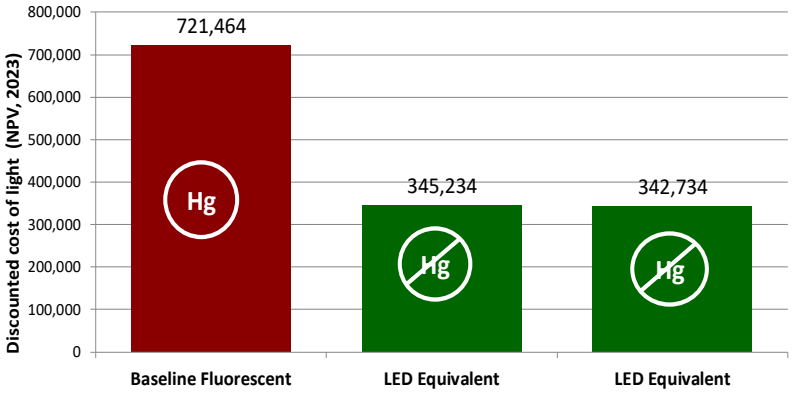
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Indonesia.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (IDR):	**20,150**	**41,500**	**39,000**	**IDR**
Price for one lamp (USD):	**1.36**	**2.79**	**2.63**	**US dollars**
Lamp wattage:	**36**	**16**	**16**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**53**	**53**	**kWh/year**
Rated lamp lifetime:	**13,000**	**15,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**4**	**4**	**4**	**years**
Life-cycle cost for analysis period, discounted to 2023	**721,464**	**345,234**	**342,734**	**IDR (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**2.7**	**2.4**	**months**
CO2 emissions due to electricity used for 4 years:	**384**	**171**	**171**	**kg CO2/4 yrs**

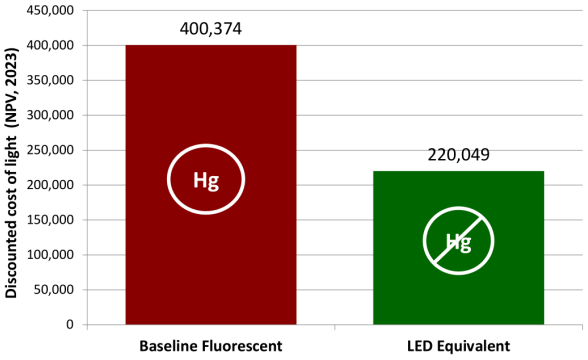
Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 15-Apr-2023

Linear Fluorescent Lamp - T8 - 600 mm

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (IDR):	**20,000**	**35,000**	***IDR***
Price for one lamp (USD):	**1.32**	**2.31**	***US dollars***
Lamp wattage:	**18**	**8**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**59**	**26**	***kWh/year***
Rated lamp lifetime:	**13,000**	**15,000**	***Hours***
Analysis period for life-cycle assessment:	**4**	**4**	***years***
Life-cycle cost for analysis period, discounted to 2023	**400,374**	**220,049**	***IDR (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**9.4**	***months***
CO2 emissions due to electricity used for 4 years:	**192**	**85**	***kg CO2/4 yrs***

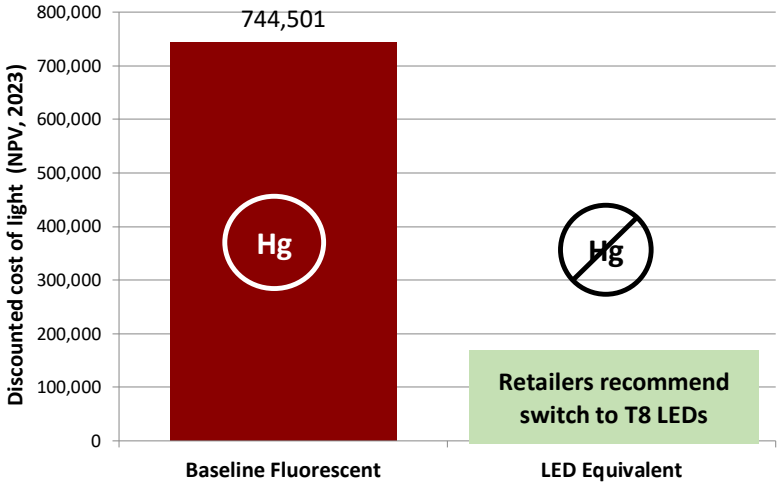
Photographs of the light bulbs selected in a retail store for this comparison.
Taken: April 2023

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (IDR):	**175,000**	***IDR***
Price for one lamp (USD):	**11.78**	***US dollars***
Lamp wattage:	**40**	***Watts***
Lamp is on for hours/day:	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	***kWh/year***
Rated lamp lifetime:	**13,000**	***Hours***
Analysis period for life-cycle assessment:	**3**	***years***
Life-cycle cost for analysis period, discounted to 2023	**744,501**	***IDR (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	***months***
CO2 emissions due to electricity used for 3 years:	**320**	***kg CO2/3 yrs***

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: April 2023

India

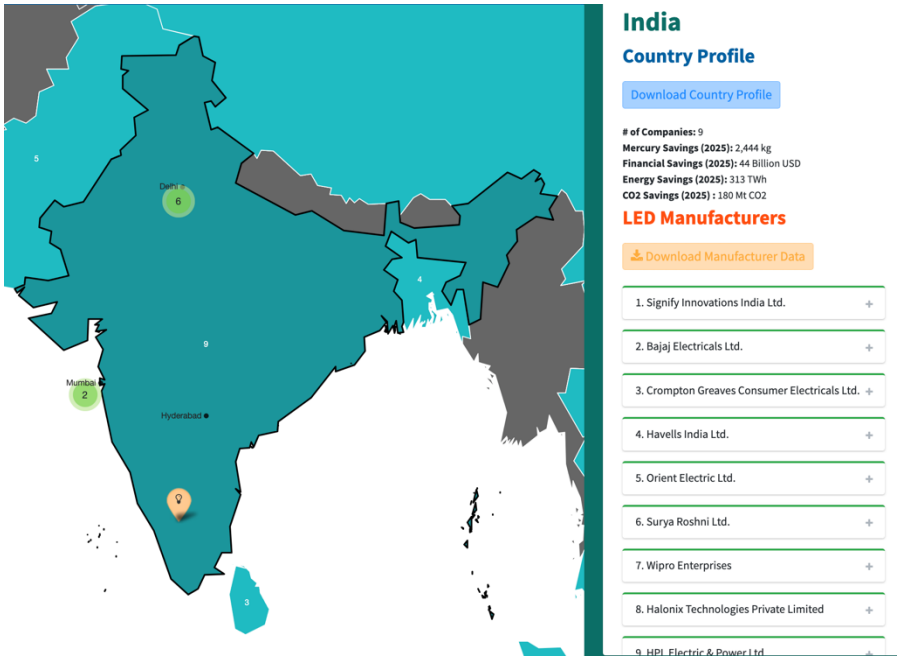
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in India

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	326,000,000	287,000,000	252,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	2,440	2,160	1,890	kg of mercury
National electricity savings	313	279	247	TWh of electricity
National financial savings from avoided electricity use	44.2	39.7	34.9	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	180	159	139	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- India's Electric Lamp and Component Manufacturers Association (ELCOMA) published its Vision 2024 Roadmap to transition the lighting market to LEDs by 2024.
- As per ELCOMA, India manufactured about 1.4 billion lamps (ICL, CFL and LED), tubular fluorescent lights, and linear LEDs in 2018-2019. The lighting market is dominated by conventional lighting – incandescent lamp, linear fluorescent, and CFL (54%) – followed by LED lamps and tube lights (46%), with the combined share of CFL and fluorescent tubes accounting for 11%.
- According to ELCOMA's production data for 2010-2018, approximately 22 tons of mercury was used in CFLs and fluorescent tubes during this period. In the absence of environmentally sound mercury management for collecting and disposing discarded fluorescent lamps, the mercury from these discarded lamps was likely released into the environment.

Map of LED Companies in India



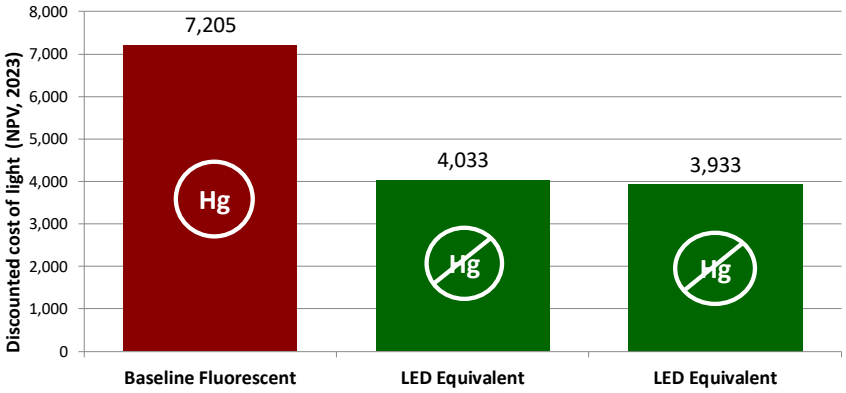
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in India.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (INR):	**38**	**515**	**415**	**INR**
Price for one lamp (USD):	**0.48**	**6.55**	**5.28**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**5,000**	**25,000**	**25,000**	**Hours**
Analysis period for life-cycle assessment:	**7**	**7**	**7**	**years**
Life-cycle cost for analysis period, discounted to 2023	**7,205**	**4,033**	**3,933**	**INR (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**11.4**	**9.0**	**months**
CO2 emissions due to electricity used for 7 years:	**557**	**278**	**278**	**kg CO2/7 yrs**

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 12-Jun-2023

Japan

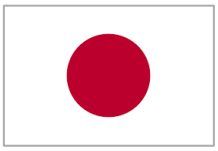


Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Japan

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	523,000,000	469,000,000	419,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	3,920	3,520	3,140	kg of mercury
National electricity savings	496	449	405	TWh of electricity
National financial savings from avoided electricity use	161	147	132	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	136	122	109	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2010, Japan promoted Green Innovation initiatives as a core concept of its New Growth Strategy and Strategic Energy Plan. The basic policy, decided by the Cabinet, aims to achieve 100% sales of next generation LED and OLED by 2020 and 100% of lighting stock by 2030.
- In 2019, Japan exported $0.66 billion USD (21%) of total global LED packages and chips for general lighting packages, placing Japan second, behind Malaysia, as the biggest exporter of these components.
- In 2019, energy conservation lighting policies were introduced to regulate incandescent lightbulbs, LEDs, and fluorescent lighting. Starting in 2020, lighting equipment regulations were introduced to regulate LEDs and fluorescent lamps.
- Lamps represent the largest share (35.4%) of mercury demand in Japan, equating to 3.3 tonnes annually. Other statistics show that in 2017, the use of mercury in lighting accounted for 25% of the 5.6 tonne total material flow of mercury.

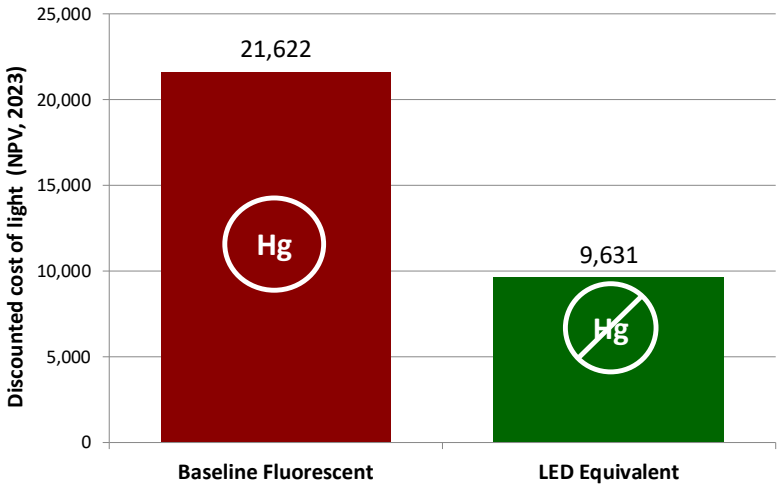
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Japan.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (JPY):	**1,466**	**1,870**	***JPY***
Price for one lamp (USD):	**11.15**	**14.22**	***US dollars***
Lamp wattage:	**40**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	**57**	***kWh/year***
Rated lamp lifetime:	**12,000**	**40,000**	***Hours***
Analysis period for life-cycle assessment:	**10**	**10**	***years***
Life-cycle cost for analysis period, discounted to 2023	**21,622**	**9,631**	***JPY (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**4.9**	***months***
CO2 emissions due to electricity used for 12 years:	**499**	**218**	***kg CO2/10 yrs***

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 14-Jun-2023

South Korea

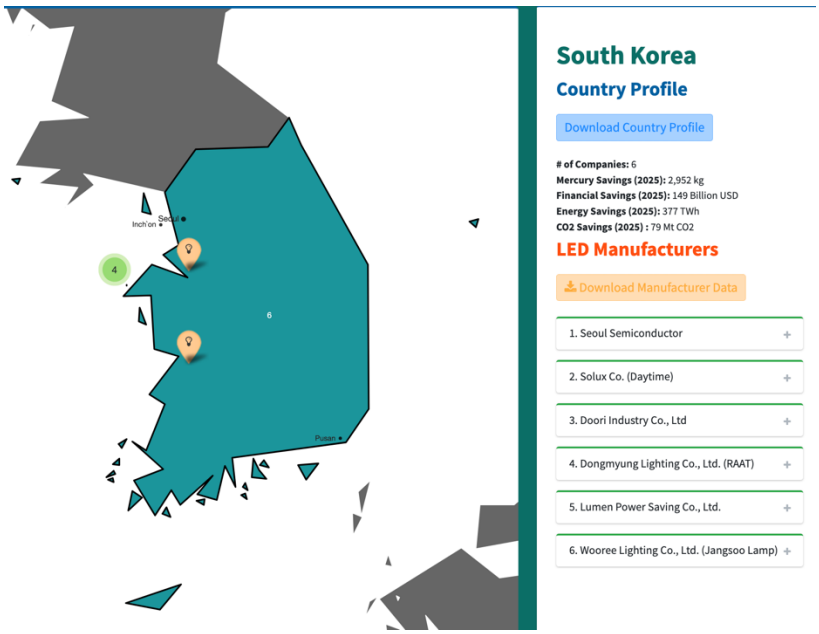
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in South Korea

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	394,000,000	352,000,000	312,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	2,950	2,640	2,340	kg of mercury
National electricity savings	377	340	305	TWh of electricity
National financial savings from avoided electricity use	149	135	121	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	78.9	70.7	62.7	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2020, approximately 2,957 tons (or 27.9 million units) of end-of-life fluorescent lamps from households were collected and recycled by the recycling facilities in South Korea. Approximately 278 kg of mercury was recovered from the lamps and treated at the hazardous incineration facilities.
- In South Korea, fluorescent lamps have been managed by the Extended Producer Responsibility (EPR) system under the Promotion Act on Savings and Recycling of Resources (often called “Recycling Act”) since 2004. LED lamps were included in the EPR system at the beginning of 2023.

Map of LED Companies in South Korea



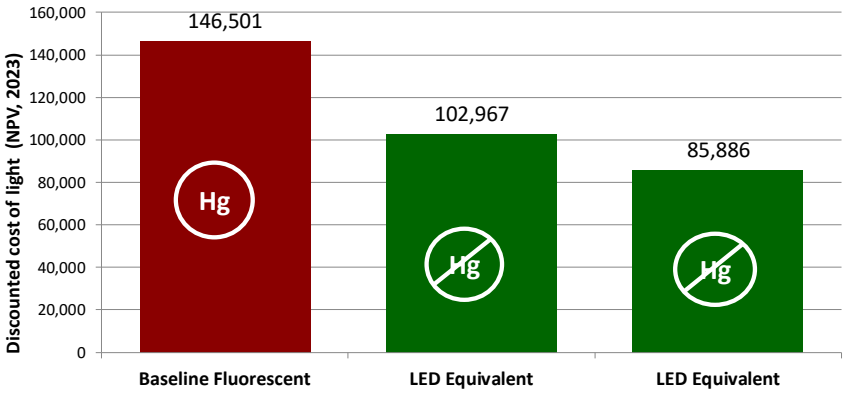
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in South Korea.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (KRW):	**2,200**	**5,400**	**8,000**	**KRW**
Price for one lamp (USD):	**1.70**	**4.18**	**6.19**	**US dollars**
Lamp wattage:	**32**	**21**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**105**	**69**	**57**	**kWh/year**
Rated lamp lifetime:	**16,000**	**25,000**	**30,000**	**Hours**
Analysis period for life-cycle assessment:	**9**	**9**	**9**	**years**
Life-cycle cost for analysis period, discounted to 2023	**146,501**	**102,967**	**85,886**	**KRW (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**7.1**	**9.7**	**months**
CO2 emissions due to electricity used for 9 years:	**664**	**436**	**363**	**kg CO2/9 yrs**

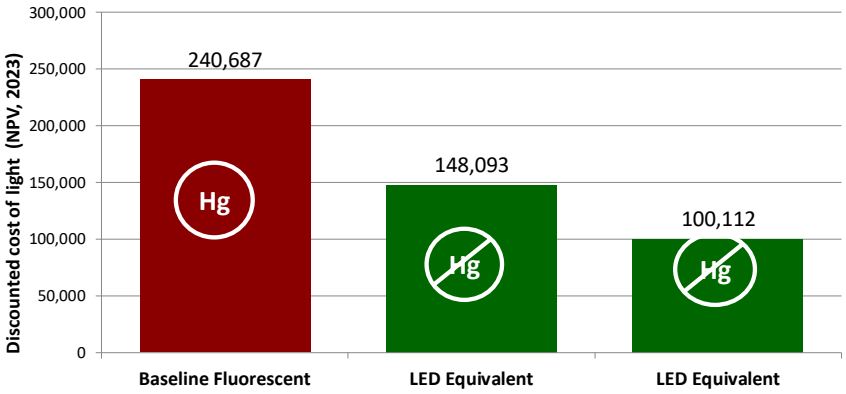
Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 15-Apr-2023

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (KRW):	**35,000**	**33,000**	**20,000**	**KRW**
Price for one lamp (USD):	**27.10**	**25.55**	**15.49**	**US dollars**
Lamp wattage:	**40**	**20**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**131**	**66**	**59**	**kWh/year**
Rated lamp lifetime:	**20,000**	**20,000**	**30,000**	**Hours**
Analysis period for life-cycle assessment:	**9**	**9**	**9**	**years**
Life-cycle cost for analysis period, discounted to 2023	**240,687**	**148,093**	**100,112**	**KRW (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**instant**	**instant**	**months**
CO2 emissions due to electricity used for 9 years:	**830**	**415**	**373**	**kg CO2/9 yrs**

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 15-Apr-2023

Sri Lanka

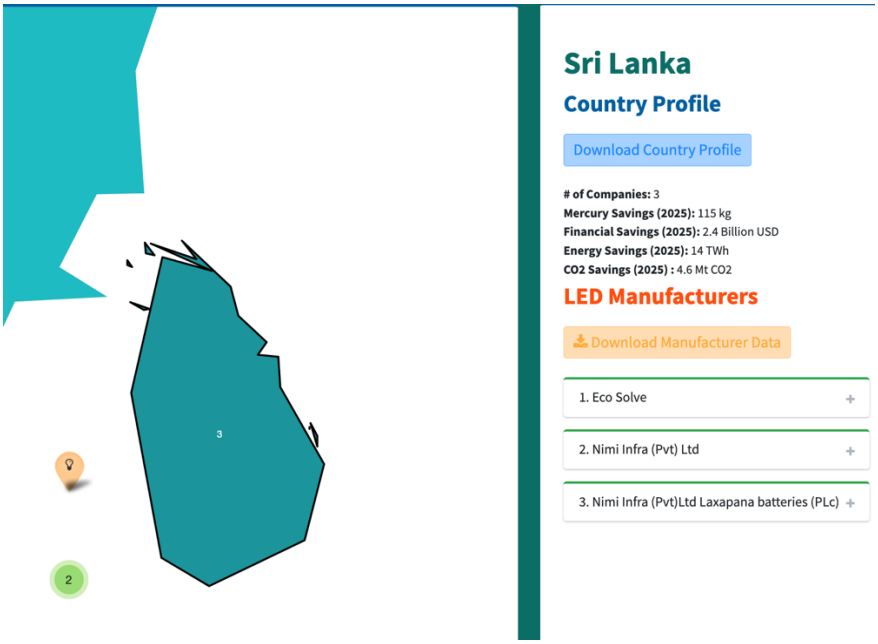
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Sri Lanka

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	15,400,000	14,300,000	13,200,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	115	107	99	kg of mercury
National electricity savings	14.1	13.2	12.3	TWh of electricity
National financial savings from avoided electricity use	2.40	2.25	2.09	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	4.63	4.30	3.96	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Between 2013-2016, 99% of the mercury-containing lamps imported to Sri Lanka were fluorescent lamps, of which more than 87% were CFLs.
- Orange Electric has a market share of 48% for CFLs. Orange Electric also owns the only CFL recycling company in the country, which exports the extracted mercury to Germany. CFL collection is, however, not very effective, according to the Sri Lanka Sustainable Energy Authority.
- The country is implementing a project (2021-2023) under the Minamata Specific International Program to strengthen the national capacity for phasing out mercury-added products. This includes a shift towards fluorescent lighting alternatives.

Map of LED Companies in Sri Lanka



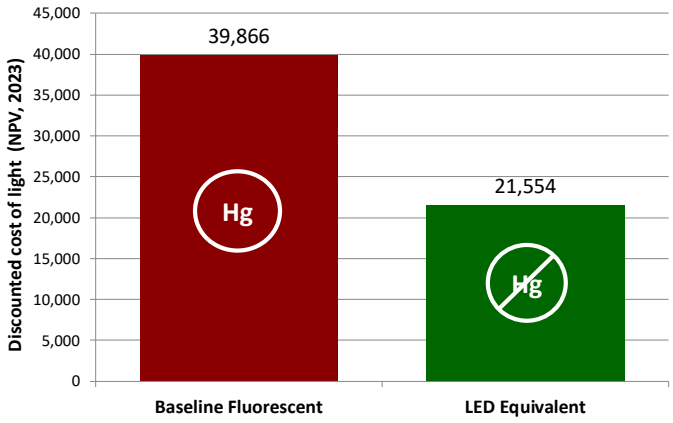
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Sri Lanka.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (LKR):	**345**	**2,100**	***LKR***
Price for one lamp (USD):	**1.06**	**6.48**	***US dollars***
Lamp wattage:	**36**	**18**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**118**	**59**	***kWh/year***
Rated lamp lifetime:	**8,000**	**25,000**	***Hours***
Analysis period for life-cycle assessment:	**7**	**7**	***years***
Life-cycle cost for analysis period, discounted to 2023	**39,866**	**21,554**	***LKR (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**7.6**	***months***
CO2 emissions due to electricity used for 7 years:	**388**	**194**	***kg CO2/7 yrs***

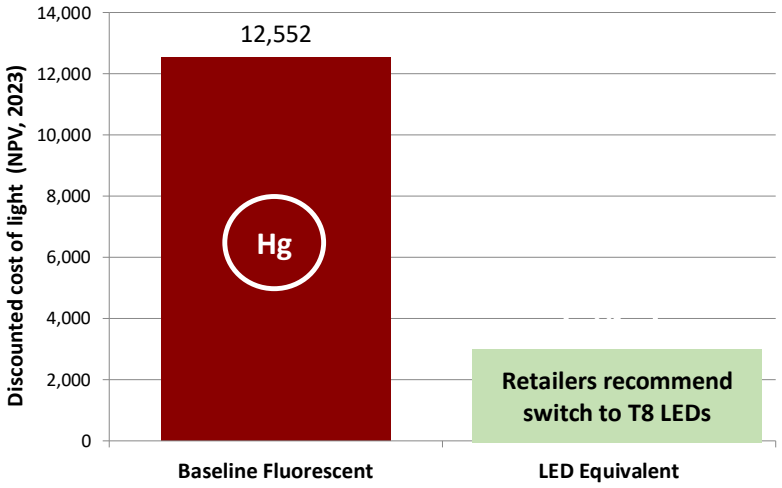
Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 22-May-2023

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (LKR):	**200**	***LKR***
Price for one lamp (USD):	**0.62**	***US dollars***
Lamp wattage:	**40**	***Watts***
Lamp is on for hours/day:	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	***kWh/year***
Rated lamp lifetime:	**8,000**	***Hours***
Analysis period for life-cycle assessment:	**2**	***years***
Life-cycle cost for analysis period, discounted to 2023	**12,552**	***LKR (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	***months***
CO2 emissions due to electricity used for 2 years:	**123**	***kg CO2/2 yrs***

Pakistan

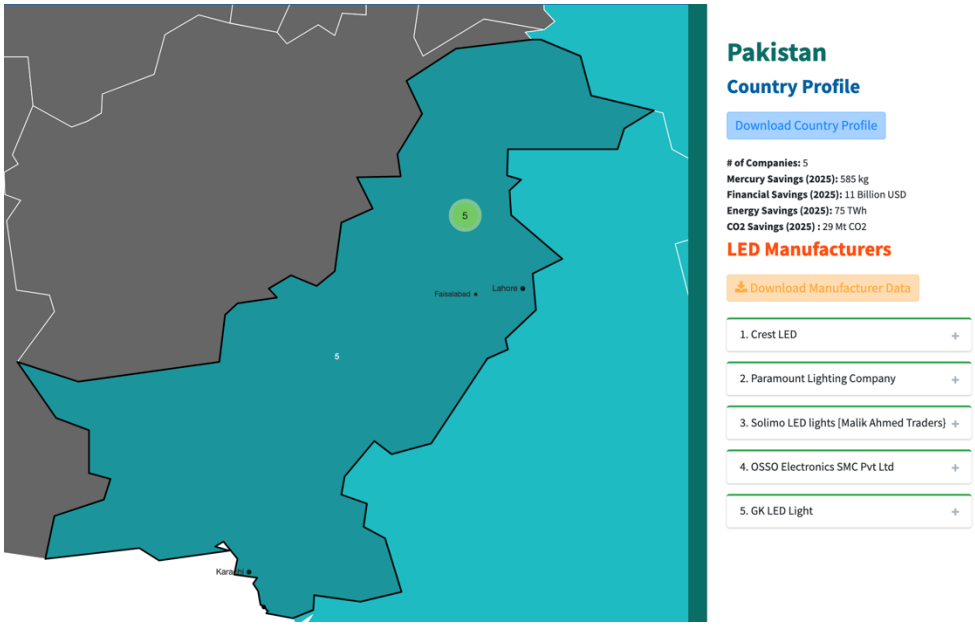
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Pakistan

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	78,100,000	69,400,000	61,200,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	585	521	459	kg of mercury
National electricity savings	75.2	67.7	60.4	TWh of electricity
National financial savings from avoided electricity use	10.6	9.61	8.53	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	28.5	25.5	22.5	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Pakistan's 2021 Nationally Determined Contribution states a mitigation objective of increasing energy efficiency by 1.5% per year, with specific mention of LEDs.
- Pakistan started regulating LED bulbs, downlights, tubes, and outdoor lighting through MEPS in 2020 with the objective to enhance the best quality LED products, enabling a rapid phase out of CFL lamps and incandescent bulbs.
- In February 2023, Pakistan's Ministry of Science and Technology announced a law that would prohibit the manufacture, sale, and import of incandescent lamps and mercury-containing compact fluorescent lamps, effective from 1 July 2023. The policy aligns with the outcomes of COP4.

Map of LED Companies in Pakistan



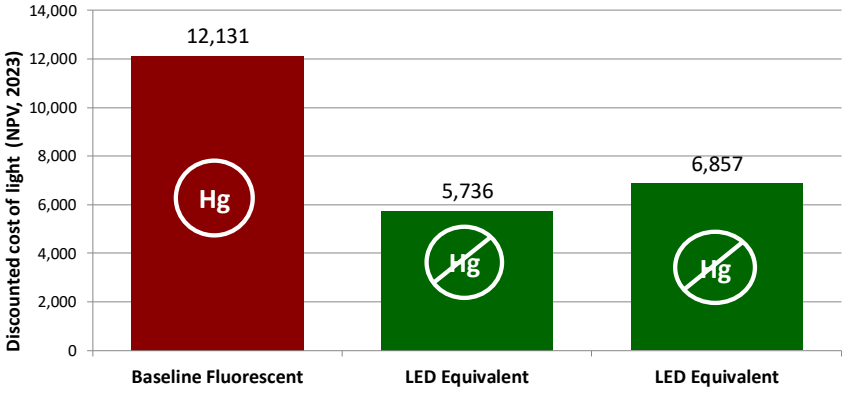
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Pakistan.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



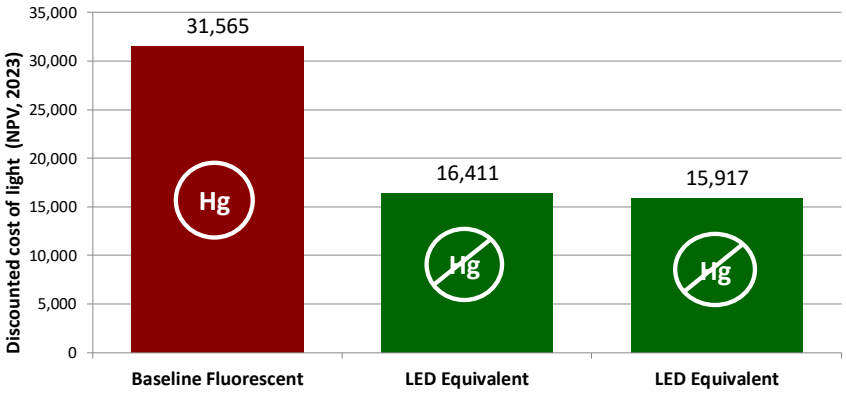
Price for one lamp (PKR):	650	900	750	PKR
Price for one lamp (USD):	3.17	4.39	3.66	US dollars
Lamp wattage:	36	16	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	53	59	kWh/year
Rated lamp lifetime:	8,000	16,000	10,000	Hours
Analysis period for life-cycle assessment:	4	4	4	years
Life-cycle cost for analysis period, discounted to 2023	12,131	5,736	6,857	PKR (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	2.0	0.9	months
CO2 emissions due to electricity used for 4 years:	215	95	107	kg CO2/4 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (PKR):	**750**	**1,300**	**450**	**PKR**
Price for one lamp (USD):	**3.66**	**6.35**	**2.20**	**US dollars**
Lamp wattage:	**40**	**20**	**20**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**131**	**66**	**66**	**kWh/year**
Rated lamp lifetime:	**20,000**	**36,000**	**20,000**	**Hours**
Analysis period for life-cycle assessment:	**10**	**10**	**10**	**years**
Life-cycle cost for analysis period, discounted to 2023	**31,565**	**16,411**	**15,917**	**PKR (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**4.4**	**instant**	**months**
CO2 emissions due to electricity used for 10 years:	**596**	**298**	**298**	**kg CO2/10 yrs**

Philippines

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in the Philippines

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	85,500,000	76,900,000	68,700,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	641	577	515	kg of mercury
National electricity savings	81.8	74.5	67.3	TWh of electricity
National financial savings from avoided electricity use	20.8	19.0	17.1	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	30.5	27.6	24.6	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Double-ended fluorescent tubes and compact fluorescent lamps are among the major sources of mercury and mercury-containing waste in the Philippines. It is estimated that they emit (or release) 23.5 and 2.20 tonnes of mercury per year, respectively.
- Philippines lamp waste is of about 50 million pieces per year. Of these, 42 million pieces (84%) are disposed of as garbage.
- House Bill No. 262 is pending approval and requires all government offices to use LEDs instead of incandescent bulbs, CFLs, or fluorescent tubes.

Map of LED Companies in Philippines

Philippines

Country Profile

Download Country Profile

# of Companies: 15
Mercury Savings (2025): 641 kg
Financial Savings (2025): 21 Billion USD
Energy Savings (2025): 82 TWh
CO2 Savings (2025) : 31 Mt CO2

LED Manufacturers

Download Manufacturer Data

1. ElecSys Manufacturing Corporation
2. HON-KWANG ELECTRIC (PHILIPPINES), INC.
3. Leader Electronics Philippine Branch Incorporated
4. P. IMES Corp. (Philippines International Manufacturing and Engineering Services Corp.)
5. Panasonic Manufacturing Philippines Corporation
6. TONG HSING Electronics Phils. Inc
7. YUMEX Philippines Corporation

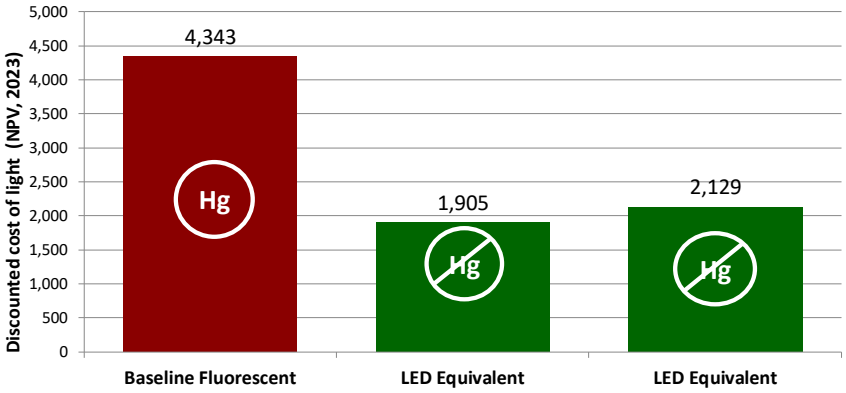
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in the Philippines.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

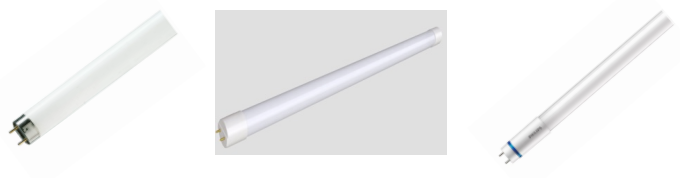
Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (PHP):	**120**	**190**	**300**	**PHP**
Price for one lamp (USD):	**2.20**	**3.49**	**5.51**	**US dollars**
Lamp wattage:	**36**	**15**	**16**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**49**	**53**	**kWh/year**
Rated lamp lifetime:	**13,000**	**15,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**4**	**4**	**4**	**years**
Life-cycle cost for analysis period, discounted to 2023	**4,343**	**1,905**	**2,129**	**PHP (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**1.4**	**3.8**	**months**
CO2 emissions due to electricity used for 4 years:	**231**	**96**	**103**	**kg CO2/4 yrs**

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 23-Apr-2023

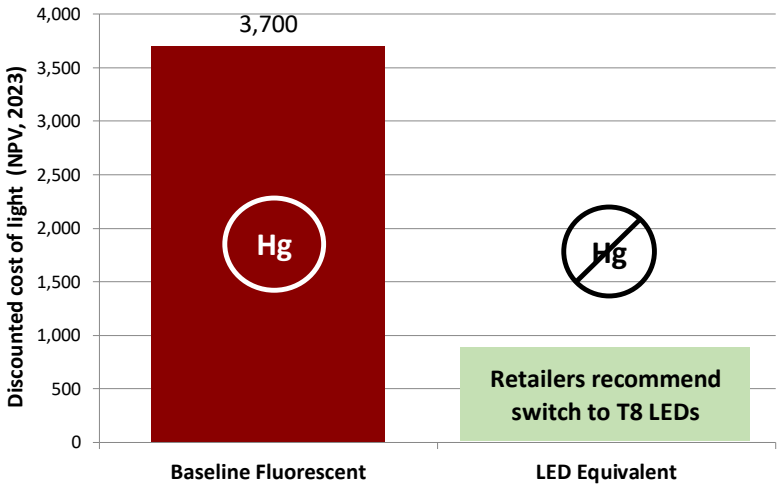


Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (PHP):	**270**	***PHP***
Price for one lamp (USD):	**4.96**	***US dollars***
Lamp wattage:	**40**	***Watts***
Lamp is on for hours/day:	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	***kWh/year***
Rated lamp lifetime:	**12,000**	***Hours***
Analysis period for life-cycle assessment:	**3**	***years***
Life-cycle cost for analysis period, discounted to 2023	**3,700**	***PHP (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	***months***
CO2 emissions due to electricity used for 3 years:	**193**	***kg CO2/3 yrs***

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 23-Apr-2023

Singapore

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Singapore

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	27,300,000	23,900,000	20,700,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	204	179	155	kg of mercury
National electricity savings	26.4	23.4	20.5	TWh of electricity
National financial savings from avoided electricity use	7.07	6.31	5.50	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	4.67	4.11	3.56	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The National Environment Agency (NEA)'s Pollution Control Division (PCD) has been actively taking steps to meet the requirements of the Minamata Convention. Since 2018, the country has disallowed the manufacture, import, and export of batteries > 5 ppm. Since January 2020, the country has disallowed the manufacture, import, and export of fluorescent lamps (above stipulated mercury limits), high-pressure mercury vapor lamps, non-electronic measuring devices, switches, and relays.
- As part of Singapore's vision to move towards becoming an energy-efficient nation, the NEA is aiming for all light bulbs sold in Singapore to be (as a minimum) as energy efficient as LED bulbs, from 2023 onwards.

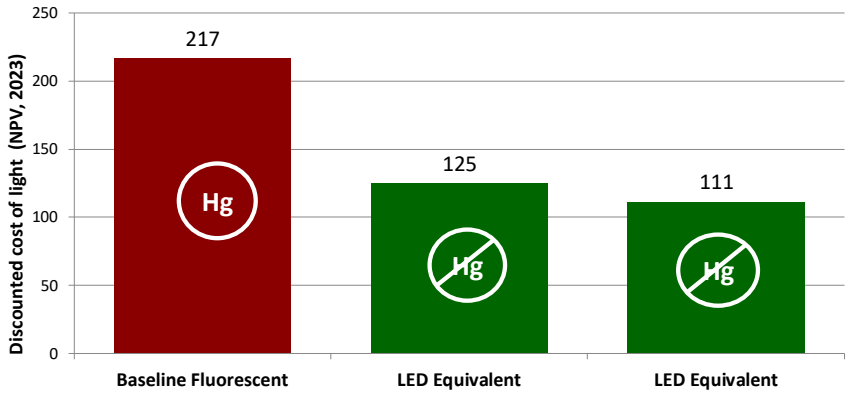
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Singapore.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (SGD):	**4**	**10**	**5**	**SGD**
Price for one lamp (USD):	**2.90**	**7.25**	**3.55**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**20,000**	**15,000**	**20,000**	**Hours**
Analysis period for life-cycle assessment:	**6**	**6**	**6**	**years**
Life-cycle cost for analysis period, discounted to 2023	**217**	**125**	**111**	**SGD (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**4.1**	**0.61**	**months**
CO2 emissions due to electricity used for 6 years:	**177**	**88**	**88**	**kg CO2/6 yrs**

Photographs of the light bulbs selected in a retail store for this compar
Taken: 18-Apr-2023

Thailand

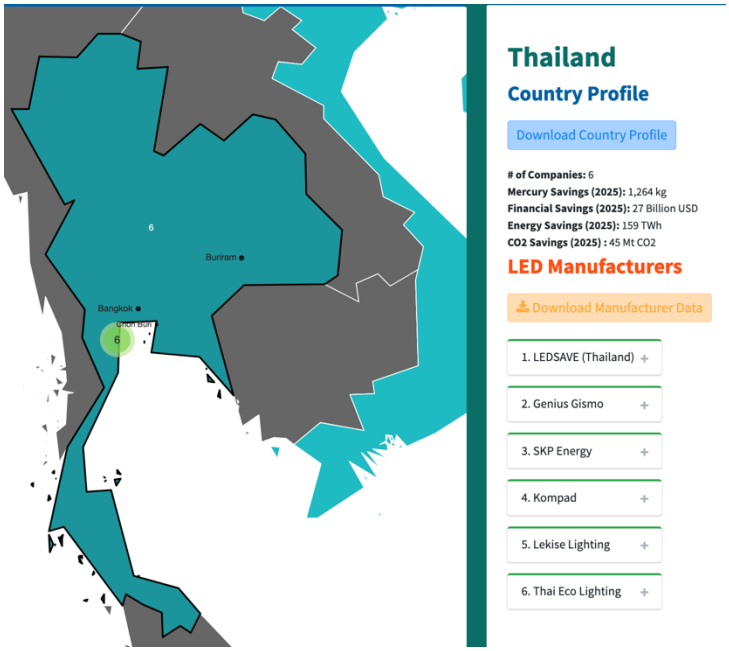
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Thailand

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	169,000,000	154,000,000	139,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	1,260	1,150	1,050	kg of mercury
National electricity savings	159	147	134	TWh of electricity
National financial savings from avoided electricity use	27.0	25.0	22.8	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	45.2	41.4	37.4	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Thailand ratified the Minamata Convention in 2017 and published its first national report on mercury inventory in 2021.
- In 2019, Thailand registered for exemptions to continue manufacturing, importing, and exporting mercury-added products (CFLs, LFLs, CCFL/EEFLs, and HPMV lamps) for an additional five years beyond the phase-out date listed in Annex A.
- In 2021, Thailand's Ministry of Industry enforced mercury limits for CFLs ranging from 2.5 to 15 mg based on wattage. For LFLs, this was set at 4 mg for T2, 3 mg for T5, 3.5 mg for tri-band phosphor T8 and T12, 10 mg for halophosphate T10 and T12, 5 mg for products with a rated lifetime of over 25,000 hours, and 15 mg for non-straight lamps.
- Thailand's LED industry was expected to grow at a CAGR of 28.3% (2016-2022) to reach $1.97 USD billion by 2022, driven by government subsidies and investments, decreasing LED prices, replacing streetlights with LEDs, and multinational players entering the market.

Map of LED Companies in Thailand



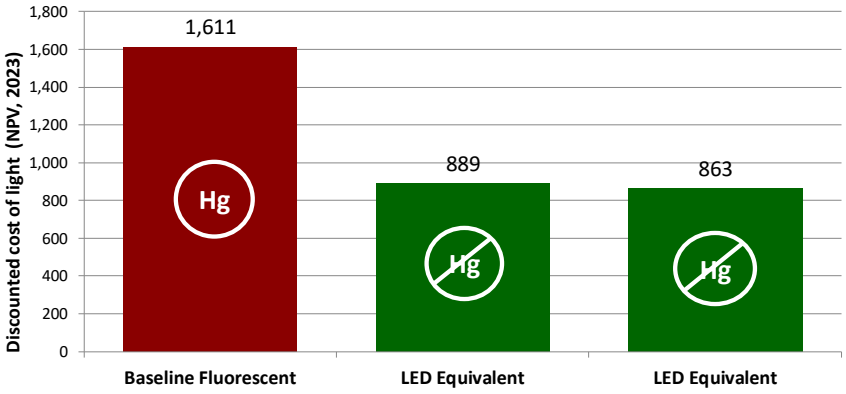
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Thailand.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (THB):	**65**	**145**	**119**	**THB**
Price for one lamp (USD):	**1.85**	**4.14**	**3.39**	**US dollars**
Lamp wattage:	**36**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**13,000**	**15,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**4**	**4**	**4**	**years**
Life-cycle cost for analysis period, discounted to 2023	**1,611**	**889**	**863**	**THB (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**5.2**	**3.5**	**months**
CO2 emissions due to electricity used for 4 years:	**184**	**92**	**92**	**kg CO2/4 yrs**

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 03-May-2023

Vietnam

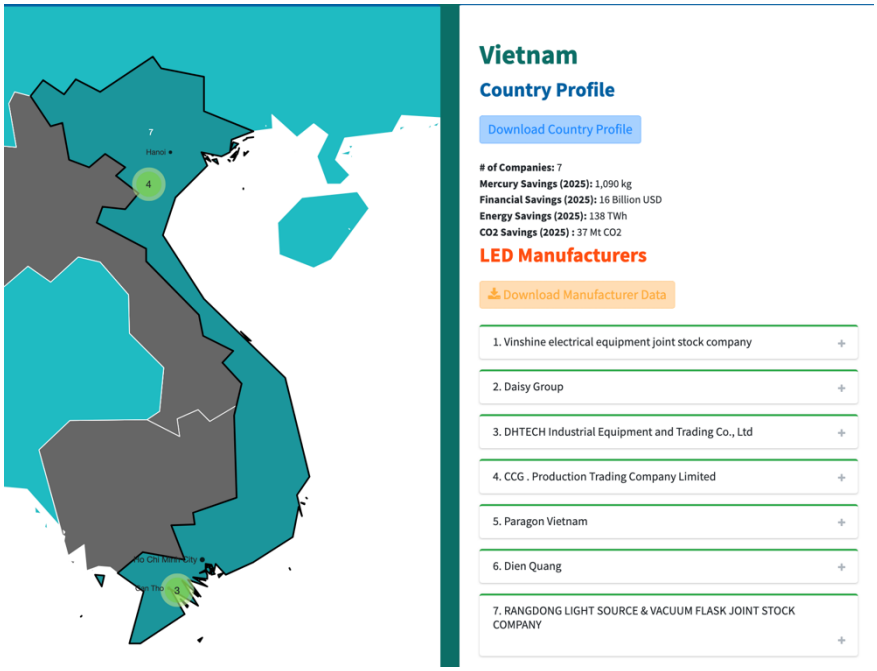
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Vietnam

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	145,000,000	132,000,000	120,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	1,090	992	897	kg of mercury
National electricity savings	138	127	116	TWh of electricity
National financial savings from avoided electricity use	15.6	14.4	13.1	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	36.6	33.5	30.2	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2015, GEF started implementing the Local Development and Promotion of LED Technologies for Advanced General Lighting project. Its target is mitigating GHG emissions through transforming the lighting market by encouraging greater usage of locally produced LED lighting products. The project was implemented from 2015 to 2019. The estimated indirect emissions reduction is up to 5,154 ktonnes CO_2eq, cumulative for a ten-year period after the end of the project.
- In 2019, a lightbulb warehouse fire in Hanoi leaked 15-27 kg of mercury when 480,000 fluorescent lightbulbs were burnt.
- In 2019, MOIT issued Circular No. 08/2019/TT-BKHCN that mandates certification requirements for domestically produced and imported LED products.
- In 2020, GEF approved a project to support Vietnam's transition to non-mercury lighting, among others. According to GEF, Vietnam is preparing to shift from CFLs to LEDs, which will be further driven by the Minamata Convention on Mercury.
- Vietnam accounts for 2% of the total global LED die and chips exports.

Map of LED Companies in Vietnam



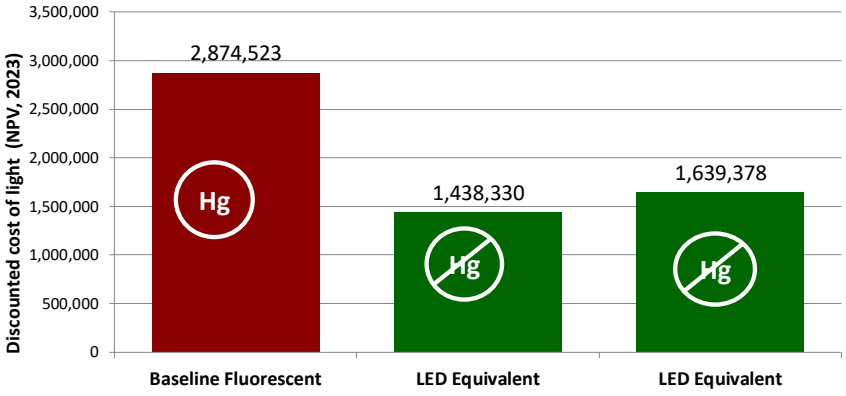
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Vietnam.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (VND):	**25,300**	**181,620**	**126,000**	**VND**
Price for one lamp (USD):	**1.09**	**7.80**	**5.41**	**US dollars**
Lamp wattage:	**36**	**16**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**118**	**53**	**59**	**kWh/year**
Rated lamp lifetime:	**15,000**	**30,000**	**20,000**	**Hours**
Analysis period for life-cycle assessment:	**9**	**9**	**9**	**years**
Life-cycle cost for analysis period, discounted to 2023	**2,874,523**	**1,438,330**	**1,639,378**	**VND (NPV, 2023)**
Simple Payback period in months, compared with LFL:	**-**	**10.7**	**7.7**	**months**
CO2 emissions due to electricity used for 9 years:	**379**	**168**	**189**	**kg CO2/9 yrs**

Photographs of the light bulbs selected in a retail store for this comparison.
Taken: 12-May-2023

Clean Lighting Coalition

Technical & Economic Assessment of Mercury-Free Lighting: Latin America & the Caribbean Region

Latin America and Caribbean Region

If a 2025 LFL phase out date is negotiated and adopted at Minamata COP5– reflecting the position of the Clean Lighting Coalition – it would avoid the sale of 913 million linear fluorescent lamps in the Latin America and Caribbean Region, and result the following cumulative benefits (2025-2050):

1. avoid **6.9 metric tons** of mercury pollution from leaking into the environment.
2. avoid **190 million tons of CO2** emissions.
3. save approximately **860 TWh of the region's total electricity consumption** and
4. save **$137 billion USD**

The data above reflects the benefits of a global fluorescent phase-out to all countries in Latin America and the Caribbean Region, not just parties to the Minamata Convention on Mercury and based on CLASP's MEPSy model[1]

Lighting Market Overview

The LAC region is a net importer of fluorescent lamps, with nearly no manufacturing of fluorescent lighting. Most existing regional CFL manufacturers have already transitioned to produce LEDs.

Furthermore, there are over 45 LED manufacturing and assembly companies present in several countries across the region, accounting for an important share of the LAC LED market. These companies include:

1. **Argentina** – Luctron, Indular, LedScene, I-LED, Cosmel
2. **Brazil** – City Lumi, DirectLight, Fortlight, Prolumi
3. **Chile** – SERI, Megabright, EGLO
4. **Colombia** – Distecsa, Roy Alpha, EFEL, Sylvania
5. **Costa Rica** - Sylvania
6. **Honduras** – Equipos Industriales, Lumiart, Larach
7. **Mexico** – LED Mexico, LEDLAB, The LED Shop, LJ Iluminación, New Light, Forlighting, Assic Maquiladora
8. **Peru** – Kranzz, Portalamparas, LED Design, Lumicenter, Inkalux
9. **Uruguay** – Tarmax, Imtran
10. **Venezuela** – TEDAS, Obralux

[1] https://clasp.shinyapps.io/mepsy/

A complete phase-out of fluorescents in this region would further encourage domestic LED industry growth. This move would stimulate economic growth, generate employment opportunities, mitigate toxic mercury pollution, and reduce reliance on lighting imports.

The Clean Lighting Coalition developed a dashboard that provides a global overview of LED lighting technology manufacturers available by country[2]. The figure below shows the current LED manufacturing and assembly in Latin America and the Caribbean.

Global LED Manufacturer Map

[2] The interactive map is here

Comparing Costs: LEDs vs LFL

LED lamps are more expensive than the fluorescent lamp on a first-cost basis, but payback for themselves quickly, 2.9 months and 5.1 months respectively for T8s and T12s. The map below provides an inventory of the average payback periods across different countries in the region for T8s.

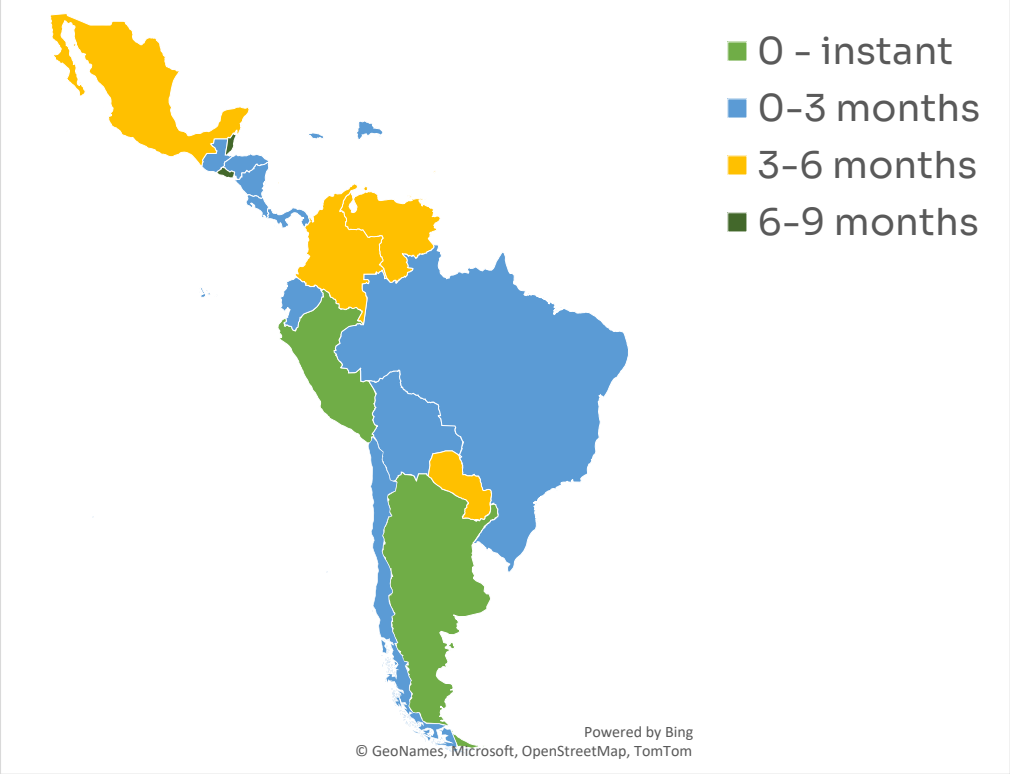


Figure 1 LED T8 Payback Periods in Assessed Countries

Additionally, the LED lamp consumes half as much power as fluorescents – so electricity bills are halved over the lamp lifetime. Finally, on average, LAC consumers save 50% on lifecycle costs when they replace LFLs with LEDs. Figure 2 summarizes the cost savings for LED T8s. The graph below details this further

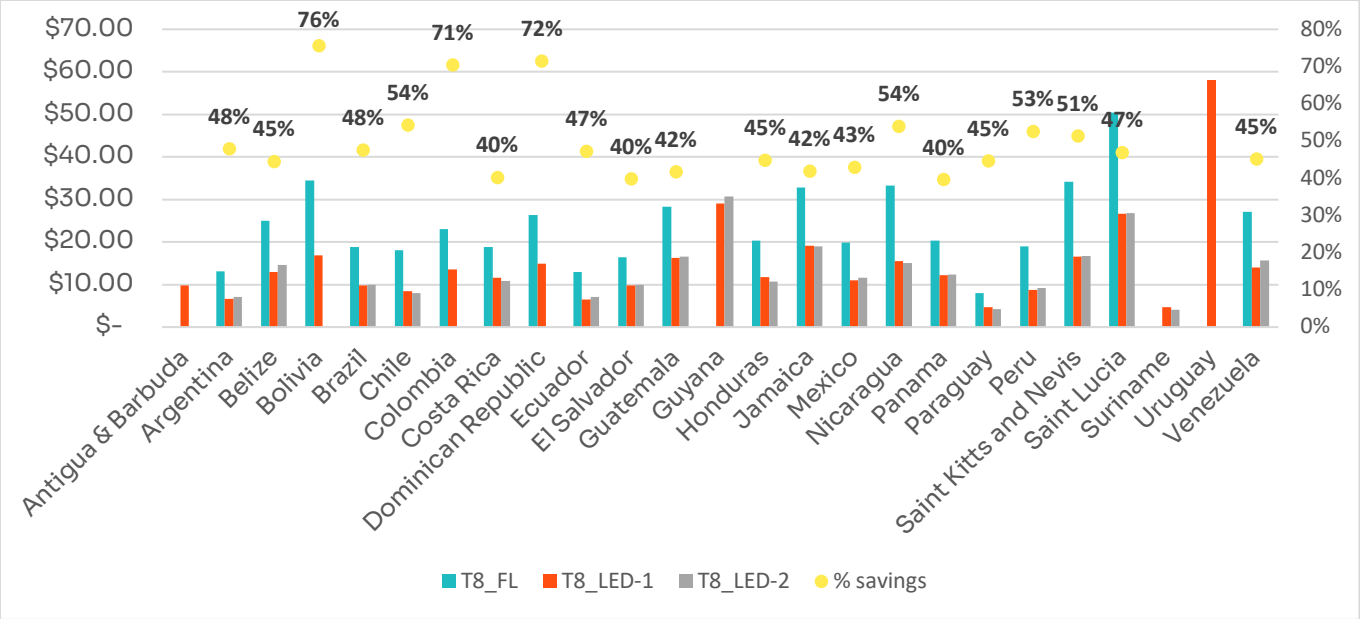


Figure 2 Lifecycle Savings of LEDS over Fluorescents

Tables 1 and 2 provide comparative information about the cost of light for LFL vs LED lamps across countries in the region.

Table 1 True Cost of Light: T8 Lamps

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Antigua & Barbuda		XCD 19.25 (US$7.13)		
Argentina	ARS 880 (US$6.74)	ARS 740 (US$5.67)	instantaneous	ARS 768.69 (US$5.88)
Belize	BZD 2.3 (US$1.15)	BZD 15 (US$7.5)	6.3 months	BZD 24.24 (US$12.12)
Bolivia	BOB 10 (US$1.45)	BOB 12 (US$1.74)	0.2 months	BOB 114.71 (US$16.6)
Brazil	BRL 19.9 (US$3.86)	BRL 29.97 (US$5.81)	2.8 months	BRL 43.16 (US$8.37)
Chile	CLP 2990 (US$3.42)	CLP 3550 (US$4.06)	0.8 months	CLP 8278.2 (US$9.48)

Colombia	COP 2400 (US$0.56)	COP 17800 (US$4.18)	4.3 months	COP 42678.72 (US$10.03)
Costa Rica	CRC 1830.6 (US$2.83)	CRC 2900 (US$4.48)	2.5 months	CRC 5101.21 (US$7.88)
Dominican Republic	DOP 120 (US$2.18)	DOP 186.04 (US$3.37)	1.3 months	DOP 617.65 (US$11.2)
Ecuador	USD 1.39 (US$1.39)	USD 1.76 (US$1.76)	0.8 months	USD 5.49 (US$5.49)
El Salvador	SVC 1.45 (US$1.45)	SVC 5.31 (US$5.31)	6.6 months	SVC 7.01 (US$7.01)
Guatemala	GTQ 15.23 (US$1.97)	GTQ 24 (US$3.1)	1.1 months	GTQ 94.74 (US$12.22)
Guyana		GYD 1500 (US$9.78)		
Honduras	HNL 28.49 (US$1.16)	HNL 78.07 (US$3.19)	2.4 months	HNL 245.64 (US$10.03)
Jamaica	JMD 810 (US$5.28)	JMD 1173.33 (US$7.65)	2.1 months	JMD 2031.84 (US$13.24)
Mexico	MXN 60 (US$2.98)	MXN 144 (US$7.15)	5.2 months	MXN 194.47 (US$9.66)
Nicaragua	NIO 60 (US$1.67)	NIO 95 (US$2.65)	0.7 months	NIO 645.38 (US$17.99)
Panama	PAB 1.39 (US$1.39)	PAB 3.2 (US$3.2)	2.5 months	PAB 8.78 (US$8.78)
Paraguay	PYG 9000 (US$1.29)	PYG 18000 (US$2.58)	4 months	PYG 26671.77 (US$3.82)
Peru	PEN 8.53 (US$2.22)	PEN 7.69 (US$2)	instantaneous	PEN 39.75 (US$10.35)
Saint Kitts and Nevis	XCD 19.5 (US$7.22)	XCD 30 (US$11.11)	3 months	XCD 41.39 (US$15.33)
Saint Lucia	XCD 10.44 (US$3.87)	XCD 36 (US$13.33)	4.6 months	XCD 66.28 (US$24.55)
Suriname	*Fluorescent tubes were not available in the market	SRD 136 (US$5.5)	*Fluorescent tubes were not available in the market	
Uruguay	*Fluorescent tubes were not available in the market	UYU 199 (US$4.83)	*Fluorescent tubes were not available in the market	
Venezuela	VES 1.2 (US$1.2)	VES 5 (US$5)	3.4 months	VES 13.3 (US$13.3)

Table 2 True Cost of Light: T12 Lamps

	LFL PRICE	LED PRICE	PAYBACK PERIOD	ANNUAL ENERGY SAVINGS WITH LED
Antigua & Barbuda	XCD 15 (US$5.56)	XCD 19.25 (US$7.13)	2 months	XCD 25.87 (US$9.58)
Argentina	ARS 1372 (US$10.5)	ARS 740 (US$5.67)	instantaneous	ARS 939.51 (US$7.19)
Belize	BZD 4.08 (US$2.04)	BZD 15 (US$7.5)	4.4 months	BZD 29.63 (US$14.82)
Bolivia	BOB 19 (US$2.75)	BOB 18 (US$2.6)	instantaneous	BOB 127.46 (US$18.45)
Costa Rica	CRC 4538 (US$7.01)	CRC 2,900 (US$4.48)	instantaneous	CRC 8,016 (US$12.39)
Ecuador	USD 5.55 (US$5.55)	USD 11.12 (US$11.12)	7.8 months	USD 8.57 (US$8.57)
El Salvador	SVC 10.9 (US$10.9)	SVC 21.7 (US$21.7)	8.3 months	SVC 15.52 (US$15.52)
Guatemala	GTQ 11.63 (US$1.5)	GTQ 26.46 (US$3.41)	1.2 months	GTQ 148.88 (US$19.21)
Guyana	GYD 700 (US$4.56)	GYD 1500 (US$9.78)	2.7 months	GYD 3613.5 (US$23.55)
Honduras	HNL 73.85 (US$3.02)	HNL 78.07 (US$3.19)	0.1 months	HNL 676 (US$27.61)
Jamaica	JMD 951.63 (US$6.2)	JMD 2586 (US$16.85)	6.1 months	JMD 3192.89 (US$20.81)
Mexico	MXN 176 (US$8.74)	MXN 303 (US$15.05)	7 months	MXN 218.78 (US$10.87)
Nicaragua	NIO 84 (US$2.34)	NIO 95 (US$2.65)	0.2 months	NIO 645 (US$17.98)
Panama	PAB 1.29 (US$1.29)	PAB 11.12 (US$11.12)	7.5 months	PAB 15.69 (US$15.69)
Paraguay	PYG 9500 (US$1.36)	PYG 22000 (US$3.15)	5.1 months	PYG 29635.3 (US$4.24)
Saint Kitts and Nevis	XCD 25 (US$9.26)	XCD 43.5 (US$16.11)	4.8 months	XCD 45.99 (US$17.03)
Saint Lucia	XCD 7.65 (US$2.83)	XCD 39.55 (US$14.65)	4.7 months	XCD 81.01 (US$30.01)

Suriname	*Fluorescent tubes were not available in the market	SRD 150 (US$6.07)	*Fluorescent tubes were not available in the market	
Uruguay	*Fluorescent tubes were not available in the market	UYU 400 (US$9.72)	*Fluorescent tubes were not available in the market	

The displayed prices in columns 1-2 were recorded in retail stores and on-line shops in each country. Columns 3-4 illustrate the benefits associated with switching to mercury-free LED technology. The Payback Period column shows the amount of time needed for the energy savings from the LED lamp to pay for its higher cost. If the LED is less expensive than the fluorescent lamp, then the payback is 'instantaneous'. The column labelled 'energy savings with LED' indicates the savings on energy bills over the lifetime of the LED lamp. The tables also detail comparative cost across countries. Please note that the value in brackets is the equivalent cost in US$.

Energy Efficiency Comparison

The energy efficiency of a light bulb is measured in lumens/watt. The graphic below depicts the ranges of energy efficiency of different types of bulbs available across Latin America and Caribbean markets. It represents efficiency quartiles (0%, 25%, 50%, 75%, 100%) of the data we collected when sorted from lowest to highest efficiency. The box with numbers represents the 25th-75th quartile while the thin lines with the dots represent the lowest and highest efficiency per technology on either end.

The average efficacy of the LED lamps is markedly higher than that of the fluorescent pairs, 96lm/W against 75lm/W.

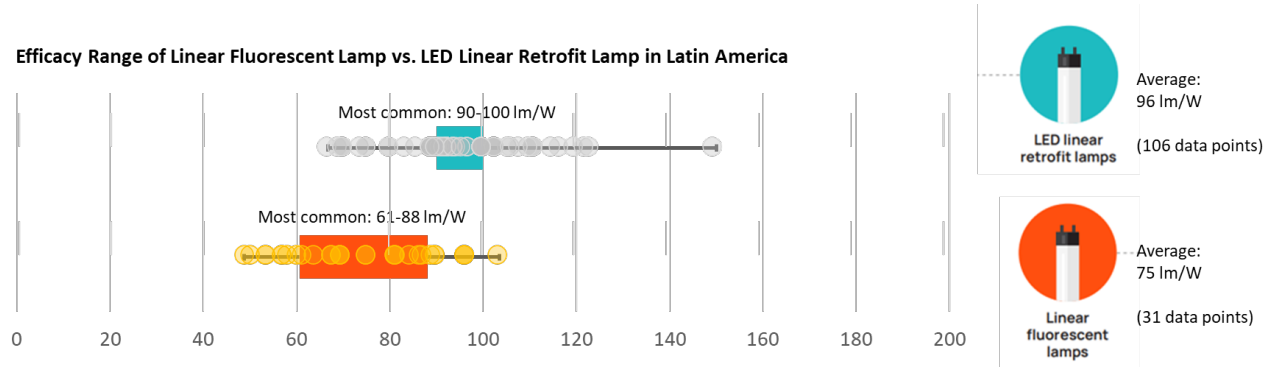


Figure 3 Efficacy Comparison Between LEDs and Fluorescents

Lighting Policy & Legislative Landscape

Many countries in the region are shifting towards LED only markets through energy efficiency policy and/or mercury regulation. Some of the notable regulations include:

1. **Chile** – Updated MEPS for general lighting, to phase out inefficient lamps: 40 lm/W by 2021, 70 lm/W by 2023, 85 lm/W by 2025. Shifts market to LED by 2023.
2. **Uruguay** - Decree No. 15/019. Since 2020, it prohibits fluorescent lamps unless the manufacturer/importer presents and implements a comprehensive end-of-life management plan. Practically shifted market to LED since 2020.
3. **Argentina** - Efficient Lighting Plan (PLAE) will replace existing luminaires in public lighting by LED technology.

Compatibility/Retrofits for LED lamps

In all LAC markets where data was collected, LED retrofits were easily available for fluorescent lamps. This availability confirms that in nearly all cases, rewiring of old lighting fixtures will not be necessary. In the few cases (6 to 9%) where the LED lamps available in the market are not compatible with the fixtures, the ballast can be 'by- passed' with mains voltage at the sockets, so that the fixture can remain in place.

End of Life Management for Lighting

Collection and safe recycling/disposal of fluorescent lamps is difficult – especially in regions with low levels of general e-waste collection and processing. Various countries across the region have e-waste or mercury waste regulations, including Uruguay, Mexico, and Colombia. Where mercury treatment facilities do exist in the region, there are still important awareness, logistics and infrastructure challenges that limit the region's ability to sustainably manage mercury-containing lamps at their end-of-life.

The few fluorescent lamp recycling programs that do exist usually focus on commercial users, rather than residential. A few companies and non-governmental organizations, such as Alianza Contaminación Cero in Panama, are working on

awareness-raising campaigns and encouraging governments to bolster fluorescent lamp recycling programs. Some businesses have lamp collection programs in place. UN agencies have supported several governments in the region in the development mercury inventories and sound end-of-life policy proposals, such as the mercury emissions inventory in Costa Rica, supported by UNDP/GEF, and the mercury emissions inventory in Panama, supported by UNEP. Despite these efforts, the regional share of sound end-of-life management of electronic waste (including fluorescent lamps) is estimated at 2.7%, according to a UNIDO- GEF report published in 2023.

Accelerating the transition to LEDs would turn off the mercury tap – eliminating hazardous waste and mercury contents from new lighting imported to developing and lower-income countries. The proposed African Lighting Amendment would more quickly remove toxic fluorescent e-waste from the LAC market, mitigating environmental pollution and public health safety concerns.

ANNEX OF COUNTRY LEVEL DATA

Argentina

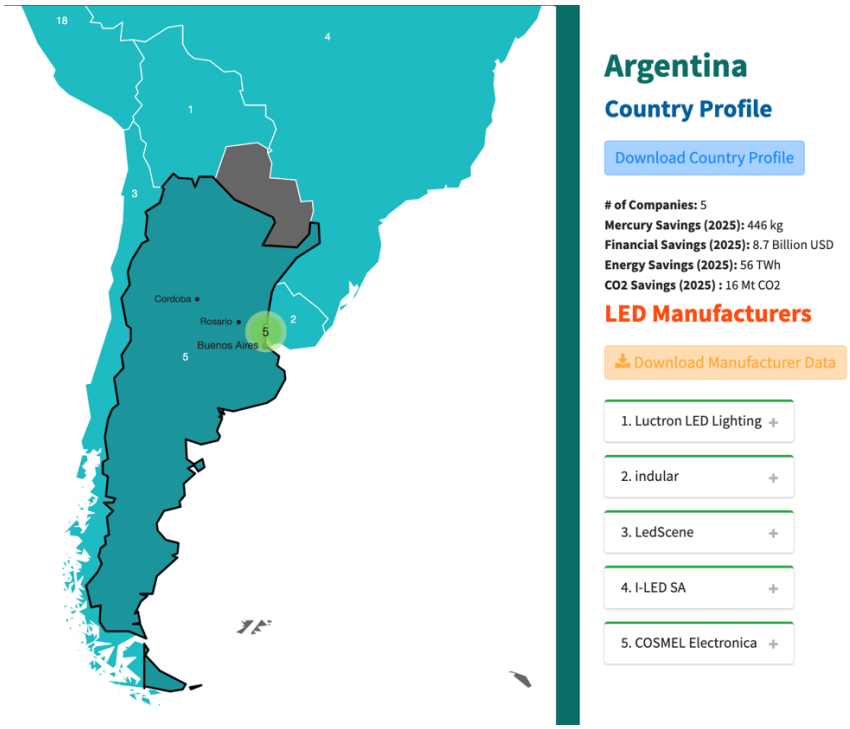
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Argentina

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	59,400,000	53,600,000	48,200,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	446	402	361	kg of mercury
National electricity savings	56	51	46	TWh of electricity
National financial savings from avoided electricity use	8.7	8.0	7.2	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	16.0	14.5	13.0	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Resolution 71/2019 established the need for Prior Informed Consent for the import and export of products with added mercury.
- Resolution 75/2019 prohibited the production, import, and export of products with mercury as of January 1, 2020, as specified in the Minamata Convention Annex A. This includes compact fluorescent lamps ≤ 30 W with more than 5 mg of mercury, triband phosphor linear fluorescent lamps < 60 W with more than 5 mg of mercury, halophosphate phosphor lamps ≤ 40 W with more than 10 mg of mercury, high-pressure mercury vapor lamps, and cold cathode fluorescent as specified in Annex A.
- The Efficient Lighting Plan (*Plan de Alumbrado Eficiente* – PLAE) promotes replacing public lighting with LED technology. Incorporating this higher-efficiency technology can result in up to 50% energy savings over current consumption (IRAM AADL J 2022-2). PLAE beneficiaries are offered non-refundable contributions to make LED technology replacements in public lighting systems throughout the country's provinces and/or municipalities that meet the requirements and criteria established in the General Regulations, including:
    - potential for energy savings and/or efficiency
    - adequate infrastructure or adequacy capacity
    - ability to execute the work in a timely manner, and
    - speed of execution of work

Map of LED Companies in Argentina



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Argentina.

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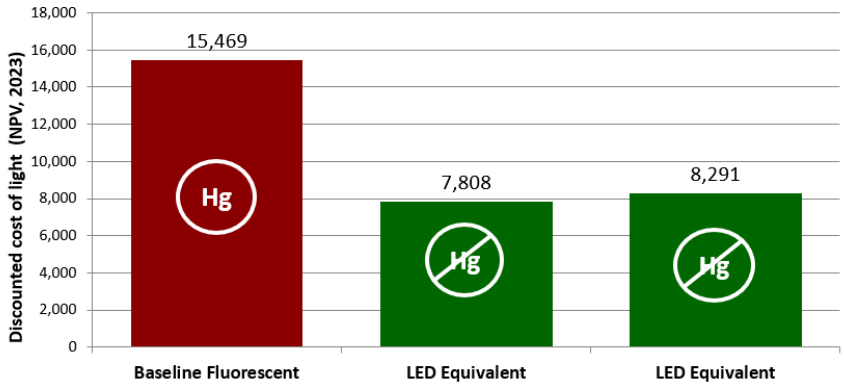
Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



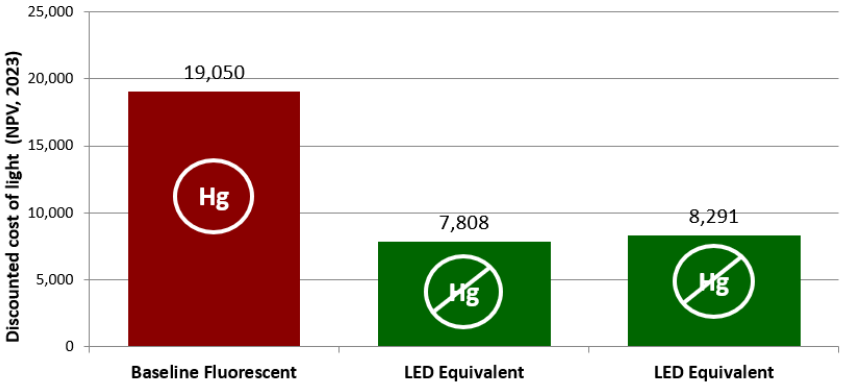
Price for one lamp (ARS):	880	890	740	ARS
Price for one lamp (USD):	6.74	6.81	5.67	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	16,000	30,000	15,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	15,469	7,808	8,291	ARS (NPV, 2023)
Simple payback period in months, compared with LFL:	-	0.2	instant	months
CO2 emissions due to electricity used for 9 years:	373	186	186	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (ARS):	**1,372**	**890**	**740**	**ARS**
Price for one lamp (USD):	**10.50**	**6.81**	**5.67**	**US dollars**
Lamp wattage:	**40**	**18**	**18**	**Watts**
Lamp is on for hours/day:	**9**	**9**	**9**	**hours/day**
Annual electricity consumption for each lamp type:	**131**	**59**	**59**	**kWh/year**
Rated lamp lifetime:	**10,000**	**30,000**	**15,000**	**Hours**
Analysis period for life-cycle assessment:	**9**	**9**	**9**	**years**
Life-cycle cost for analysis period, discounted to 2023	**19,050**	**7,808**	**8,291**	**ARS (NPV, 2023)**
Simple payback period in months, compared with LFL:	**-**	**instant**	**instant**	**months**
CO2 emissions due to electricity used for 9 years:	**414**	**186**	**186**	**kg CO2/9 yrs**

Antigua and Barbuda

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- There are mandatory energy-efficiency labels and testing methods in place for LED lamps (IEC ABNS 62612:2013) and for CFLs (IEC ABNS 60969:2016).
- The Ministry of Energy, the Antigua Public Utility Authority, the Department of Environment, and the Environmental Awareness Group are all public sector actors with interests in the health of society and the ecosystem. They have supported initiatives to phase out mercury projects.
- The National Solid Waste Management Authority Act of 2005 was created to manage the distribution and pollution of solid waste in the country. This kind of waste includes biomedical, hazardous, and any litter.
- Zero Waste Antigua and Barbuda is working to reduce the use and importation of mercury and mercury products and to implement proper disposal methods and containers for these. The organization carried out its first project, Phase Down/Phase Out Mercury, with the aim of decreasing the amount of mercury on the islands by 10-20%. The project was executed from 2019 to 2021.
- The Mercury Phase-Out Program was implemented by the Marine Ecosystems Protected Area Trust, the Medical Association of Antigua and Barbuda, the Christian Union Church, and Zero Waste Antigua and Barbuda. It was supported by GEF/UNDP and raised awareness about mercury in fluorescent lamps, also placing lamp collection bins throughout the country. Through this program, an amount equivalent to 5% of the fluorescent lamps sold in the country each year were collected, destroyed, and contained.

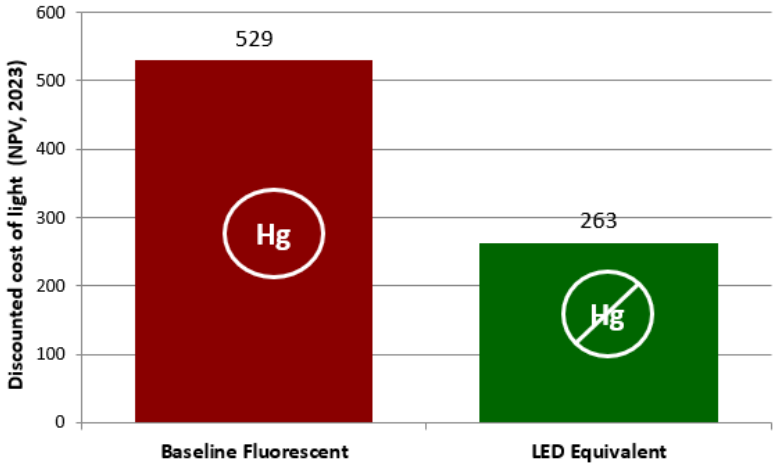
The following table compares the costs and benefits of fluorescent and LED lighting technologies in Antigua and Barbuda.

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XCD):	15	19	*XCD*
Price for one lamp (USD):	5.56	7.13	*US dollars*
Lamp wattage:	34	17	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	112	54	*kWh/year*
Rated lamp lifetime:	20,000	50,000	*Hours*
Analysis period for life-cycle assessment:	10	10	*years*
Life-cycle cost for analysis period, discounted to 2023	529	263	*XCD (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	2.0	*months*
CO2 emissions due to electricity used for 15 years:	546	265	*kg CO2/10 yrs*

Belize

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Belize

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	544,000	499,000	455,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	4	4	3	kg of mercury
National electricity savings	0.51	0.47	0.43	TWh of electricity
National financial savings from avoided electricity use	0.13	0.12	0.11	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.12	0.11	0.10	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2013, Belize was one of the co-signatories of the Central American Regional Efficient Lighting Strategy, a document developed within the framework of Proyecto Mesoamerica and supported by the United Nations Environment Programme/Global Environment Facility (UNEP/GEF) en.lighten initiative (United for Efficiency).
- Energy efficiency is Belize's first priority, highlighted in the five pillars that constitute its Sustainable Energy Roadmap 2030. Within this framework, Belize is working to develop energy standards and labels for lighting and other appliances, with the support of the Organization of American States – Sustainable Energy Capacity Building Initiative (OAS-SECBI).
- The Energy Unit within the Ministry of Public Service, Energy, and Public Utilities – in collaboration with the electrical students of the Institute for Technical and Vocational Education and Training (ITVET) Stann Creek – carried out energy conservation measures by installing LED lights in public buildings. A total of 185 LED tubes were installed. The operating cost of fluorescent tubes over five years were calculated at $55,302.91 USD. Comparatively, the operating costs of the LED replacements will amount to only $27,651.46 USD over the same five-year period. This reflects a combined estimated savings of $27,651.46 USD, accumulated over the next five years, for replacing the fluorescent tubes with LEDs.

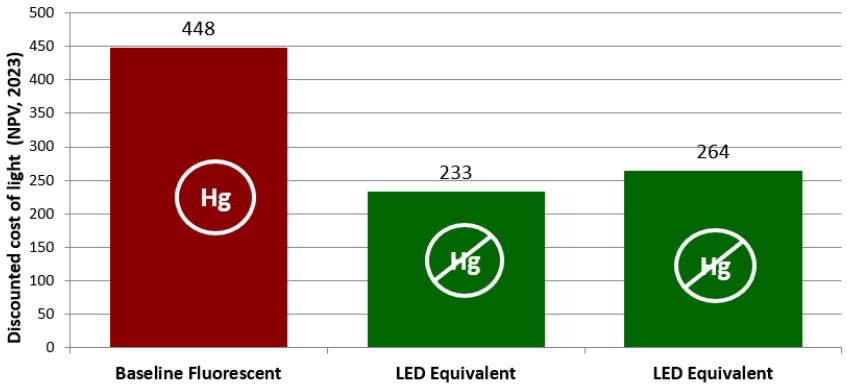
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Belize.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



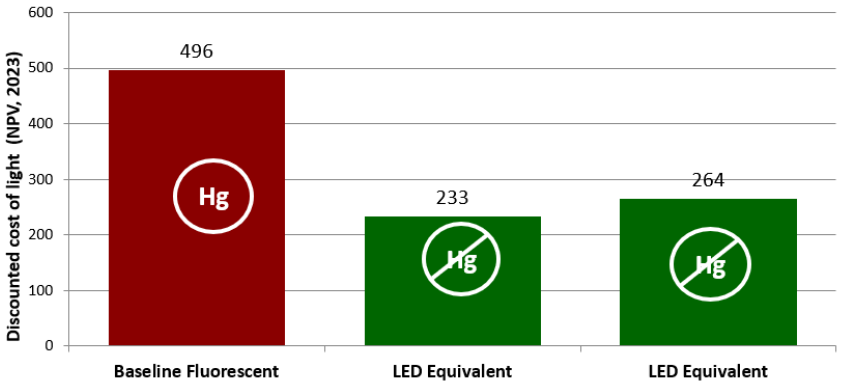
Price for one lamp (BZD):	2	15	26	BZD
Price for one lamp (USD):	1.15	7.50	13.00	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	5,000	30,000	25,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	448	233	264	BZD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	6.3	11.7	months
CO2 emissions due to electricity used for 9 years:	324	162	162	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (BZD):	4	15	26	BZD
Price for one lamp (USD):	2.04	7.50	13.00	US dollars
Lamp wattage:	40	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	131	59	59	kWh/year
Rated lamp lifetime:	10,000	30,000	25,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	496	233	264	BZD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	4.4	8.9	months
CO2 emissions due to electricity used for 9 years:	360	162	162	kg CO2/9 yrs

Bolivia

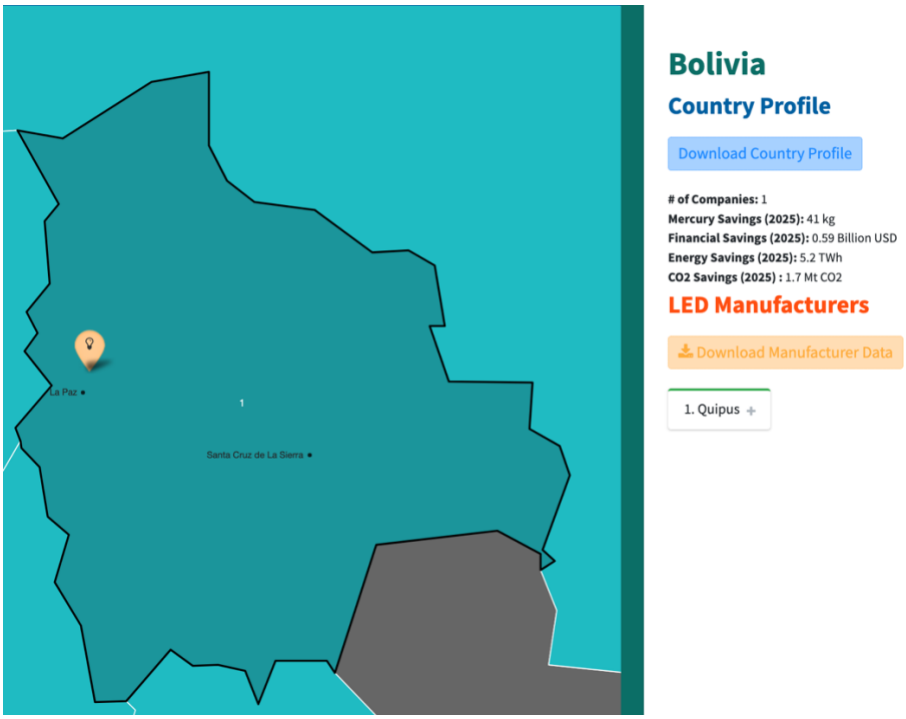
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Bolivia

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	5,410,000	4,870,000	4,340,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	41	37	33	kg of mercury
National electricity savings	5.18	4.72	4.26	TWh of electricity
National financial savings from avoided electricity use	0.59	0.54	0.48	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.68	1.52	1.36	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The Supreme Decree 4959 of June 14, 2023 and Resolution 325 of the Ministry of Environment and Water define the national mercury registry and requirements for importing/exporting mercury.
- The Transitioning to Energy-Efficient Lighting (*Realizando la Transición hacia la Iluminación Eficiente* – RTIE) initiative, implemented by UNEP/GEF, the Ministry of Environment and Water, and the Ministry of Hydrocarbons and Energy, promotes the transition to LED lighting and raises awareness about its benefits.
- Through a National Energy-Efficient Public Lighting project, President Arce has committed $7 million USD to install 14,000 LED lights in Trinidad.

Map of LED Companies in Bolivia



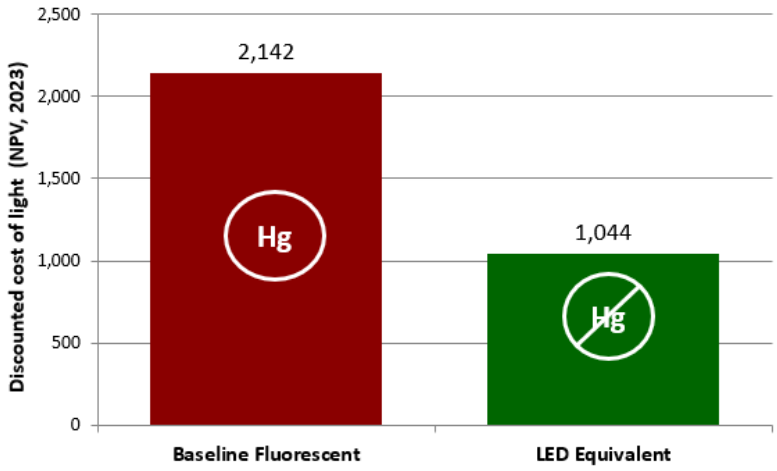
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Bolivia.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



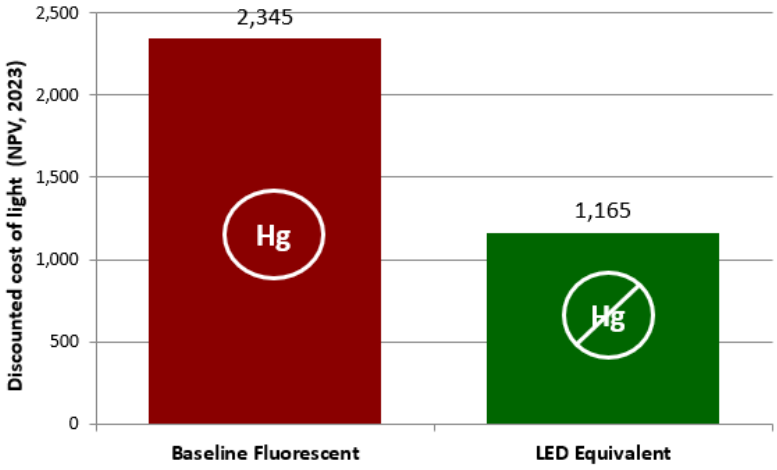
Price for one lamp (BOB):	10	12	*BOB*
Price for one lamp (USD):	1.45	1.74	*US dollars*
Lamp wattage:	36	18	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	118	59	*kWh/year*
Rated lamp lifetime:	3,000	30,000	*Hours*
Analysis period for life-cycle assessment:	9	9	*years*
Life-cycle cost for analysis period, discounted to 2023	2,142	1,044	*BOB (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	0.2	*months*
CO2 emissions due to electricity used for 9 years:	435	218	*kg CO2/9 yrs*

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (BOB):	19	18	*BOB*
Price for one lamp (USD):	2.75	2.60	*US dollars*
Lamp wattage:	40	20	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	66	*kWh/year*
Rated lamp lifetime:	12,000	30,000	*Hours*
Analysis period for life-cycle assessment:	9	9	*years*
Life-cycle cost for analysis period, discounted to 2023	2,345	1,165	*BOB (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	instant	*months*
CO2 emissions due to electricity used for 9 years:	484	242	*kg CO2/9 yrs*

Brazil

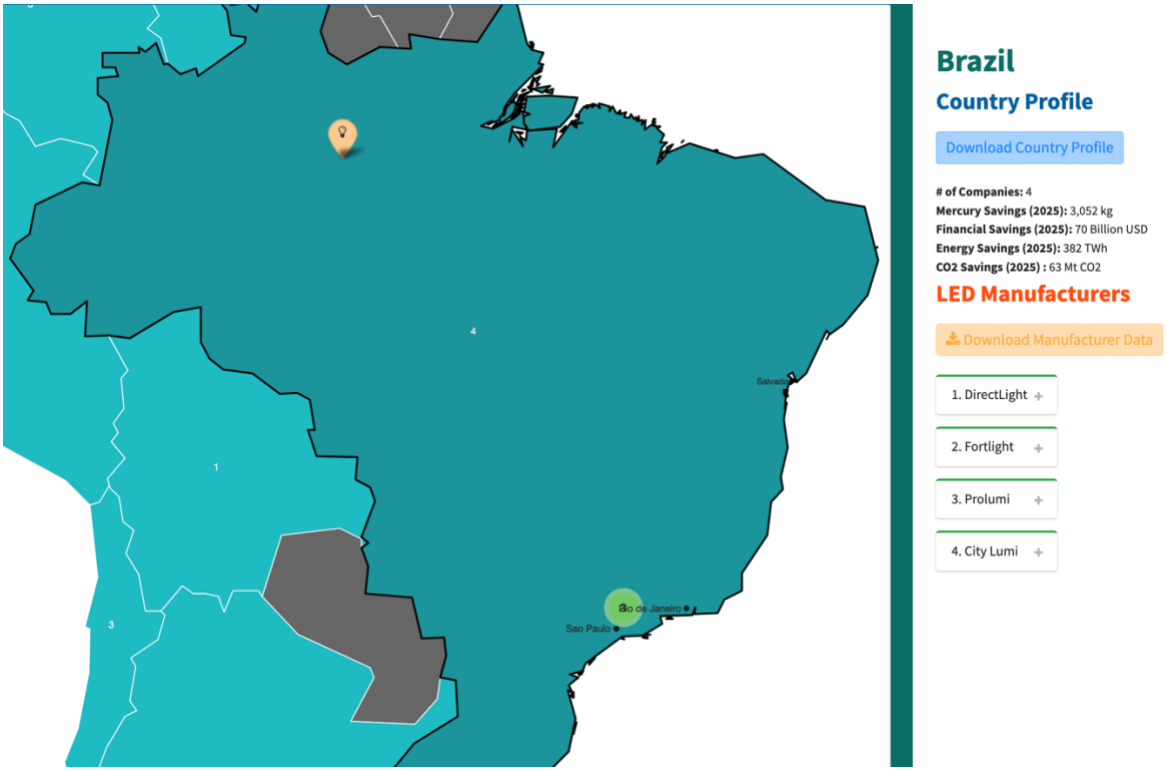
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Brazil

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	407,000,000	375,000,000	343,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	3,050	2,810	2,570	kg of mercury
National electricity savings	382	355	329	TWh of electricity
National financial savings from avoided electricity use	70.1	65.6	60.4	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	62.5	57.8	52.8	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The 2050 National Energy Plan (*Plano Nacional de Energia*, PNE 2050) was launched by the Ministry of Mines and Energy (MME) and the Brazilian Energy Research Company (EPE). For the next 30 years, energy policy making will be supported by its analysis and projections for economic growth, energy demand, and output potential.
- The Brazilian Development Bank (BNDES) and the MME are offering financial instruments to transition public lighting to LEDs. Public-private partnership bids have already been selected for projects in Macapá, Petrolina, Teresina, Porto Alegre, and Vila Velha, with upcoming projects in Curitiba, Canoas, Caruaru, and Jaboatao dos Guararapes. These projects have already updated over 570,000 lighting fixtures to LEDs, benefitting over 7 million people. BNDES has also funded energy efficiency projects in small and medium-sized enterprises, which include transitioning to LED lighting.
- On March 13, 2015, INMETRO granted Ordinance no. 144, which approves the Conformity Assessment Requirements for LED lamps intended to enter the Brazilian market. Then, on February 15, 2017, INMETRO approved the administrative Rule No. 20, 2017, establishing the technical and conformity criteria for street lighting using discharge lamps and LED technology.
- In 2018, the Ministry of Mines and Energy published a Guidebook for the Development of Municipal Public Lighting Policies, which recommends the adoption of LED technology and explains different mechanisms to obtain federal funding to finance the transition to energy-efficient public lighting in municipalities.
- Following Law 5490/20, which defines the National Plan for the Erradication of Mercury Contamination, the Ministry of Health published the Sectoral Plan for the Implementation of the Minamata Convention on Mercury. This Plan effectively phases out all mercury-containing lamps, except for those included in Annex A of the Minamata Convention on Mercury.

Map of LED Companies in Brazil



The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Brazil.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

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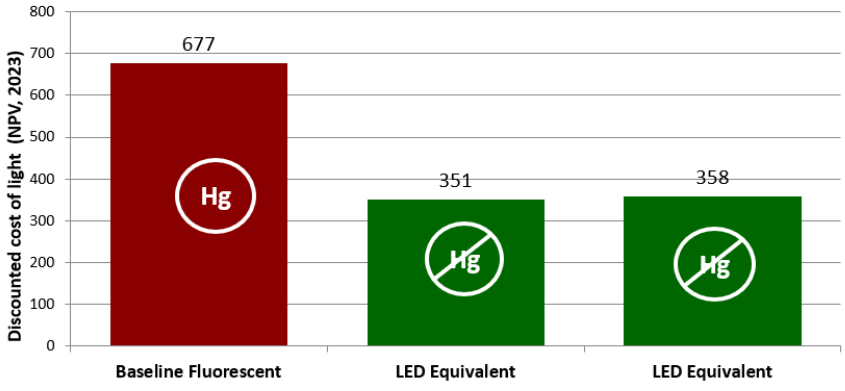


Price for one lamp (BRL):	20	49	30	BRL
Price for one lamp (USD):	3.85	9.54	5.80	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	6,000	25,000	15,000	Hours
Analysis period for life-cycle assessment:	7	7	7	years
Life-cycle cost for analysis period, discounted to 2023	677	351	358	BRL (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	8.2	2.8	months
CO2 emissions due to electricity used for 7 years:	167	83	83	kg CO2/7 yrs

Chile

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Chile

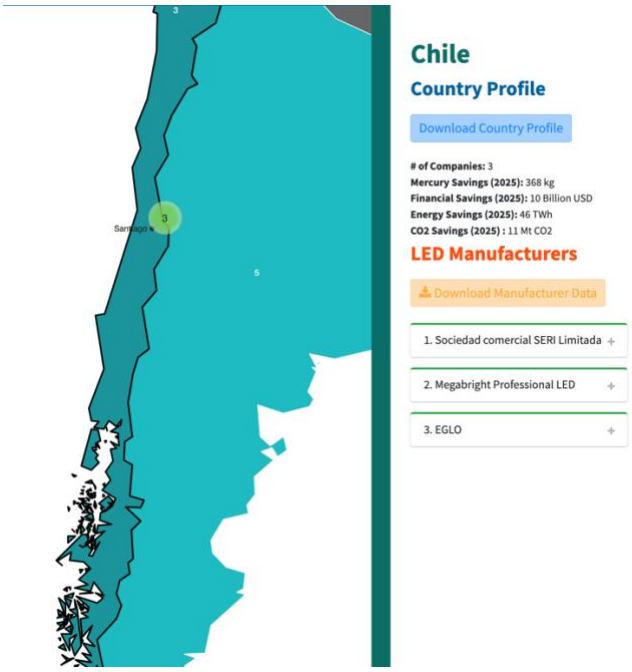
Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	49,100,000	44,900,000	40,900,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	368	337	306	kg of mercury
National electricity savings	46.1	42.7	39.2	TWh of electricity
National financial savings from avoided electricity use	10.4	9.7	8.9	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	11.3	10.4	9.4	Mt CO_2

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2013, Chile's Ministry of Energy and Fundación Chile, with the support of the UNEP/GEF en.lighten initiative (United for Efficiency), developed its National Efficient Lighting Strategy. This strategy established general minimum energy performance standards (MEPS) that phased out inefficient (incandescent) lamps, and proposed mercury labels and a sound end-of-life management system for mercury-containing lamps.
- Through Ministerial Resolution N. 10/2020, the Ministry of Energy updated MEPS for general lighting to phase out inefficient lamps as follows: 40 lm/W by 2021, 70 lm/W by 2023, and 85 lm/W by 2025. This update effectively phases out fluorescent lamps as they do not currently achieve those MEPS, thus driving the shift to LED lighting.
- In 2021, Chile published its first Energy Efficiency Law (No. 21,305) to promote the rational and efficient use of energy resources. According to the terms of this new law, the Ministry of Energy is required to prepare a National Energy Efficiency Plan and it must include, at least, the following matters:
    - residential energy efficiency
    - minimum standards and artifact labelling
    - energy efficiency in construction and transportation
    - energy efficiency and smart cities
    - energy efficiency in the productive sectors, and
    - education and training in energy efficiency
- In addition, the plan must establish short-, medium- and long-term goals, as well as the programs and actions necessary to achieve those goals. The 10% reduction in energy intensity targeted for 2030 is expected to lead to cumulative savings of $15.2 billion USD and emissions reduction of 28.6 $MtCO_2e$.

- Following Law 21,305, new homes will be required to have an energy-efficiency label, like those found on electric appliances, indicating their energy running costs. Large energy consumers will be required to implement an energy management system and to report annually on their consumption and other indicators.

Map of LED Companies in Chile



The following table compares the costs and benefits of fluorescent and LED lighting technologies in Chile.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

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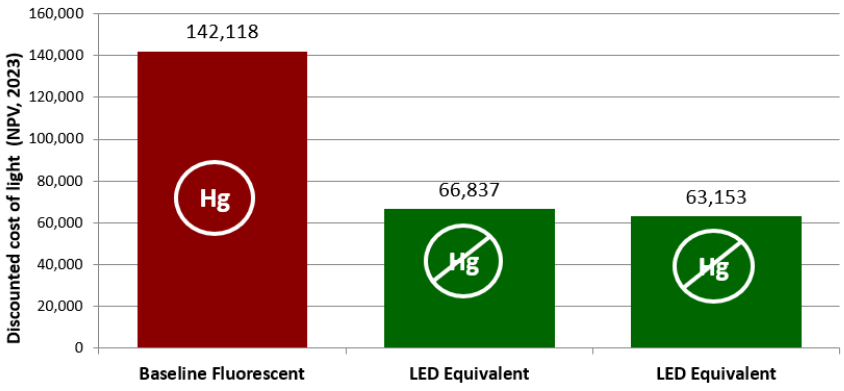


Price for one lamp (CLP):	2,990	3,900	3,550	CLP
Price for one lamp (USD):	3.42	4.47	4.06	US dollars
Lamp wattage:	36	16	16	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	53	53	kWh/year
Rated lamp lifetime:	10,000	15,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	142,118	66,837	63,153	CLP (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	1.3	0.8	months
CO2 emissions due to electricity used for 9 years:	361	160	160	kg CO2/9 yrs

Colombia

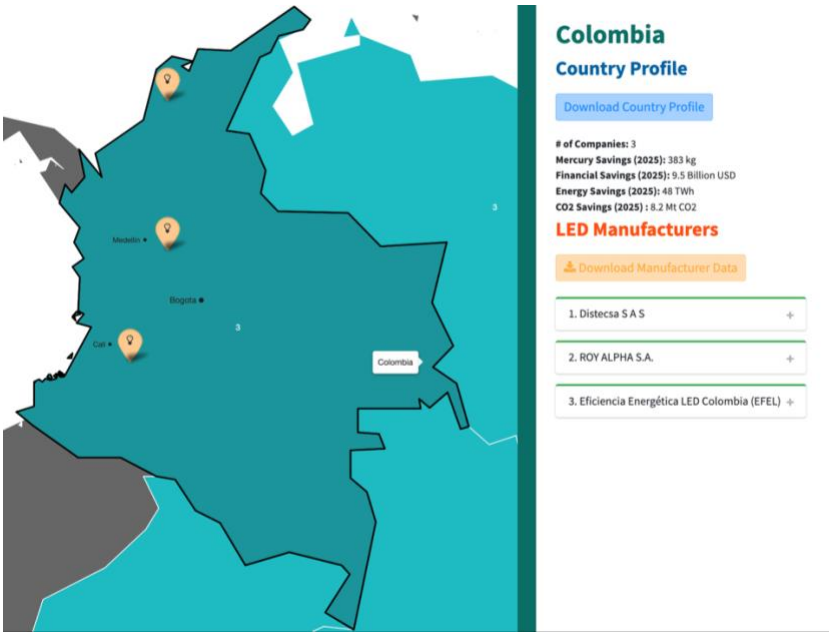
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Colombia

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	51,100,000	46,800,000	42,600,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	383	351	319	kg of mercury
National electricity savings	48.0	44.4	40.8	TWh of electricity
National financial savings from avoided electricity use	9.48	8.82	8.06	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	8.20	7.53	6.84	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- On 23 April 2021, the president of Colombia, Iván Duque, signed a decree that prohibits the manufacture, import, and export of products containing added mercury.
- In 2010, the Ministry of Energy of Colombia issued Technical Guidelines for General and Public Lighting (RETILAP). This document provides thorough minimum energy performance standards, testing parameters, and labeling requirements for all lighting appliances in Colombia. The document has been updated several times since its release.
- Following Law 1658 of 2013, a group of Ministries (Energy and Mines, Environment, Health, Labor, Agriculture, Transportation, Commerce, Industry and Tourism) published the Comprehensive National Mercury Plan (*Plan Único Nacional de Mercurio – PUNHg)* in 2018, with the aim of reducing and progressively eliminating the use of mercury in the country.

Map of LED Companies in Colombia



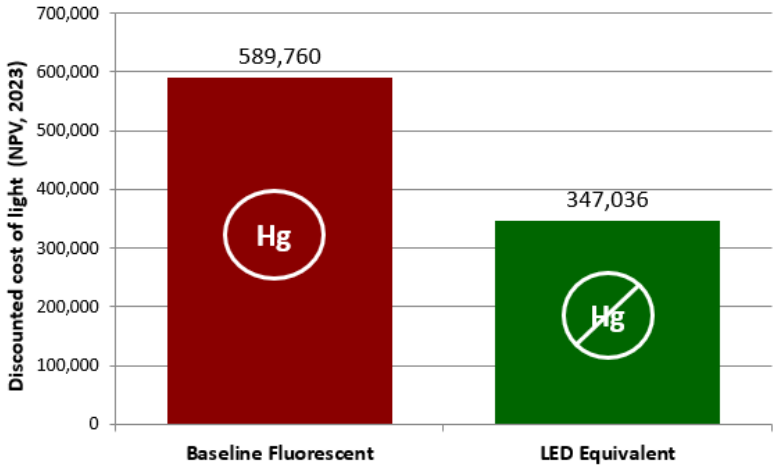
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Colombia.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (COP):	2,400	17,800	*COP*
Price for one lamp (USD):	0.56	4.18	*US dollars*
Lamp wattage:	32	18	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	105	59	*kWh/year*
Rated lamp lifetime:	15,000	20,000	*Hours*
Analysis period for life-cycle assessment:	6	6	*years*
Life-cycle cost for analysis period, discounted to 2023	589,760	347,036	*COP (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	4.3	*months*
CO2 emissions due to electricity used for 6 years:	146	82	*kg CO2/6 yrs*

Costa Rica

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Costa Rica

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	6,160,000	5,510,000	4,870,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	46	41	37	kg of mercury
National electricity savings	5.93	5.36	4.80	TWh of electricity
National financial savings from avoided electricity use	0.08	0.08	0.07	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.67	0.60	0.53	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, Costa Rica, along with other Central American countries that form part of *Proyecto Mesoamerica*, launched the Regional Strategy for Energy-Efficient Lighting. This strategy called for the phase-out of incandescent lamps and established an integrated policy approach to ensure proper end-of-life management for fluorescent lamps.
- The Costa Rican Institute of Electricity hosts the Energy Efficiency Laboratory, which is fully equipped to do lighting tests, including flicker and stroboscopic effect tests. They are capable of testing lamps for the whole region.
- The SICA Energy Efficiency Technical Working Group is working on regional standards for public and general lighting with a focus on promoting the adoption of efficient LED lighting.

Map of LED Companies in Costa Rica

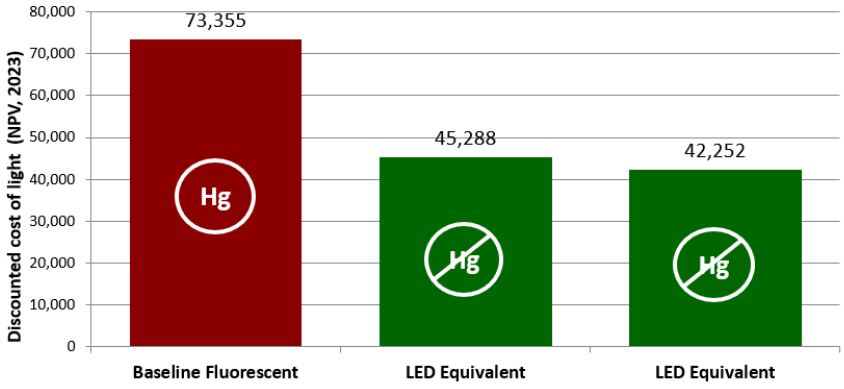
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Costa Rica.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



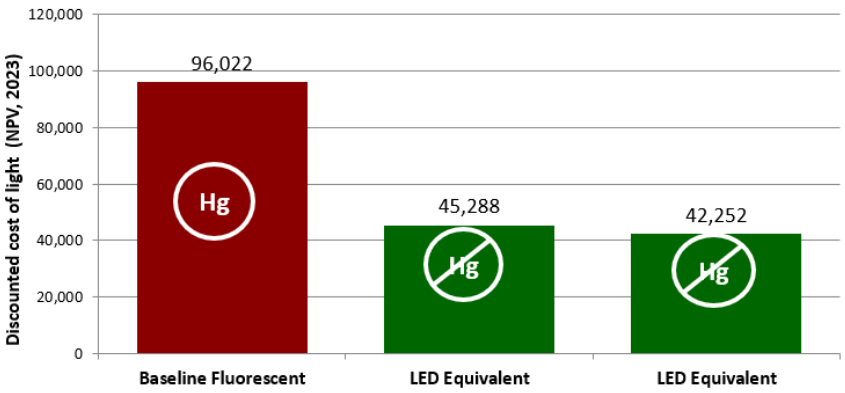
Price for one lamp (CRC):	1,831	3,200	2,900	CRC
Price for one lamp (USD):	2.83	4.94	4.48	US dollars
Lamp wattage:	32	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	59	59	kWh/year
Rated lamp lifetime:	15,000	15,000	20,000	Hours
Analysis period for life-cycle assessment:	6	6	6	years
Life-cycle cost for analysis period, discounted to 2023	73,355	45,288	42,252	CRC (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	3.2	2.5	months
CO2 emissions due to electricity used for 6 years:	92	51	51	kg CO2/6 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (CRC):	4,538	3,200	2,900	CRC
Price for one lamp (USD):	7.01	4.94	4.48	US dollars
Lamp wattage:	40	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	131	59	59	kWh/year
Rated lamp lifetime:	13,000	15,000	20,000	Hours
Analysis period for life-cycle assessment:	6	6	6	years
Life-cycle cost for analysis period, discounted to 2023	96,022	45,288	42,252	CRC (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	instant	instant	months
CO2 emissions due to electricity used for 6 years:	114	51	51	kg CO2/6 yrs

Dominican Republic

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in the Dominican Republic

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	8,430,000	7,440,000	6,470,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	63	56	49	kg of mercury
National electricity savings	8.17	7.30	6.44	TWh of electricity
National financial savings from avoided electricity use	1.61	1.45	1.27	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	3.07	2.73	2.38	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, the Dominican Republic, along with all other Central American countries that form part of *Proyecto Mesoamerica*, launched a Regional Strategy for Energy-Efficient Lighting. This strategy called for the phase-out of incandescent lamps and also established an integrated policy approach to ensure proper end-of-life management for fluorescent lamps.
- In 2018, then Minister of Environment Francisco Dominguez Brito announced the prohibition of mercury-containing lamps and an ambition to make the Dominican Republic the first 100% LED island nation in the world.

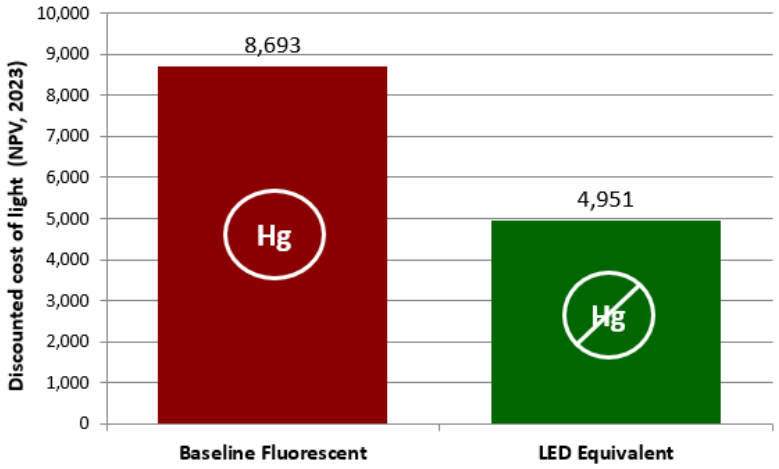
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in the Dominican Republic.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (DOP):	120	186	*DOP*
Price for one lamp (USD):	2.18	3.37	*US dollars*
Lamp wattage:	32	18	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	105	59	*kWh/year*
Rated lamp lifetime:	15,000	20,000	*Hours*
Analysis period for life-cycle assessment:	6	6	*years*
Life-cycle cost for analysis period, discounted to 2023	8,693	4,951	*DOP (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	1.3	*months*
CO2 emissions due to electricity used for 6 years:	290	163	*kg CO2/6 yrs*

Ecuador

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Ecuador

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	17,700,000	16,300,000	14,900,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	133	122	111	kg of mercury
National electricity savings	16.6	15.4	14.2	TWh of electricity
National financial savings from avoided electricity use	2.34	2.19	2.01	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	5.23	4.82	4.39	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The National Electricity Corporation (CNEL) has an energy efficiency plan for 2016-2035, with a goal of avoiding 543 MBOE, saving $84,131 million USD, and 65 $MtCO_2e$.
- A research project by the Universidad de la Loja, with the support of the Latin American Energy Organization (*Organización Latinoamericana de Energía – OLADE)*, made a cost-benefit analysis of the transition to LED in public lighting, showing potential savings of $36 million USD per year.

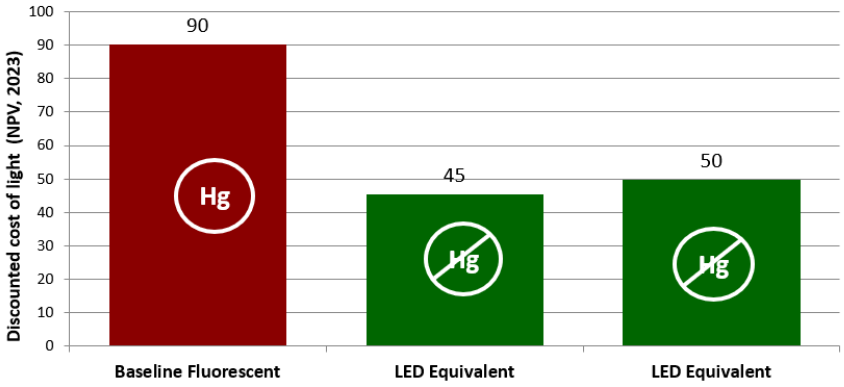
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Ecuador.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



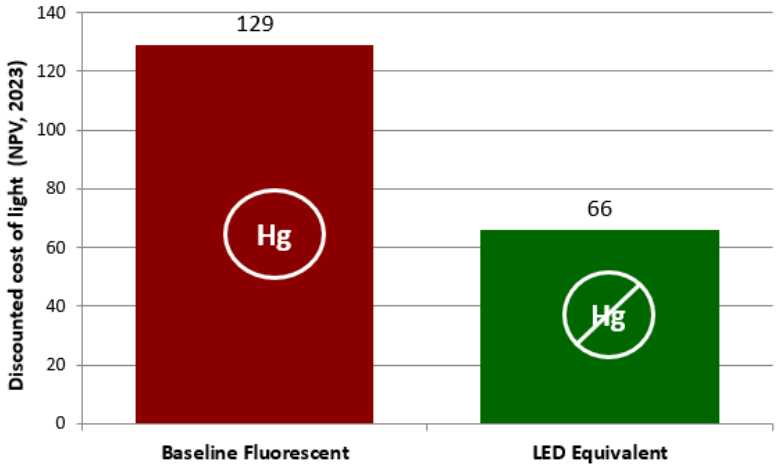
Price for one lamp (USD):	1	2	2	USD
Price for one lamp (USD):	1.39	2.08	1.76	US dollars
Lamp wattage:	36	18	20	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	66	kWh/year
Rated lamp lifetime:	10,000	25,000	25,000	Hours
Analysis period for life-cycle assessment:	7	7	7	years
Life-cycle cost for analysis period, discounted to 2023	90	45	50	USD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	1.3	0.8	months
CO2 emissions due to electricity used for 7 years:	334	167	186	kg CO2/7 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (USD):	6	11	*USD*
Price for one lamp (USD):	5.55	11.12	*US dollars*
Lamp wattage:	40	15	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	49	*kWh/year*
Rated lamp lifetime:	30,000	25,000	*Hours*
Analysis period for life-cycle assessment:	9	9	*years*
Life-cycle cost for analysis period, discounted to 2023	129	66	*USD (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	7.8	*months*
CO2 emissions due to electricity used for 9 years:	478	179	*kg CO2/9 yrs*

Guatemala

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Guatemala

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	8,720,000	8,020,000	7,340,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	65	60	55	kg of mercury
National electricity savings	8.19	7.61	7.03	TWh of electricity
National financial savings from avoided electricity use	2.43	2.27	2.09	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	2.59	2.39	2.18	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, Guatemala was one of the co-signatories of the Central American Regional Efficient Lighting Strategy, a document developed in the framework of *Proyecto Mesoamerica* with the support of the UNEP/GEF en.lighten initiative (United for Efficiency).
- The Ministry of Energy and Mines has a National Energy Efficiency Plan (2019-2032), which aims to avoid 69,790 TJ by 3032 compared to the BAU model. These savings represent 15.1% of the energy consumption countrywide.
- The Ministry of Energy and Mines also approved an Energy Efficiency Act (2023-2050), which mentions the Minamata Convention and the phase-out of mercury in its preamble.

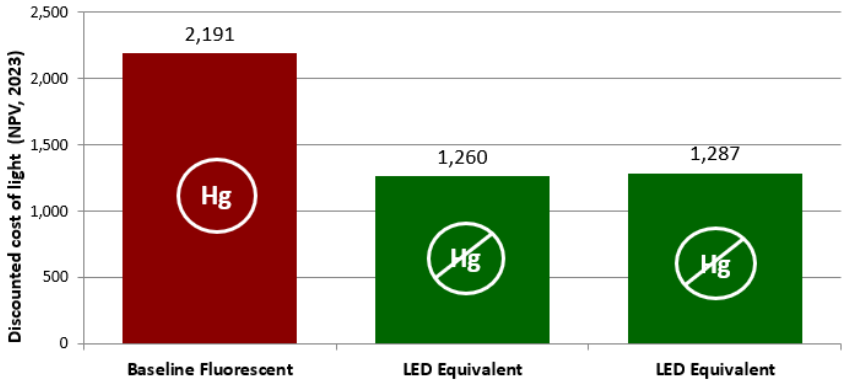
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Guatemala.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



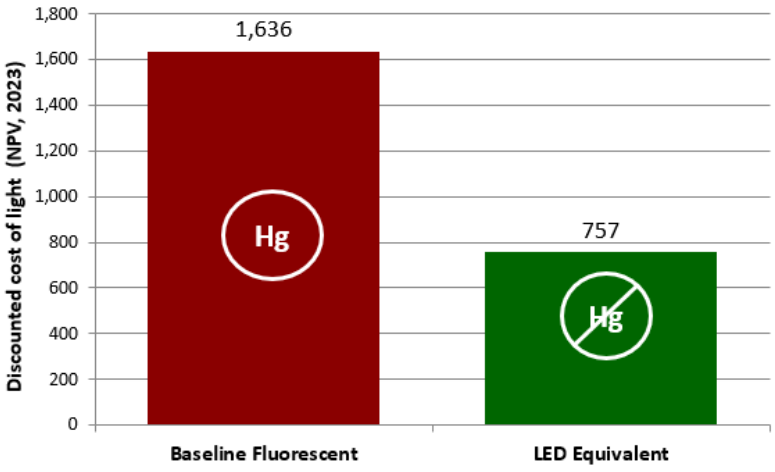
Price for one lamp (GTQ):	15	24	69	GTQ
Price for one lamp (USD):	1.97	3.10	8.91	US dollars
Lamp wattage:	32	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	59	59	kWh/year
Rated lamp lifetime:	30,000	25,000	50,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	2,191	1,260	1,287	GTQ (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	1.1	6.8	months
CO2 emissions due to electricity used for 15 years:	423	238	238	kg CO2/10 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (GTQ):	12	26	*GTQ*
Price for one lamp (USD):	1.50	3.41	*US dollars*
Lamp wattage:	40	18	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	59	*kWh/year*
Rated lamp lifetime:	20,000	20,000	*Hours*
Analysis period for life-cycle assessment:	6	6	*years*
Life-cycle cost for analysis period, discounted to 2023	1,636	757	*GTQ (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	1.2	*months*
CO2 emissions due to electricity used for 6 years:	317	143	*kg CO2/6 yrs*

Guyana

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Guyana

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	979,000	901,000	822,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	7	7	6	kg of mercury
National electricity savings	0.93	0.86	0.80	TWh of electricity
National financial savings from avoided electricity use	0.35	0.33	0.30	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.49	0.46	0.42	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The Guyana Energy Agency installed 602 stand-alone solar-powered LED streetlights across all ten of its administrative regions.
- Under the hinterland LED lighting project, the Guyana Energy Agency initiated an energy conservation initiative that will replace energy-inefficient lights with energy-efficient lights. Beneficiaries are customers of the six hinterland utilities.

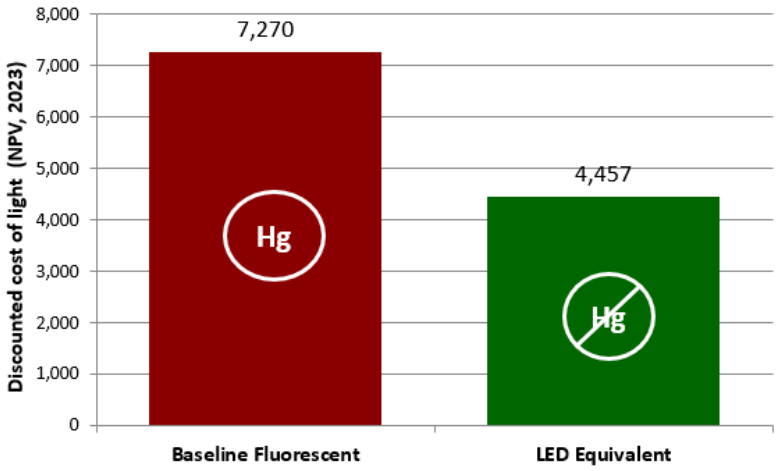
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Guyana.

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (GYD):	700	1,500	*GYD*
Price for one lamp (USD):	4.56	9.78	*US dollars*
Lamp wattage:	40	18	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	59	*kWh/year*
Rated lamp lifetime:	6,000	6,000	*Hours*
Analysis period for life-cycle assessment:	1	1	*years*
Life-cycle cost for analysis period, discounted to 2023	7,270	4,457	*GYD (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	2.7	*months*
CO2 emissions due to electricity used for 1 years:	80	36	*kg CO2/1 yrs*

Honduras

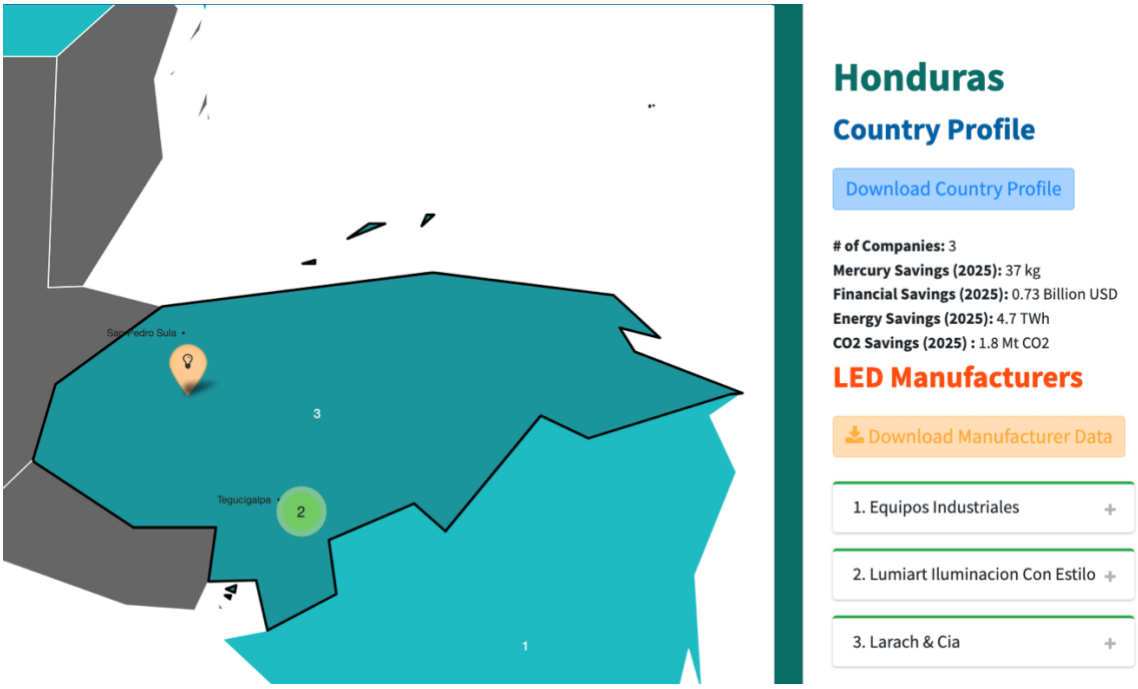
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Honduras

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	4,890,000	4,430,000	3,970,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	37	33	30	kg of mercury
National electricity savings	4.69	4.30	3.90	TWh of electricity
National financial savings from avoided electricity use	0.73	0.67	0.61	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.81	1.65	1.48	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, Honduras was one of the co-signatories of the Central American Regional Efficient Lighting Strategy, a document developed in the framework of *Proyecto Mesoamerica* with the support of the UNEP/GEF en.lighten initiative (United for Efficiency).
- In 2023, the Energy Secretariat, along with the Secretariat for Governance, Justice, and Decentralization, signed an agreement to distribute 5.2 million LED bulbs through the framework of the Education in Energy Efficiency Program (PEEE). There are plans to extend this activity with the support of mayoral offices throughout the country.
- A Rational and Efficient Use of Energy Act is currently in discussion.

Map of LED Companies in Honduras



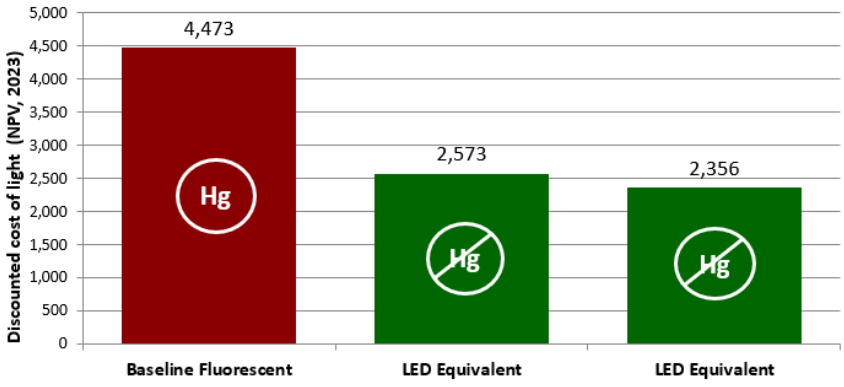
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Honduras.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



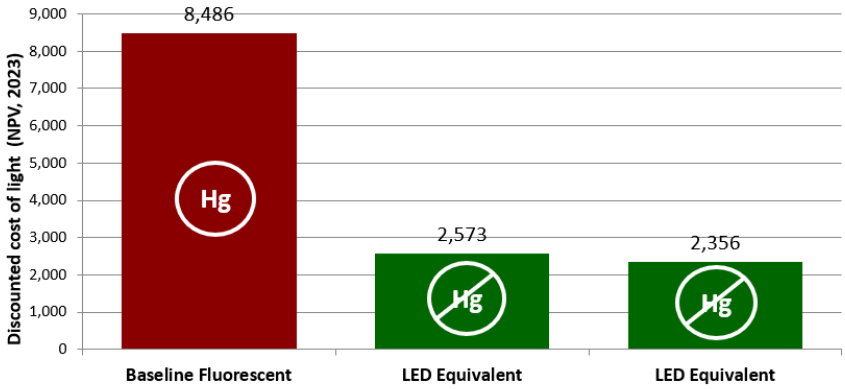
Price for one lamp (HNL):	28	86	78	HNL
Price for one lamp (USD):	1.16	3.51	3.19	US dollars
Lamp wattage:	32	18	16	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	59	53	kWh/year
Rated lamp lifetime:	18,000	30,000	15,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	4,473	2,573	2,356	HNL (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	3.2	2.4	months
CO2 emissions due to electricity used for 9 years:	447	252	224	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (HNL):	74	86	78	HNL
Price for one lamp (USD):	3.02	3.51	3.19	US dollars
Lamp wattage:	60	18	16	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	197	59	53	kWh/year
Rated lamp lifetime:	12,000	30,000	15,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	8,486	2,573	2,356	HNL (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	0.2	0.1	months
CO2 emissions due to electricity used for 9 years:	839	252	224	kg CO2/9 yrs

Jamaica

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Jamaica

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	1,840,000	1,650,000	1,470,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	14	12	11	kg of mercury
National electricity savings	1.76	1.60	1.45	TWh of electricity
National financial savings from avoided electricity use	1.12	1.03	0.92	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.92	0.83	0.74	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Jamaica Public Service Company Limited, with the support of USTDA, is implementing a project to transition 110,000 streetlights to LED, also installing intelligent controls and metering capabilities for revenue generation.
- As of 2020, two-thirds of the public lighting in Jamaica was LED.
- In 2017, the Minister of Finance and the Public Service at the time, Audley Shaw, inaugurated the Energy Management and Efficiency Programme (EMEP), with support from the Japan International Cooperation Agency and the Inter-American Development Bank. At the inauguration event, the Minister promoted LED lights and encouraged the population to transition to these to reduce utility bills and electricity consumption.

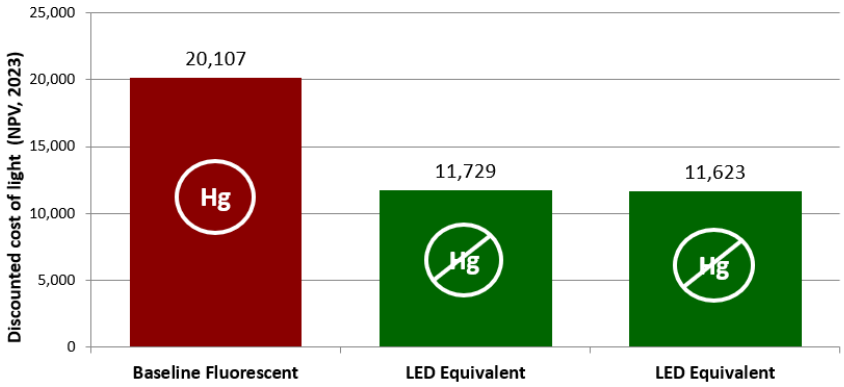
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Jamaica.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



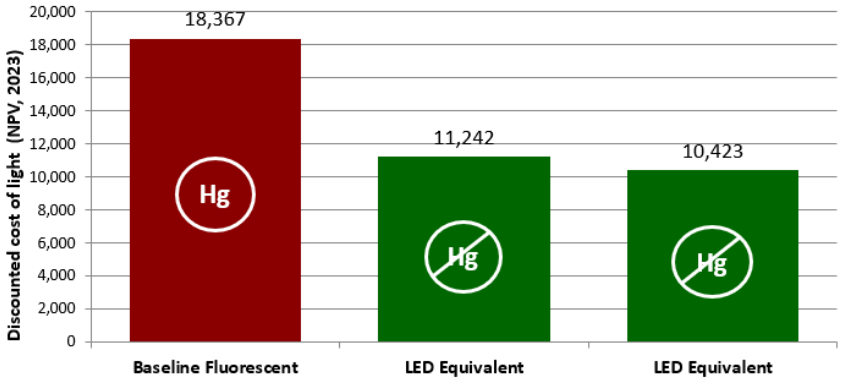
Price for one lamp (JMD):	810	1,280	1,173	JMD
Price for one lamp (USD):	5.28	8.34	7.65	US dollars
Lamp wattage:	32	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	59	59	kWh/year
Rated lamp lifetime:	10,000	15,000	15,000	Hours
Analysis period for life-cycle assessment:	4	4	4	years
Life-cycle cost for analysis period, discounted to 2023	20,107	11,729	11,623	JMD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	2.8	2.1	months
CO2 emissions due to electricity used for 4 years:	228	128	128	kg CO2/4 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (JMD):	952	2,534	2,586	JMD
Price for one lamp (USD):	6.20	16.52	16.85	US dollars
Lamp wattage:	40	20	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	131	66	59	kWh/year
Rated lamp lifetime:	10,000	13,000	13,000	Hours
Analysis period for life-cycle assessment:	3	3	3	years
Life-cycle cost for analysis period, discounted to 2023	18,367	11,242	10,423	JMD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	6.5	6.1	months
CO2 emissions due to electricity used for 3 years:	214	107	96	kg CO2/3 yrs

Saint Kitts and Nevis

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, Saint Kitts and Nevis replaced 323,000 residential light bulbs with LED bulbs – costing about $2.5 million USD.
- In 2020, The St. Kitts Electricity Company installed LED streetlights under the Street and Floodlight Retrofit Project, supported by the Caribbean Development Bank's $5,792,000 USD contribution.

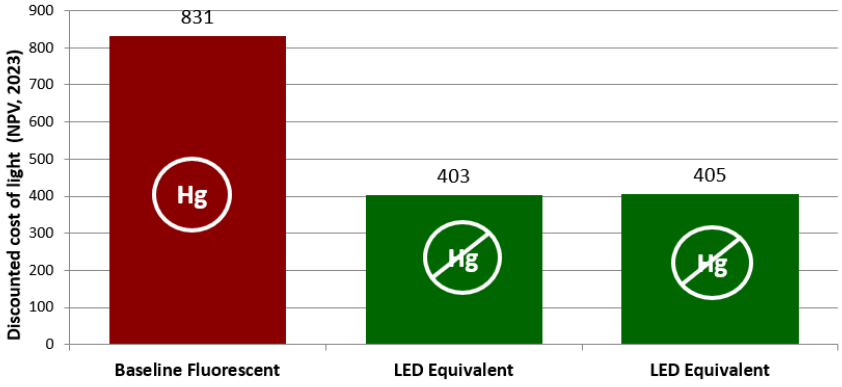
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Saint Kitts and Nevis.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



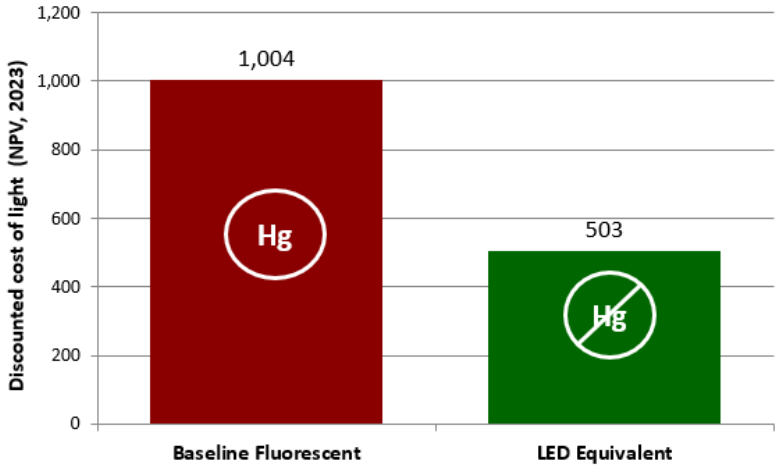
Price for one lamp (XCD):	20	30	32	XCD
Price for one lamp (USD):	7.22	11.11	11.85	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	6,000	30,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	831	403	405	XCD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	3.0	3.6	months
CO2 emissions due to electricity used for 9 years:	508	254	254	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XCD):	**25**	**44**	***XCD***
Price for one lamp (USD):	**9.26**	**16.11**	***US dollars***
Lamp wattage:	**40**	**20**	***Watts***
Lamp is on for hours/day:	**9**	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**131**	**66**	***kWh/year***
Rated lamp lifetime:	**10,000**	**35,000**	***Hours***
Analysis period for life-cycle assessment:	**10**	**10**	***years***
Life-cycle cost for analysis period, discounted to 2023	**1,004**	**503**	***XCD (NPV, 2023)***
Simple Payback period in months, compared with LFL:	**-**	**4.8**	***months***
CO2 emissions due to electricity used for 10 years:	**627**	**313**	***kg CO2/10 yrs***

Saint Lucia

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2015, the St. Lucia Electricity Services company installed 250 LED streetlamps in Castries and announced plans to replace all 20,000 streetlamps in the country with LEDs.
- In 2018, St. Lucia, with the support of GEF, UNEP, and the Basel Convention Regional Centre for Training and Technology Transfer for the Caribbean, developed the Minamata Initial Assessment, supporting the phase-out of mercury-added lamps.

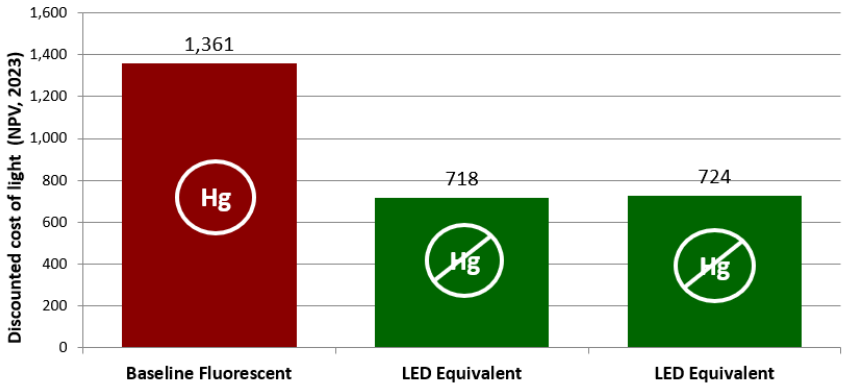
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Saint Lucia.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



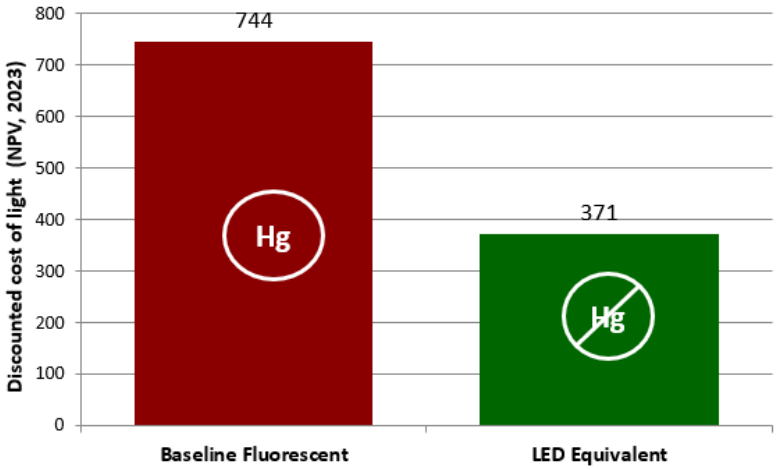
Price for one lamp (XCD):	10	55	36	XCD
Price for one lamp (USD):	3.87	20.37	13.33	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	10,000	50,000	30,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	1,361	718	724	XCD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	8.1	4.6	months
CO2 emissions due to electricity used for 15 years:	616	308	308	kg CO2/10 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (XCD):	8	40	*XCD*
Price for one lamp (USD):	2.83	14.65	*US dollars*
Lamp wattage:	40	18	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	59	*kWh/year*
Rated lamp lifetime:	18,000	18,000	*Hours*
Analysis period for life-cycle assessment:	5	5	*years*
Life-cycle cost for analysis period, discounted to 2023	744	371	*XCD (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	4.7	*months*
CO2 emissions due to electricity used for 5 years:	342	154	*kg CO2/5 yrs*

Mexico

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Mexico

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	182,000,000	165,000,000	148,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	1,370	1,240	1,110	kg of mercury
National electricity savings	174	159	144	TWh of electricity
National financial savings from avoided electricity use	14.7	13.5	12.2	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	44.9	40.8	36.5	$MTCO_2$

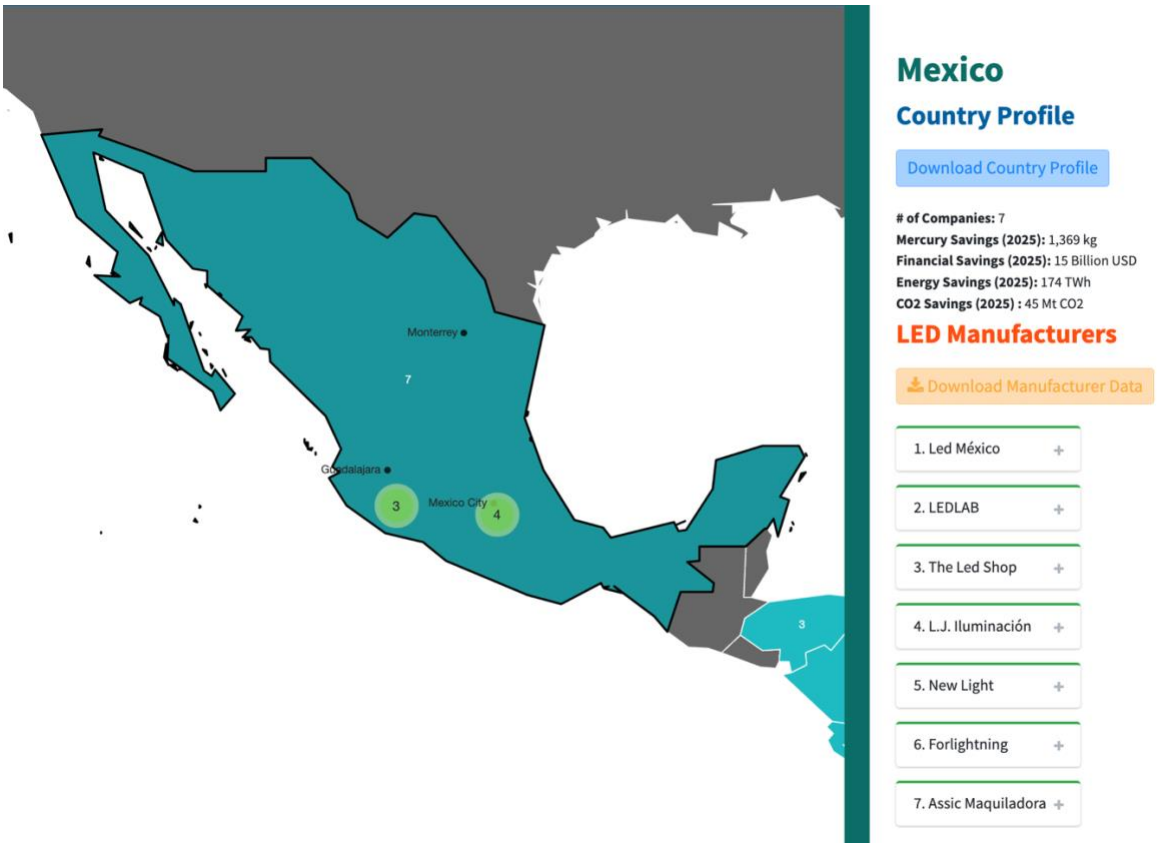
National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2018, the National Institute of Ecology and Climate Change (INECC) published an initial assessment report to investigate the readiness of Mexico's current legal framework and to propose modifications to allow the Minamata Convention to be adopted in the country.
- In Mexico, regulations for lighting products are based on nine official Mexican standards (currently in force). The report mentioned above identified that the following norms must be revised and adapted to satisfy the Minamata Convention obligations:
    - NOM-017-ENER/SCFI-2012, Energy efficiency and safety requirements of self-ballasted compact fluorescent lamps. Limits and test methods.
    - NOM-028-ENER-2017, Energy efficiency of lamps for general use. Limits and test methods.
- Notably, Mexico also has NOM-030-ENER-2016 and NOM-031-ENER-2019 in place, which define the minimum energy efficiency and safety standards for LED lamps for general use and for public lighting use, respectively. These standards are an important step in protecting the national market from low-quality lighting products.
- Mexico is an important actor in the global LED market, accounting for 4.6% of global LED luminaires exports and 0.6% of LED packages/dies. A growing number of LED lamp manufacturers/assemblers are based in Mexico.
- There are several policies, institutions, and mechanisms in place that support the transition to more efficient and cleaner technologies, such as:
    - The Energy Efficiency Program, which is promoted through the Trust Funds for Rural Development (FIRA)
    - The Energy Efficiency Program in the Federal Public Administration (2020-2024), which is promoted through the Ministry of Energy (SENER) and the National Commission for the Efficient Use of Energy (CONUEE). This program

establishes specific annual energy savings goals for participating buildings, vehicle fleets, and industrial facilities.

- The FIDE substantive programs, which are promoted through the Trust for the Saving of Electric Energy. FIDE is a private, non-profit fund created through the Federal Electricity Commission (CFE)'s initiative to contribute to the saving and efficient use of electrical energy. These programs include FIDE's voluntary certification of energy-efficient products.

Map of LED Companies in Mexico



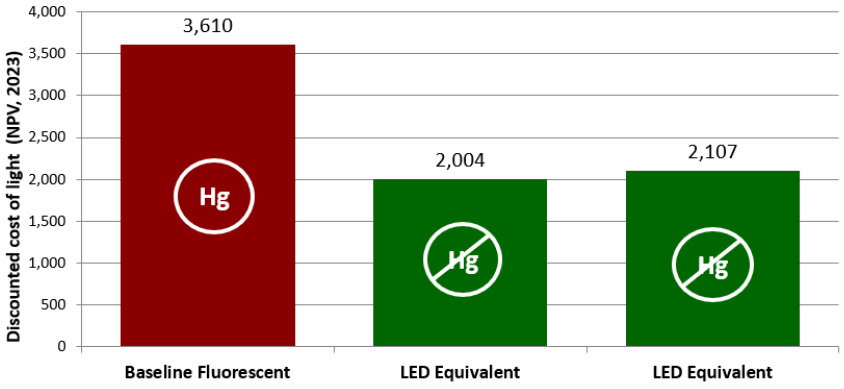
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Mexico.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



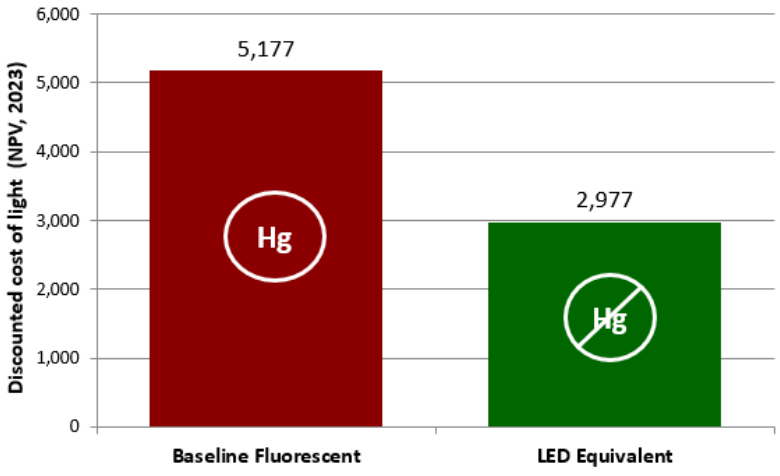
Price for one lamp (MXN):	60	144	138	MXN
Price for one lamp (USD):	2.98	7.15	6.86	US dollars
Lamp wattage:	32	16	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	53	59	kWh/year
Rated lamp lifetime:	18,000	25,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	3,610	2,004	2,107	MXN (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	5.2	5.5	months
CO2 emissions due to electricity used for 9 years:	302	151	170	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (MXN):	176	303	*MXN*
Price for one lamp (USD):	8.74	15.05	*US dollars*
Lamp wattage:	40	22	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	72	*kWh/year*
Rated lamp lifetime:	20,000	45,000	*Hours*
Analysis period for life-cycle assessment:	10	10	*years*
Life-cycle cost for analysis period, discounted to 2023	5,177	2,977	*MXN (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	7.0	*months*
CO2 emissions due to electricity used for 13 years:	420	231	*kg CO2/10 yrs*

Nicaragua

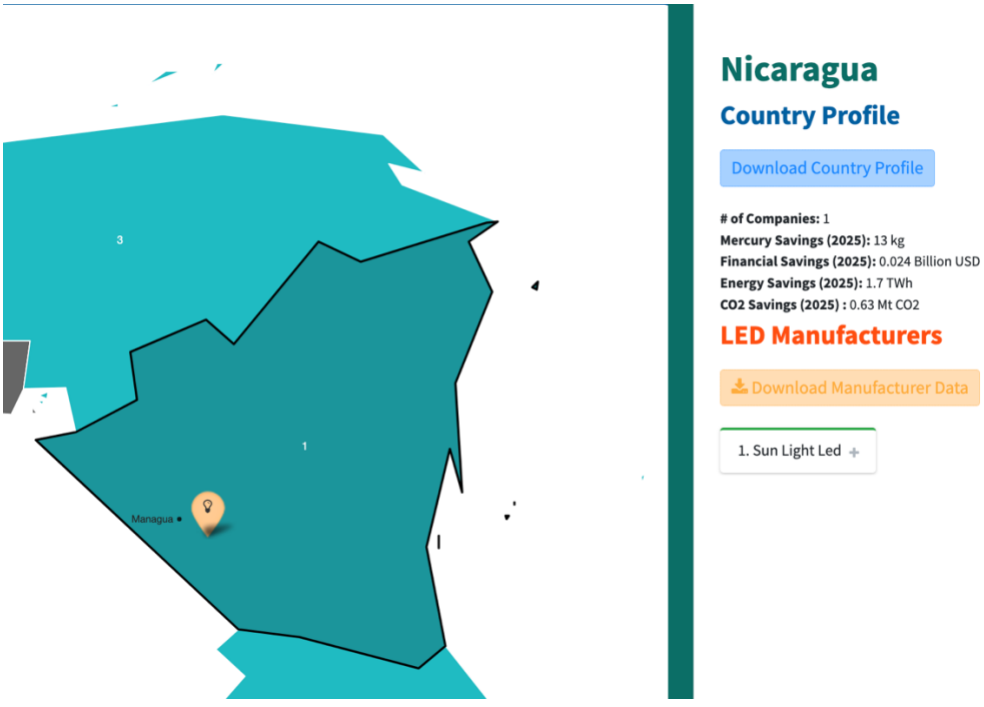
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Nicaragua

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	1,780,000	1,620,000	1,460,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	13	12	11	kg of mercury
National electricity savings	1.69	1.55	1.41	TWh of electricity
National financial savings from avoided electricity use	0.02	0.02	0.02	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.63	0.58	0.52	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, Nicaragua was one of the co-signatories of the Central American Regional Efficient Lighting Strategy, a document developed in the framework of *Proyecto Mesoamerica* with the support of the UNEP/GEF en.lighten initiative (United for Efficiency).
- The Energy Efficiency Act 956 of 2017 establishes the framework for all national and regional energy efficiency programs.

Map of LED Companies in Nicaragua



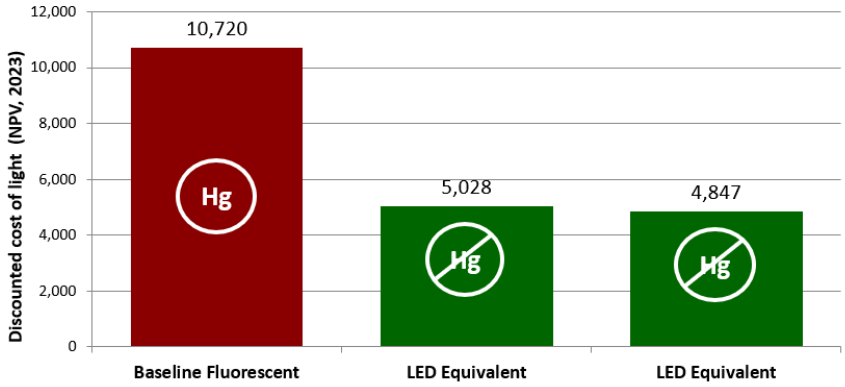
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Nicaragua.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



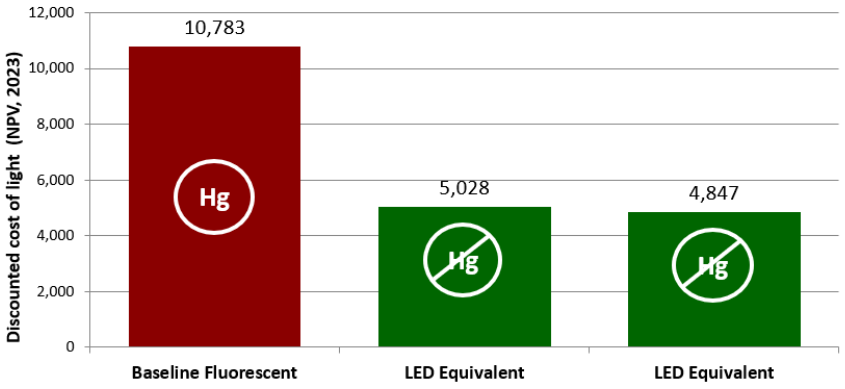
Price for one lamp (NIO):	60	156	95	NIO
Price for one lamp (USD):	1.67	4.36	2.65	US dollars
Lamp wattage:	40	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	131	59	59	kWh/year
Rated lamp lifetime:	12,000	25,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	10,720	5,028	4,847	NIO (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	1.8	0.7	months
CO2 emissions due to electricity used for 9 years:	507	228	228	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (NIO):	84	156	95	NIO
Price for one lamp (USD):	2.34	4.36	2.65	US dollars
Lamp wattage:	40	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	131	59	59	kWh/year
Rated lamp lifetime:	12,000	25,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	9	years
Life-cycle cost for analysis period, discounted to 2023	10,783	5,028	4,847	NIO (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	1.3	0.2	months
CO2 emissions due to electricity used for 9 years:	507	228	228	kg CO2/9 yrs

Panama

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Panama

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	5,850,000	5,230,000	4,640,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	44	39	35	kg of mercury
National electricity savings	5.60	5.07	4.55	TWh of electricity
National financial savings from avoided electricity use	1.66	1.51	1.35	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.63	1.47	1.30	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2013, Panama was one of the co-signatories of the Central American Regional Efficient Lighting Strategy, a document developed in the framework of *Proyecto Mesoamerica* with the support of the UNEP/GEF en.lighten initiative (United for Efficiency).
- In 2018, the Government of Panama prohibited appliances (i.e., air conditioners, lamps, and refrigerators) that do not meet certain minimum energy efficiency requirements from entering the country. Promoting efficient equipment is one of the aspects included in Law 69 of 12 October 2012, which establishes a policy for the rational use, and efficiency, of energy (UREE).
- Law 69 is regulated by the Ministry of the Presidency of Panama through Executive Decree No. 398 of 19 June 2013. This regulation seeks to raise awareness among consumers to achieve rational and efficient energy use and to promote the development of new energy technologies in the country.
- At the end of 2020, the Panamanian government approved a ten-year energy transition policy roadmap that considers universal access to electricity as “priority one.” Although Panama has been working to expand rural electrification in recent years, it is estimated that approximately $350 USD million of new investment is needed to achieve universal access by 2030.

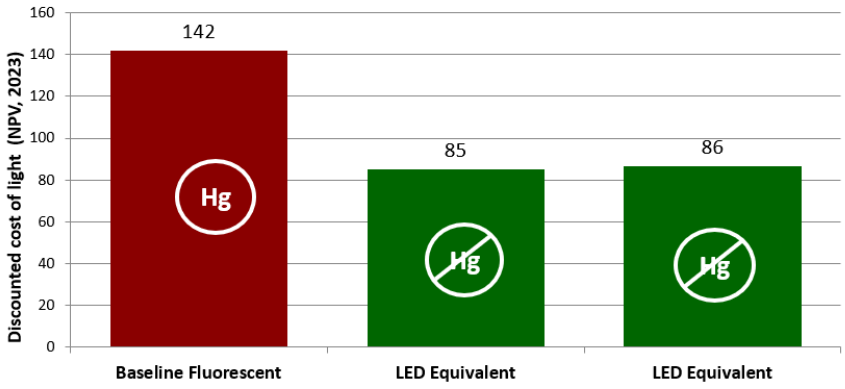
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Panama.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



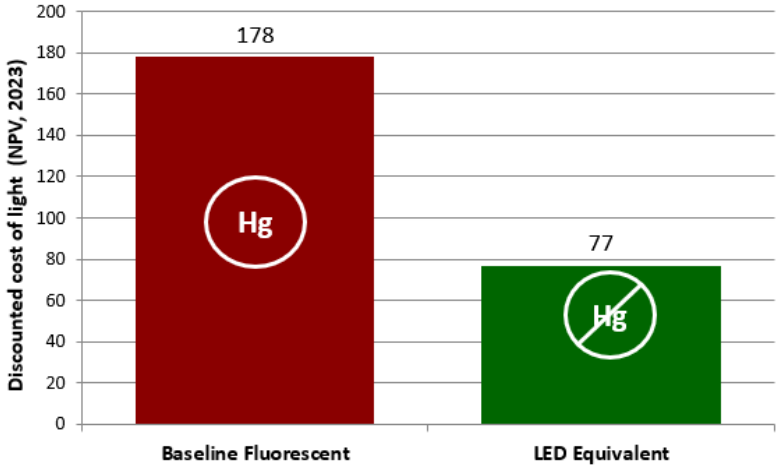
Price for one lamp (PAB):	1	3	4	PAB
Price for one lamp (USD):	1.39	3.20	4.04	US dollars
Lamp wattage:	32	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	59	59	kWh/year
Rated lamp lifetime:	24,000	18,000	18,000	Hours
Analysis period for life-cycle assessment:	7	7	7	years
Life-cycle cost for analysis period, discounted to 2023	142	85	86	PAB (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	2.5	3.6	months
CO2 emissions due to electricity used for 7 years:	265	149	149	kg CO2/7 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (PAB):	1	11	*PAB*
Price for one lamp (USD):	1.29	11.12	*US dollars*
Lamp wattage:	40	15	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	131	49	*kWh/year*
Rated lamp lifetime:	20,000	25,000	*Hours*
Analysis period for life-cycle assessment:	7	7	*years*
Life-cycle cost for analysis period, discounted to 2023	178	77	*PAB (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	7.5	*months*
CO2 emissions due to electricity used for 7 years:	332	124	*kg CO2/7 yrs*

Peru

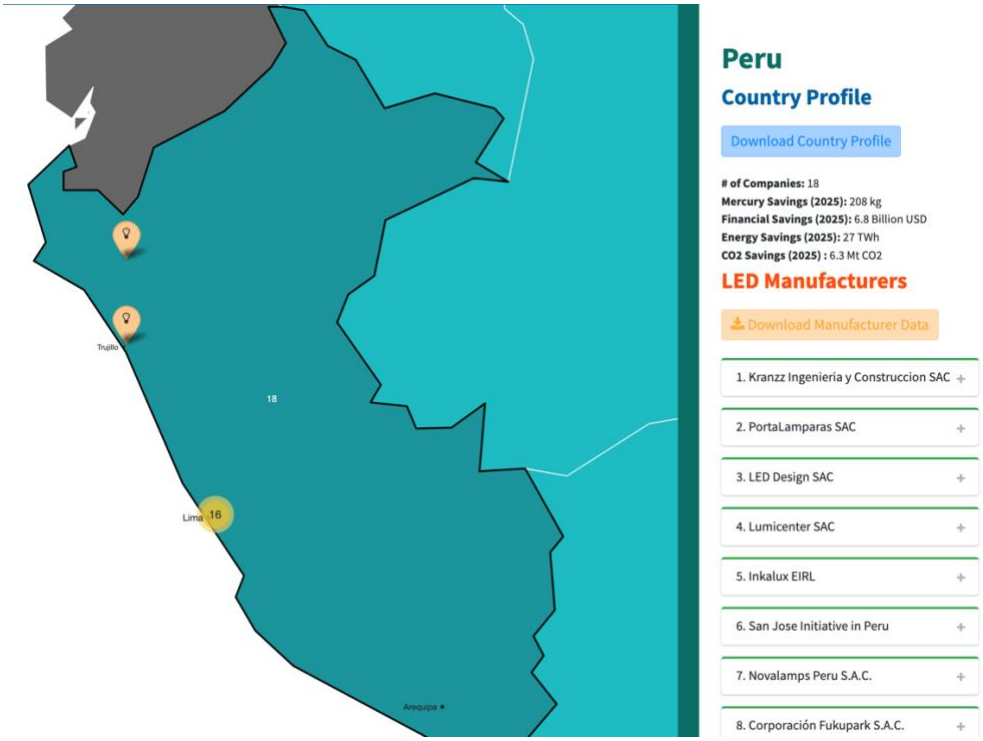
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Peru

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	27,700,000	24,700,000	21,800,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	208	185	163	kg of mercury
National electricity savings	26.7	24.1	21.5	TWh of electricity
National financial savings from avoided electricity use	6.79	6.16	5.47	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	6.32	5.66	4.99	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2019, Peru approved its national plan for the implementation of the Minamata Convention on Mercury, through Supreme Decree No. 004-2019.
- A lighting market study developed by MINEM in 2015 projected that, from 2021, the purchases of spotlights in the country would migrate massively towards the purchase of LED bulbs and that, from 2024, incandescent bulbs would disappear from the national market.
- Peru has a climate change mitigation measures program, which includes transforming the residential lighting market through more efficient technology.
- Peru has a technical regulation on energy efficiency labeling for energy equipment, approved in 2017 by MINEM through Supreme Decree No. 009-2017-EM. This technical regulation aims to establish energy efficiency labeling as an obligation, also defining the technical requirements and energy efficiency ranges for equipment classification to protect the environment and safeguard consumers' and users' right to information.
- In 2016, a Supreme Decree approving measures for efficient energy use (Supreme Decree No. 004-2016-EM) was promulgated. This regulation requires that entities and/or public companies acquiring or replacing energy equipment must do so with the most efficient technology that exists in the market at the time of purchase.

Map of LED Companies in Peru



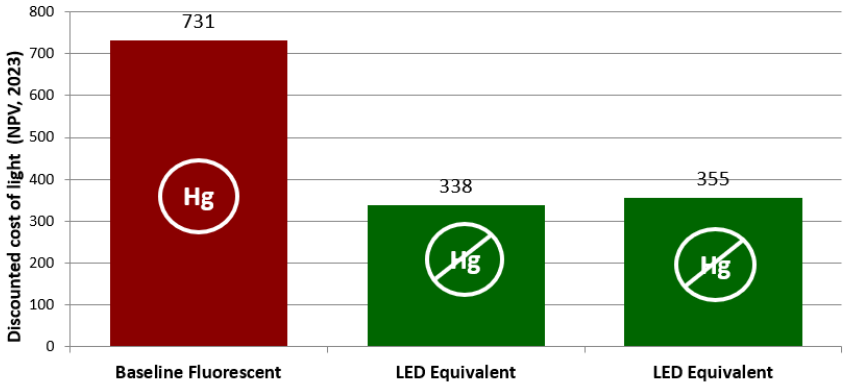
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Peru.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (PEN):	9	8	47	PEN
Price for one lamp (USD):	2.22	2.01	12.18	US dollars
Lamp wattage:	36	16	16	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	53	51	kWh/year
Rated lamp lifetime:	20,000	15,000	60,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	731	338	355	PEN (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	instant	11.2	months
CO2 emissions due to electricity used for 18 years:	356	158	153	kg CO2/10 yrs

Paraguay

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Paraguay

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	7,040,000	6,330,000	5,630,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	53	48	42	kg of mercury
National electricity savings	6.75	6.14	5.53	TWh of electricity
National financial savings from avoided electricity use	0.67	0.61	0.55	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.27	0.25	0.22	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The National Energy Efficiency Committee (CNEE) was created in 2011 by Decree N. 6377 with the purpose of developing and implementing the National Plan for the Efficient Use of Energy in the Republic of Paraguay. This plan takes into consideration energy efficiency policies for lighting products.
- Paraguay's National Energy Policy 2040 establishes the guidelines and goals for the development of any energy efficiency regulations in the country.

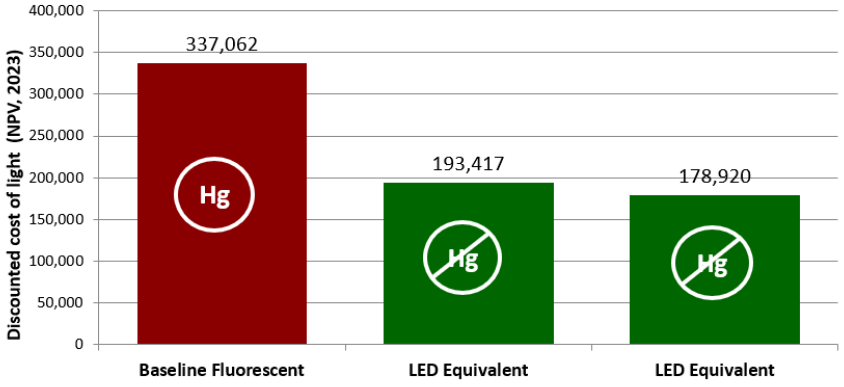
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Paraguay.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



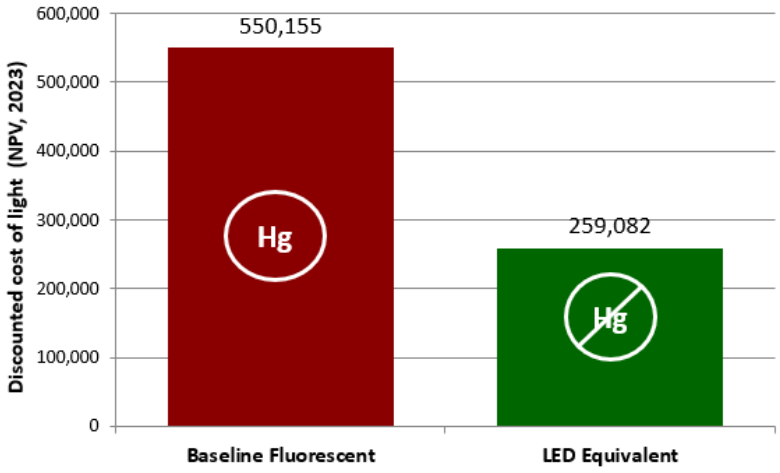
Price for one lamp (PYG):	9,000	18,000	18,889	PYG
Price for one lamp (USD):	1.29	2.58	2.71	US dollars
Lamp wattage:	36	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	59	kWh/year
Rated lamp lifetime:	13,000	15,000	20,000	Hours
Analysis period for life-cycle assessment:	6	6	6	years
Life-cycle cost for analysis period, discounted to 2023	337,062	193,417	178,920	PYG (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	4.0	4.4	months
CO2 emissions due to electricity used for 6 years:	30	15	15	kg CO2/6 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (PYG):	9,500	22,000	*PYG*
Price for one lamp (USD):	1.36	3.15	*US dollars*
Lamp wattage:	36	16	*Watts*
Lamp is on for hours/day:	9	9	*hours/day*
Annual electricity consumption for each lamp type:	118	53	*kWh/year*
Rated lamp lifetime:	25,000	35,000	*Hours*
Analysis period for life-cycle assessment:	10	10	*years*
Life-cycle cost for analysis period, discounted to 2023	550,155	259,082	*PYG (NPV, 2023)*
Simple Payback period in months, compared with LFL:	-	5.1	*months*
CO2 emissions due to electricity used for 10 years:	51	23	*kg CO2/10 yrs*

El Salvador

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in El Salvador

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	4,390,000	3,990,000	3,600,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	33	30	27	kg of mercury
National electricity savings	4.17	3.84	3.50	TWh of electricity
National financial savings from avoided electricity use	0.82	0.76	0.69	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.13	1.03	0.93	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2014, El Salvador was one of the co-signatories of the Central American Regional Efficient Lighting Strategy, a document developed in the framework of *Proyecto Mesoamerica* with the support of the UNEP/GEF en.lighten initiative (United for Efficiency).
- RTS 29.02.01:21, which entered into force on 23 February 2023, establishes technology-specific MEPS for lamps and luminaires at 65 lm/W for LED lamps and 40 lm/W for CFLs.
- El Salvador has eight other energy efficiency technical regulations to reduce energy consumption, also establishing MEPS for air conditioning, electric motors, and refrigeration.

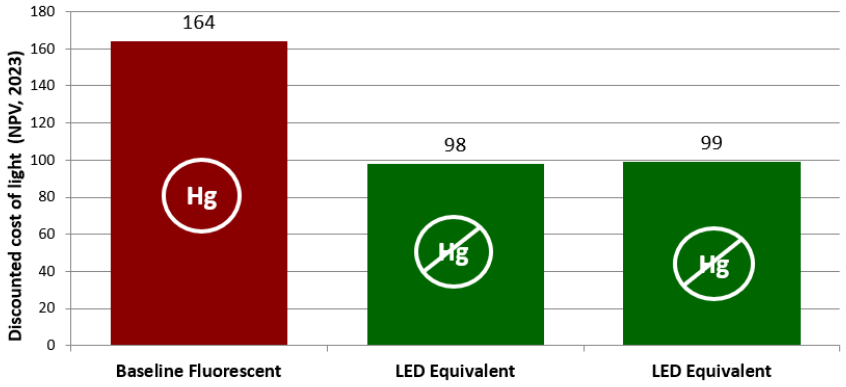
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in El Salvador.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



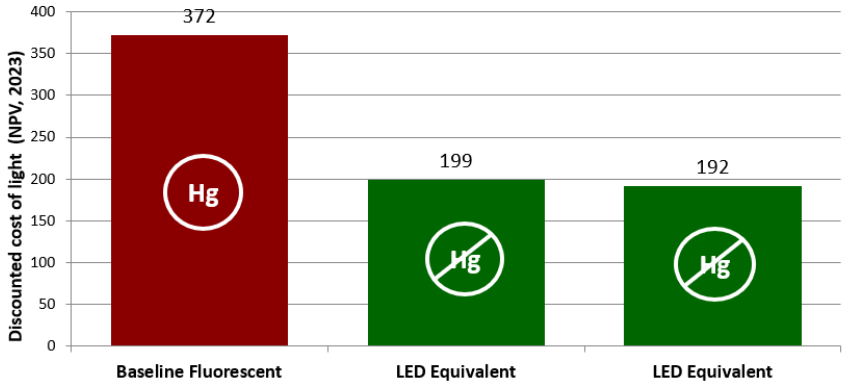
Price for one lamp (SVC):	1	8	5	SVC
Price for one lamp (USD):	1.45	7.75	5.31	US dollars
Lamp wattage:	32	18	18	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	105	59	59	kWh/year
Rated lamp lifetime:	15,000	60,000	30,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	164	98	99	SVC (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	10.8	6.6	months
CO2 emissions due to electricity used for 18 years:	361	203	203	kg CO2/10 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (SVC):	11	23	22	SVC
Price for one lamp (USD):	10.90	22.90	21.70	US dollars
Lamp wattage:	65	32	34	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	214	105	112	kWh/year
Rated lamp lifetime:	8,000	30,000	50,000	Hours
Analysis period for life-cycle assessment:	10	10	10	years
Life-cycle cost for analysis period, discounted to 2023	372	199	192	SVC (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	8.7	8.3	months
CO2 emissions due to electricity used for 15 years:	734	361	384	kg CO2/10 yrs

Suriname

Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Suriname

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	1,550,000	1,430,000	1,310,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	12	11	10	kg of mercury
National electricity savings	1.43	1.34	1.24	TWh of electricity
National financial savings from avoided electricity use	0.08	0.08	0.07	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	0.54	0.50	0.45	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- In 2018, the Caribbean Development Bank approved a loan of $30 million USD to Suriname to replace its 40,000 streetlights with LED lamps.
- Since 2016, the Electricity Act has provided a framework for the adoption of energy efficiency policies in the country.

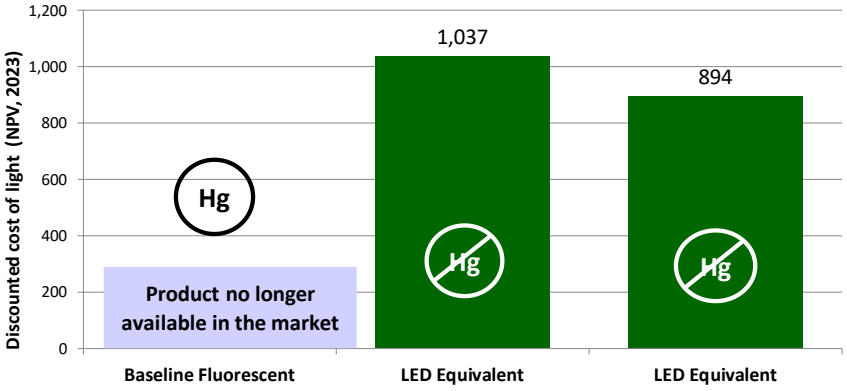
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Suriname.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



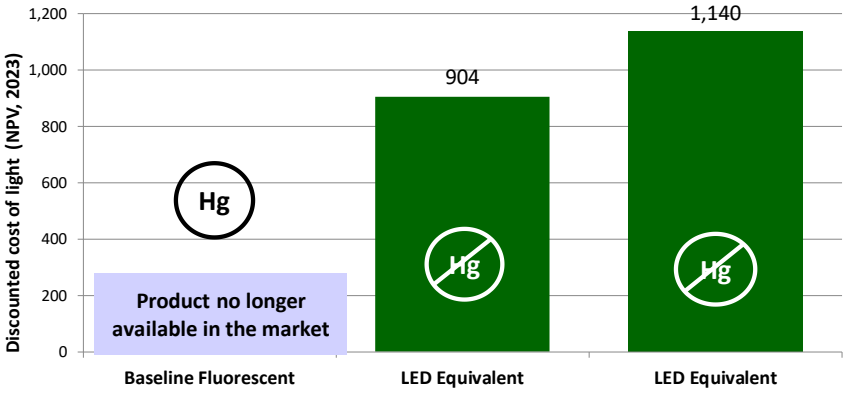
Price for one lamp (SRD):	136	110	SRD
Price for one lamp (USD):	5.50	4.45	US dollars
Lamp wattage:	18	18	Watts
Lamp is on for hours/day:	9	9	hours/day
Annual electricity consumption for each lamp type:	59	59	kWh/year
Rated lamp lifetime:	15,000	30,000	Hours
Analysis period for life-cycle assessment:	9	9	years
Life-cycle cost for analysis period, discounted to 2023	1,037	894	SRD (NPV, 2023)
Simple Payback period in months, compared with LFL:			months
CO2 emissions due to electricity used for 9 years:	258	258	kg CO2/9 yrs

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (SRD):	120	150	SRD
Price for one lamp (USD):	4.86	6.07	US dollars
Lamp wattage:	18	20	Watts
Lamp is on for hours/day:	9	9	hours/day
Annual electricity consumption for each lamp type:	59	66	kWh/year
Rated lamp lifetime:	30,000	20,000	Hours
Analysis period for life-cycle assessment:	9	9	years
Life-cycle cost for analysis period, discounted to 2023	904	1,140	SRD (NPV, 2023)
Simple Payback period in months, compared with LFL:			months
CO2 emissions due to electricity used for 9 years:	258	287	kg CO2/9 yrs

Uruguay

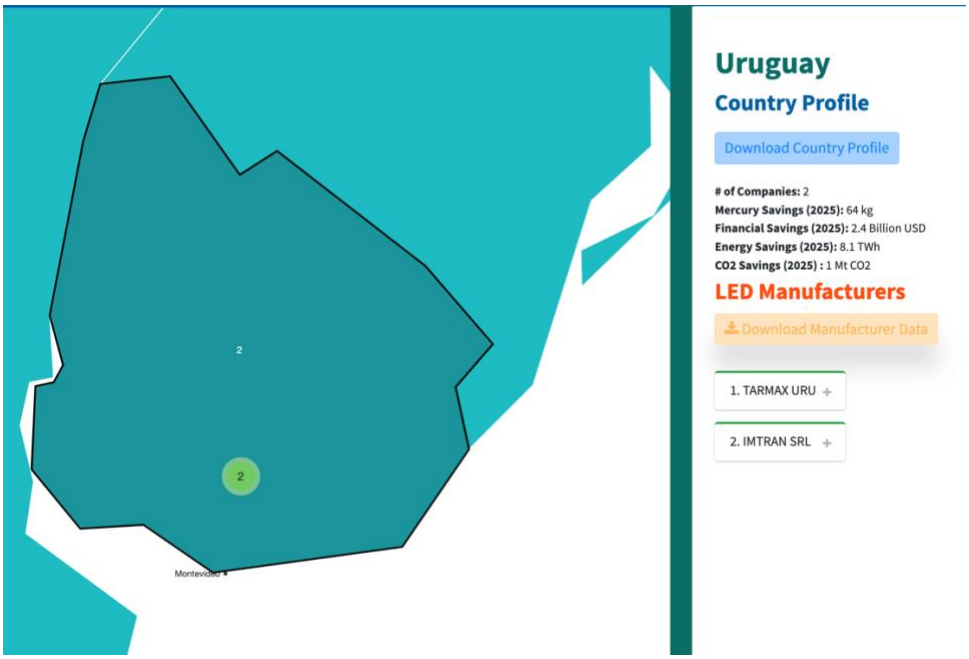
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Uruguay

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	8,520,000	7,780,000	7,050,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	64	58	53	kg of mercury
National electricity savings	8.08	7.45	6.82	TWh of electricity
National financial savings from avoided electricity use	2.39	2.22	2.03	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	1.02	0.93	0.85	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- Decree 15/2019 of the Ministry of Environment of Uruguay (MVOTMA) regulates and promotes the adequate management of mercury-containing products. This includes products covered in Annex A of the Minamata Convention (i.e., compact and linear fluorescent lamps, high-pressure mercury vapor lamps, cold cathode fluorescent lamps, external electrode fluorescent lamps, high-discharge lamps, thermometers, and pressure measuring devices). These products may not exceed the maximum mercury content established in the Minamata Convention.
- Decree 15/2019 also establishes the obligation for importers of mercury-containing products to design and implement a sound end-of-life management system, including the reception, collection, storage, treatment, and destination of the mercury-containing waste.
- In 2013, the MVOTMA, with the support of the UNEP/GEF en.lighten initiative (United for Efficiency), developed its National Efficient Lighting Strategy. This strategy set the goals for phasing out inefficient lamps and certain mercury-containing lamps such as high-pressure mercury lamps used for public lighting. It also presented plans for the sound management of mercury in fluorescent lamps.
- As per CLiC's research partners in Uruguay, fluorescent lamps are not found for sale in the country as of May 2023.

Map of LED Companies in Uruguay



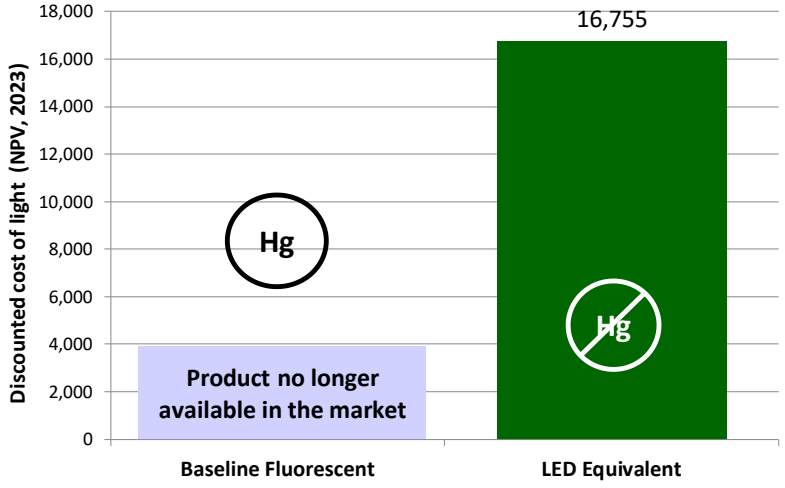
The following tables compare the costs and benefits of fluorescent and LED lighting technologies in Uruguay.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



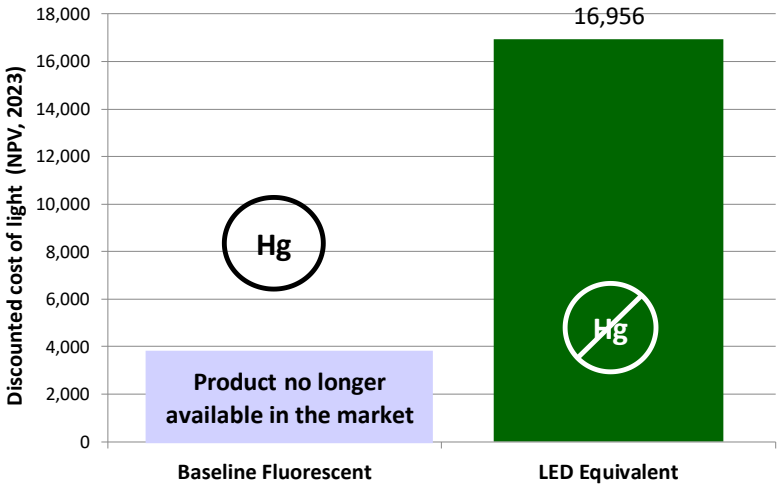
Price for one lamp (UYU):	**199**	***UYU***
Price for one lamp (USD):	**4.83**	***US dollars***
Lamp wattage:	**18**	***Watts***
Lamp is on for hours/day:	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**59**	***kWh/year***
Rated lamp lifetime:	**25,000**	***Hours***
Analysis period for life-cycle assessment:	**7**	***years***
Life-cycle cost for analysis period, discounted to 2023	**16,755**	***UYU (NPV, 2023)***
Simple Payback period in months, compared with LFL:		***months***
CO2 emissions due to electricity used for 7 years:	**65**	***kg CO2/7 yrs***

Linear Fluorescent Lamp - T12

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

LED light sources cost about half as much as fluorescent sources, yet produce the same amount of light from the fixture.



Price for one lamp (UYU):	**400**	***UYU***
Price for one lamp (USD):	**9.72**	***US dollars***
Lamp wattage:	**18**	***Watts***
Lamp is on for hours/day:	**9**	***hours/day***
Annual electricity consumption for each lamp type:	**59**	***kWh/year***
Rated lamp lifetime:	**25,000**	***Hours***
Analysis period for life-cycle assessment:	**7**	***years***
Life-cycle cost for analysis period, discounted to 2023	**16,956**	***UYU (NPV, 2023)***
Simple Payback period in months, compared with LFL:		***months***
CO2 emissions due to electricity used for 7 years:	**65**	***kg CO2/7 yrs***

Venezuela

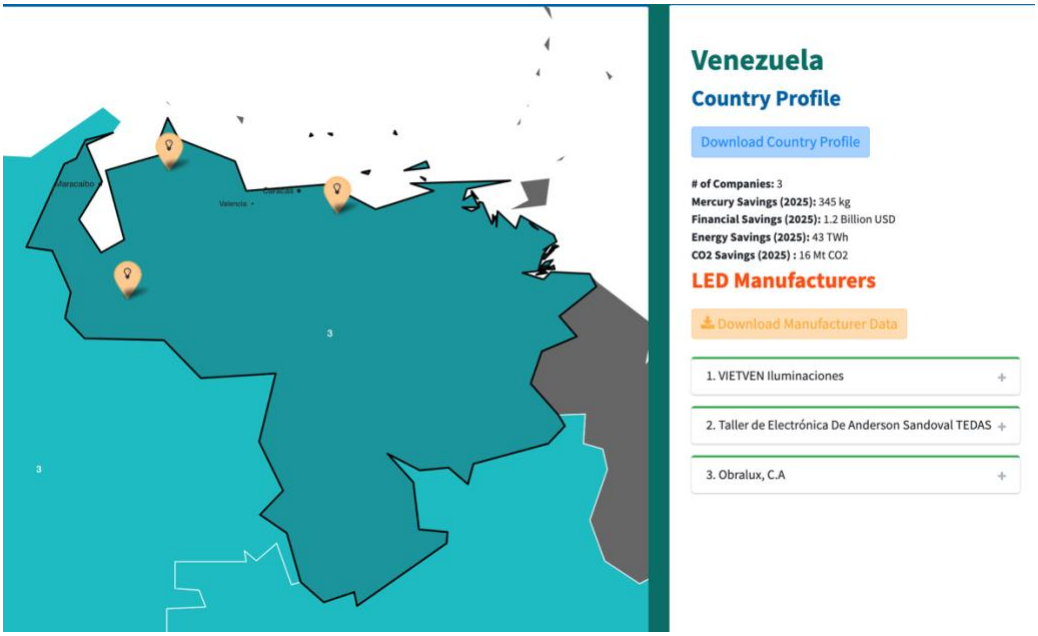
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Venezuela

Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	46,000,000	42,100,000	38,300,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	345	316	287	kg of mercury
National electricity savings	43.2	39.8	36.5	TWh of electricity
National financial savings from avoided electricity use	1.22	1.13	1.03	Billion USD
Total CO_2 emissions mitigated from avoided electricity use	16.1	14.8	13.4	$MTCO_2$

National Policies, Regulations, and Initiatives Around Mercury and Lighting

- The Rational and Efficient Use of Energy Act (UREE) establishes a framework for energy efficiency activities in the country.
- Corpoelec, the national electricity provider, has implemented a Rational and Efficient Use of Energy campaign to educate Venezuelans about energy efficiency and incentivize the transition to more efficient appliances.
- In 2021, Corpoelec announced the distribution of 1.5 million LED bulbs to organized communities, targeting more than 300,000 families.
- In 2022, Corpoelec installed more than 125,000 LED streetlights throughout the country.

Map of LED Companies in Venezuela



The following table compares the costs and benefits of fluorescent and LED lighting technologies in Venezuela.

Linear Fluorescent Lamp - T8

Cost of lighting comparison of purchasing and running (consuming electricity) different light bulbs.

Analysis period for life-cycle assesment is shown, with light bulb and electricity costs discounted back to the present (2023).

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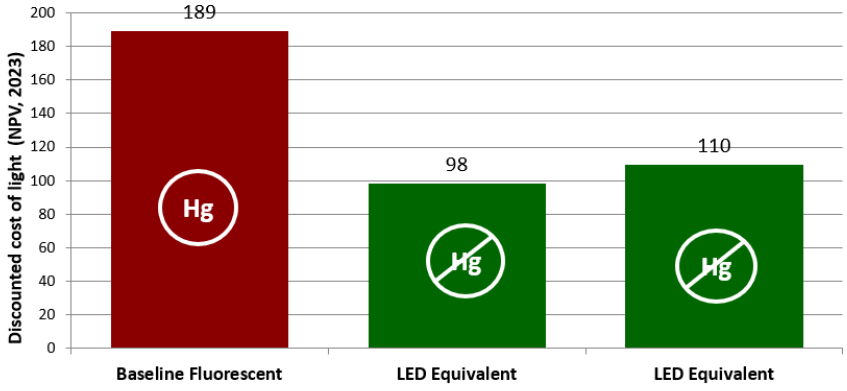

Price for one lamp (USD):	1	5	6	USD
Price for one lamp (USD):	1.20	5.00	6.15	US dollars
Lamp wattage:	36	18	20	Watts
Lamp is on for hours/day:	9	9	9	hours/day
Annual electricity consumption for each lamp type:	118	59	66	kWh/year
Rated lamp lifetime:	10,000	25,000	25,000	Hours
Analysis period for life-cycle assessment:	7	7	7	years
Life-cycle cost for analysis period, discounted to 2023	189	98	110	USD (NPV, 2023)
Simple Payback period in months, compared with LFL:	-	3.4	5.0	months
CO2 emissions due to electricity used for 7 years:	285	143	159	kg CO2/7 yrs

CLiC

END TOXIC LIGHTING TOGETHER