

A nighttime photograph of a city skyline with numerous illuminated skyscrapers and buildings. In the foreground, a highway shows long, bright light trails from moving vehicles. The sky is a deep blue, and the overall scene is lit with a mix of warm yellow and cool blue tones.

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

Clean
Lighting
Coalition

Latin America and Caribbean Region

In 2021 the Clean Lighting Coalition engaged partner organisations in **35 countries across Africa, Latin America and Asia** and gathered over 1200 models of both mercury-containing fluorescent and LED retrofits from those markets.

In April 2021, the African region proposed an amendment to Annex A of the Minamata Convention on Mercury to remove exemptions for mercury-containing fluorescent lamps, phasing out virtually all fluorescents by 2025. While these fluorescent exemptions may have been necessary in 2013 when the Convention was drafted, lighting technology has moved on rapidly – and today, the accessibility and affordability of mercury-free LED retrofit lamps makes the fluorescent lamp exemption unnecessary.

Adopting the proposed amendment at the fourth Conference of Parties (COP4) would lead to an accelerated global transition to LED lighting, which is non-toxic and climate friendly. Specifically, it would:

- avoid **232 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.
- avoid **3.5 gigatons** of CO2 emissions which is equivalent to getting ALL passenger cars (globally) off the road for a whole year.

If adopted, the Latin American Region would avoid



11,300 kilograms

of mercury pollution and



239 mega tons

of CO2 emissions cumulatively 2025-2050.

Countries in green are parties to the Minamata Convention on Mercury.



The data above reflects the benefits of a global fluorescent phase-out to all countries in Latin America and the Caribbean, not just parties to the Minamata Convention on Mercury.

Based on projections from [CLASP's MEPSY model](#), the table below provides country-level projections of avoided CO2 emissions and mercury releases cumulatively 2025-2050.

COUNTRY	CO2 (MT)	MERCURY (KG)
ARGENTINA	20.4	737.9
BAHAMAS	0.5	13.8
BARBADOS	0.3	9.6
BELIZE	0.2	7.1
BOLIVIA	2.2	67.9
BRAZIL	79.4	5042.8
CHILE	14.2	575.5
COLOMBIA	10.5	652.4
COSTA RICA	0.9	78.8
DOMINICAN REPUBLIC	4.0	109.3
ECUADOR	6.8	229.5
EL SALVADOR	1.4	54.4
GUATEMALA	3.2	102.6
GUYANA	0.6	12.8
HAITI	0.5	3.4
HONDURAS	2.3	57.9
JAMAICA	1.2	23.3
MEXICO	56.7	2,207.8
NICARAGUA	0.8	20.9
PANAMA	2.1	74.7
PARAGUAY	0.4	93.6
PERU	8.2	373.1
SURINAME	0.7	19.7
TRINIDAD AND TOBAGO	1.7	57.9
URUGUAY	1.3	104.5
VENEZUELA	19.3	582.0

*Note: Table sums will not match above totals due to rounding. There were not sufficient data to accurately project mercury and CO2 figures for the following countries: Antigua and Barbuda, Cuba, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and St. Vincent and the Grenadines.

Lighting Market Overview

The LAC region is a net importer of fluorescent lamps, with nearly no manufacturing of fluorescent lighting. Most CFL manufacturers have already transitioned to producing LEDs. Furthermore, there are many LED manufacturing and assembly companies in several countries in the region, accounting for an important share of the LAC LED market (19 of the top 50 LED companies in LAC are local, and together, these account for 12.7% of the LAC market share, or 395.72 million USD).

Key LED players in the region are:

- **Mexico** - 4.6% of global exports of LED luminaires and 0.6% of LED packages/dies. LED companies identified include: Construlita, Argos, Iluminación LED Hércules, and LEDsmex
- **Brazil** - 13 of the top 50 LED companies in the region are in Brazil, including Taschibra - 2nd in the region (after Signify) with a market share of 4.4% (131.6 million USD).

As an import-based market, a complete phase-out of fluorescents in this region would further encourage the growth of the local LED industry, stimulating economic growth, generating employment opportunities, and reducing reliance on lighting product importation.

Comparing Costs: LEDs vs CFL/LFL

Based on projections from [CLASP's MEPSY model](#), transitioning to efficient LED lighting would avoid the sale of **893 million compact fluorescent lamps and 913 million linear fluorescent lamps in the GRULAC region**. Taken together, this will avoid 11,300 kilogrammes of mercury in the lamps and save approximately 806 TWh of the GRULAC Region's total electricity consumption between 2025 and 2050. Over the 25-year analysis period, Latin America and the Caribbean would save \$90.9 billion USD and 239 million metric tonnes of CO₂. The following tables detail the comparative cost across countries. Please note that the value in parentheses is the equivalent cost in USD.

TABLE 1

THE TRUE COST OF LIGHT - GENERAL SERVICE LAMPS











 COUNTRY	 CFL PRICE	 LED PRICE	 PAYBACK PERIOD	 ENERGY SAVINGS WITH LED
Antigua & Barbuda	XCD 19.95 (US\$ 7.38)	XCD 18.95 (US\$ 7.01)	Instantaneous	XCD 78.51 (US\$ 29.05)
Belize	BZD 9.75 (US\$ 4.82)	BZD 6.41 (US\$ 3.17)	Instantaneous	BZD 37.58 (US\$ 18.56)
Brazil	BRL 10.9 (US\$ 2.15)	BRL 7.99 (US\$ 1.58)	Instantaneous	BRL 57.78 (US\$ 11.41)
Peru	PEN 9.9 (US\$ 2.64)	PEN 9.9 (US\$ 2.64)	Instantaneous	PEN 76.36 (US\$ 20.38)
Guyana	GYD 700 (US\$ 3.34)	GYD 550 (US\$ 2.64)	Instantaneous	GYD 6,144.66 (US\$ 29.28)
Mexico	MXN 40 (US\$ 1.88)	MXN 42 (US\$ 1.97)	4 months	MXN 89.33 (US\$ 4.26)
Argentina	CFL not available	ARS 249 (US\$ 2.29)	Instantaneous	ARS 891.83 (US\$ 8.22)
Chile	CLP 3,490 (US\$ 4.33)	CLP 2,190 (US\$ 2.72)	Instantaneous	CLP 12,928.53 (US\$ 16.03)
Uruguay	UYU 70 (US\$ 1.63)	UYU 77 (US\$ 1.76)	1.3 months	UYU 627.11 (US\$ 14.42)
Colombia	COP 7,900 (US\$ 1.98)	COP 3,690 (US\$ 0.92)	Instantaneous	COP 58,171.28 (US\$ 15.40)
Jamaica	JMD 393 (US\$ 2.55)	JMD 560 (US\$ 3.61)	6 months	JMD 3,357.89 (US\$ 21.65)
Trinidad & Tobago	TTD 41.65 (US\$ 6.11)	TTD 33.75 (US\$ 4.95)	Instantaneous	TTD 61.75 (US\$ 9.06)
Panama	PAB 1.99 (US\$ 1.99)	PAB 2.99 (US\$ 2.99)	5 months	PAB 23.73 (US\$ 23.73)

TABLE 2

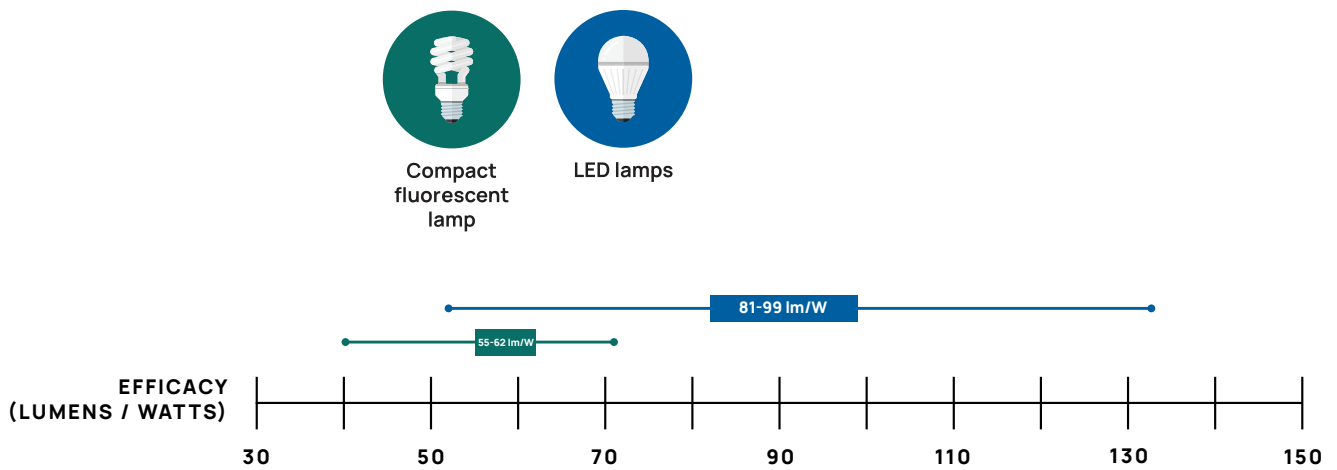
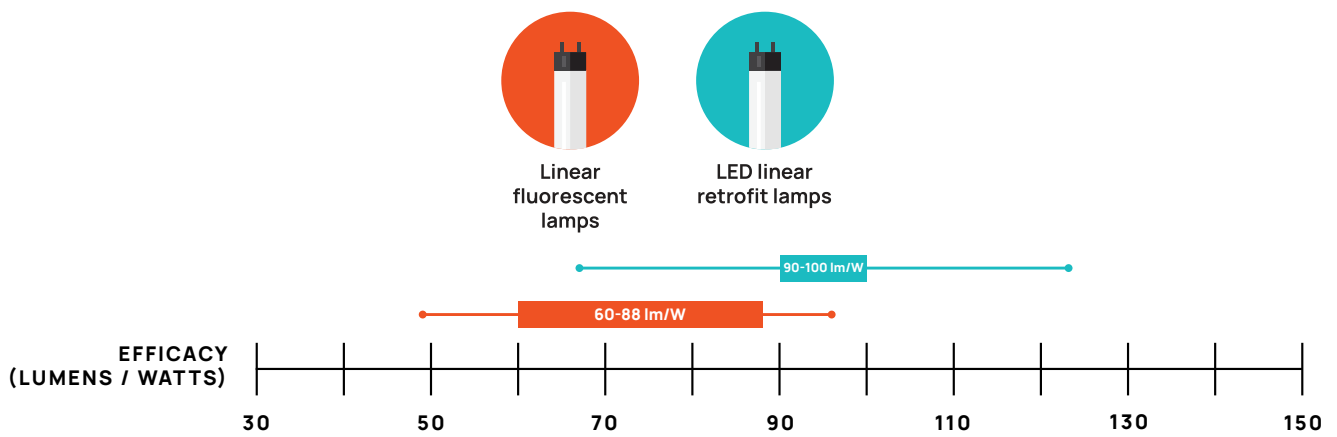
THE TRUE COST OF LIGHT - LINEAR LAMPS

 COUNTRY	 LFL PRICE	 TLED PRICE	 PAYBACK PERIOD	 ENERGY SAVINGS WITH LED
Antigua & Barbuda	XCD 16.48 (US\$ 6.10)	XD 55 (US\$ 20.35)	6 months	XCD 1063.78 (US\$ 393.62)
Belize	BZD 4.50 (US\$ 2.25)	BZD 18 (US\$ 9)	10 months	BZD 101.27 (US\$ 50.03)
Brazil	BRL 14.90 (US\$ 2.94)	BRL 29.99 (US\$ 5.92)	5 months	BRL 271.85 (US\$ 53.70)
Peru	PEN 6.90 (US\$ 1.64)	PEN 14.90 (US\$ 3.98)	4 months	PEN 93.31 (US\$ 24.90)
Guyana	LFL not available	GYD 1,000 (US\$ 4.80)	--	--
Mexico	LFL not available	MXN 174 (US\$ 8.31)	--	--
Argentina	LFL not available	ARS 399 (US\$ 3.68)	--	--
Chile	CLP 1,790 (US\$ 2.15)	CLP 2,390 (US\$ 2.96)	2 months	CLP 25,519 (US\$ 31.64)
Uruguay	LFL not available	UYU 199 (US\$ 4.60)	--	--
Colombia	COP 2,200 (US\$ 0.55)	COP 7,900 (US\$ 1.98)	4 months	COP 161,105.84 (US\$ 42.66)
Jamaica	JMD 488 (US\$3.15)	JMD 718.75 (US\$ 4.60)	7 weeks	JMD 7,217 (US\$ 46.53)
Trinidad & Tobago	TTD 70 (US\$ 10.50)	TTD 45 (US\$ 6.60)	Instantaneous	TTD 312.72 (US\$ 47.19)
Panama	PAB 1.59 (US\$ 1.59)	PAB 3.99 (US\$ 3.99)	4 months	PAB 29.45 (US\$ 29.45)

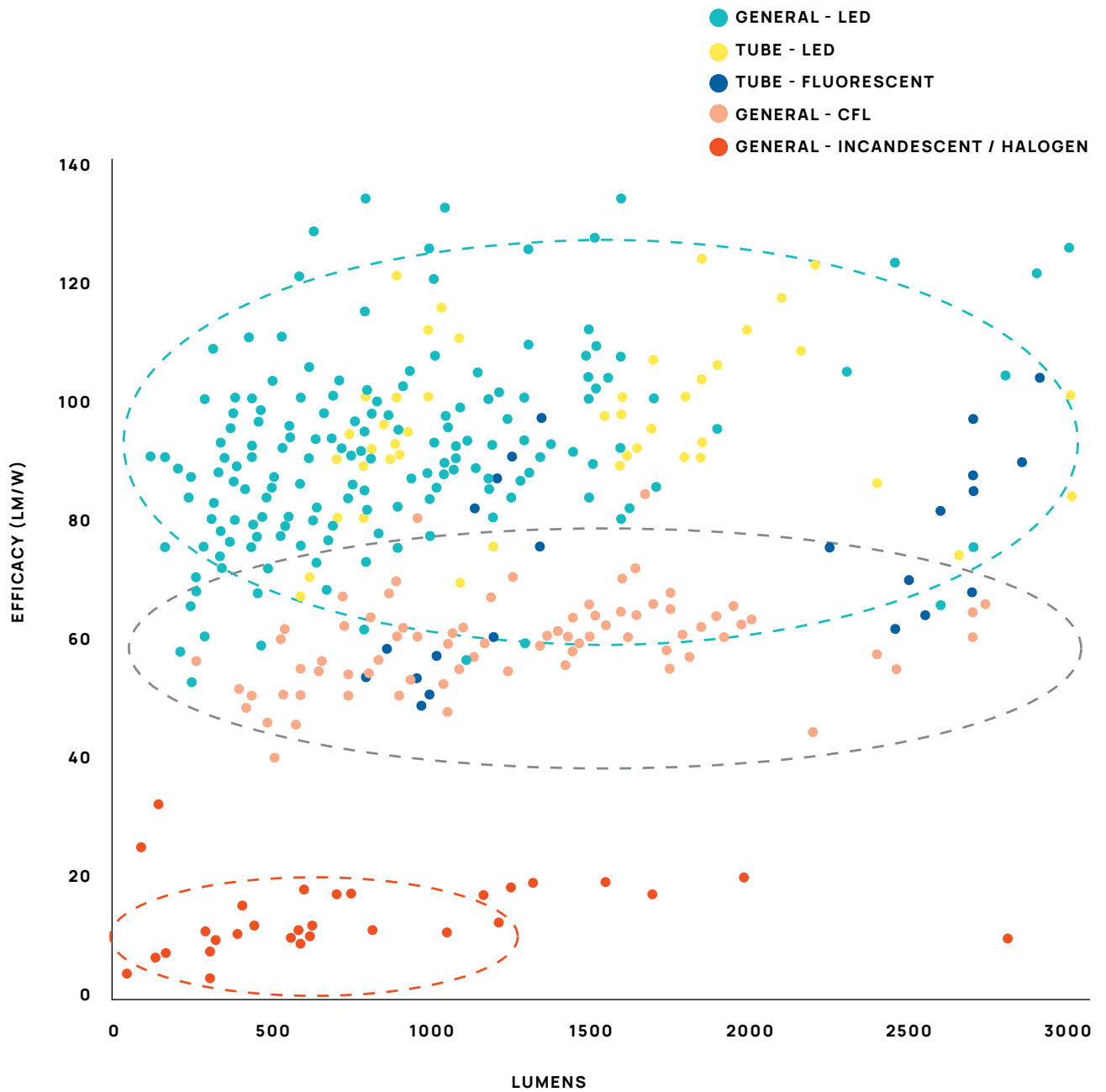
Energy Efficiency Comparison

The energy efficiency of a light bulb is measured in lumens/watt.

Based on data collected in Q4 2021, the scales below depict the ranges of energy efficiency of different types of bulbs available across LAC markets.



The graph below shows the energy efficiency of individual samples collected across the region. LEDs are up to 2-3 times more efficient than the other lighting technologies, therefore use less overall electricity to provide the same or better lighting service.



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:

- **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.
- **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.
- **Mexico** - [NOM-030-ENER-2016](#) establishes minimum energy efficiency and safety standards for LED lamps. Having these standards is an important step to ensure the quality of the LEDs available in the local market.
- **Argentina** - [Efficient Lighting Plan \(PLAE\)](#) will replace existing luminaires in public lighting by LED technology.

Compatibility/Retrofits for LED tubes

In all LAC markets where data was collected, LED retrofits were easily available for both general service lamps and tube 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 tubes 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

Collecting fluorescent lamps at the end of life has been a global challenge since the introduction of fluorescents. In addition, mercury released during the lifecycle of fluorescent lamps contaminate the atmosphere, land, and water. This contamination may occur from lamp breakage when old lamps are comingled with general household waste, and during installation, collection, or transport of discarded lamps, processing, or recycling of spent lamps, or when lamps are landfilled, incinerated, or otherwise disposed of.

Collection and safe recycling/disposal of fluorescent lamps is difficult – especially in regions with low levels of general e-waste collection and processing. Several e-waste or mercury waste regulations are in force in countries in the region, such as Uruguay, Mexico, and Colombia. Mercury treatment facilities have been identified in the region, however, there are still important awareness, logistics and infrastructure issues that limit the region's capabilities to manage mercury-containing lamps soundly at end-of-life. There are few fluorescent lamps recycling programs, and they are usually focused on commercial rather than residential users. Some companies and non-governmental organizations, such as Alianza Contaminación Cero in Panama, are working on awareness-raising campaigns and encouraging governments to enforce fluorescent lamp recycling programs. Some local businesses have lamp collection programs in place, and the United Nations Environment Programme has supported several governments in the region in the development mercury inventories and sound end-of-life policy proposals. 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 this year](#). While LED lamps are also considered e-waste, they are not toxic or considered hazardous waste.



Annex of Country Level Data

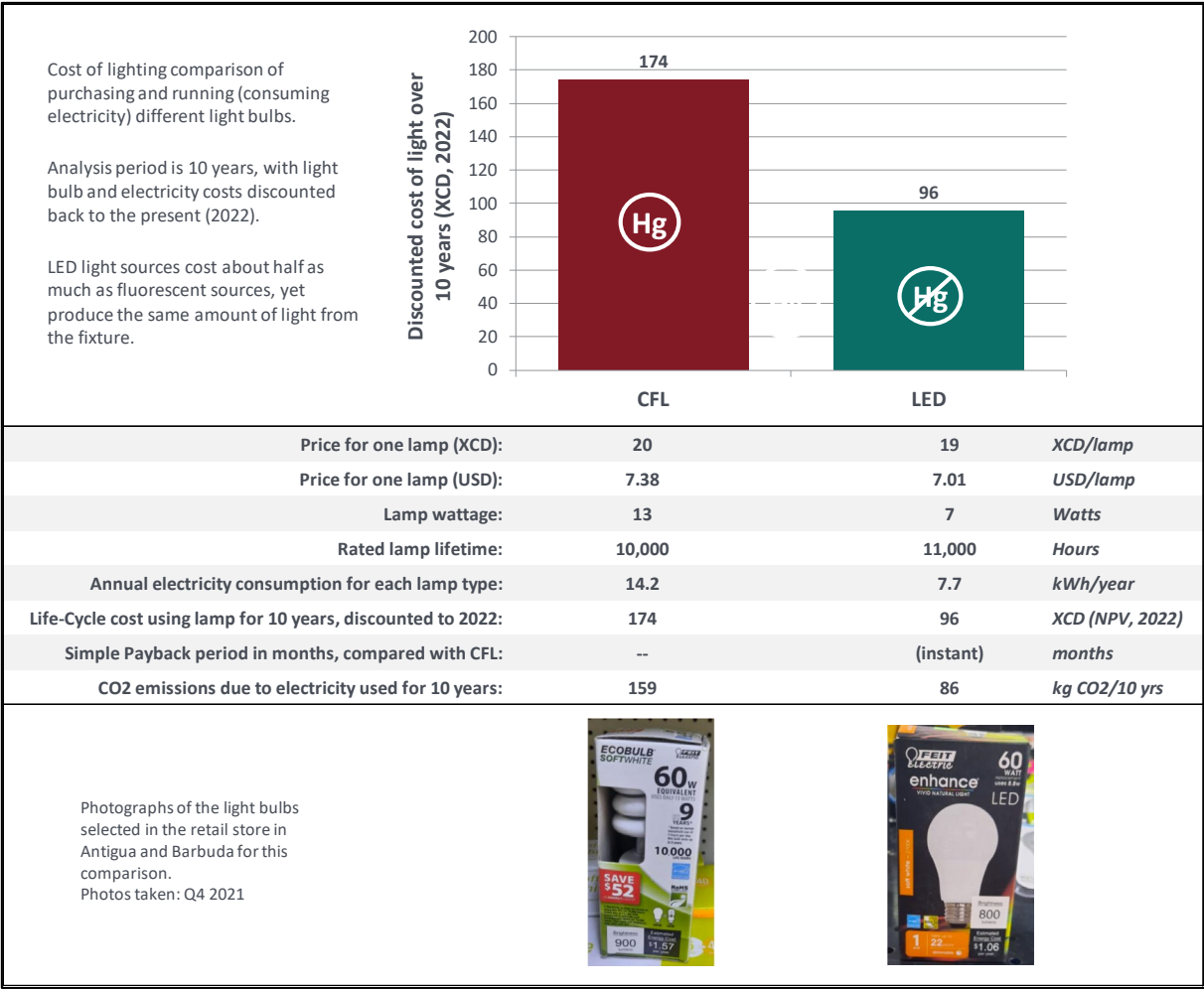
Antigua & Barbuda



Important information about mercury and lighting in Antigua & Barbuda:

- There are mandatory energy efficiency labels and testing methods 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, 2005 was created to maintain the distribution and pollution by solid waste in the country of Antigua and Barbuda. 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 use of proper disposal methods and containers. The organisation carried out its first project, Phase Down/Phase Out Mercury with the aim of decreasing the amount of mercury on the islands by 10% to 20%. The project was executed from 2019 to 2021.
- The Mercury Phase Out Programme, implemented by The Marine Protected Areas Trust, the Medical Association of Antigua and Barbuda, the Christian Union Church, and Zero Waste Antigua and Barbuda, supported by GEF/UNDP, raised awareness about mercury in fluorescent lamps and placed lamp collection bins throughout the country. With this program, an amount equivalent to 5% of the fluorescent lamps sold in the country each year were collected, destroyed and contained.
- Findings of the market study carried out by our NGO partners show that LED lamps for general use are already more affordable than CFLs in Antigua and Barbuda.

The box below offers an economic analysis of a compact fluorescent lamp (CFL) and two light emitting diode (LED) retrofit bulbs. All of these lamps were selected and photographed in a retail store in Antigua & Barbuda. Switching to LED in Antigua & Barbuda offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately XCD 78 over the lifetime of the LED retrofit lamp.

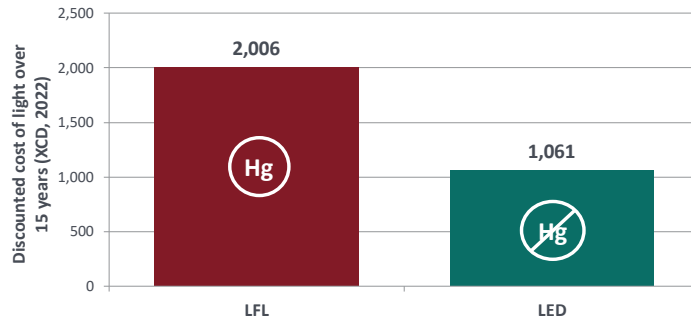


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Antigua & Barbuda. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately XCD 1000 over the lifetime of the LED lamp, yet the LED only costs XCD 60 more at the time of purchase.

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

Analysis period is 15 years, with light bulb and electricity costs discounted back to the present (2022).

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):	16	75	XCD/lamp
Price for one lamp (USD):	6.10	27.77	USD/lamp
Lamp wattage:	40	20	Watts
Rated lamp lifetime:	24,000	50,000	Hours
Annual electricity consumption for each lamp type:	131.4	65.7	kWh/year
Life-Cycle cost using lamp for 15 years, discounted to 2022:	2,006	1,061	XCD (NPV, 2022)
Simple Payback period in months, compared with LFL:	--	10.7	months
CO2 emissions due to electricity used for 15 years:	2,208	1,104	kg CO2/15 yrs

Photographs of the light bulbs selected in the retail store in Antigua and Barbuda for this comparison.



Argentina

Table 2. Quantifying the Benefits of the African Lighting Amendment in Argentina

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	58,464,107 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	59,407,335 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	738 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	52.5 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 5.8 billion

Important information about mercury and lighting in Argentina:

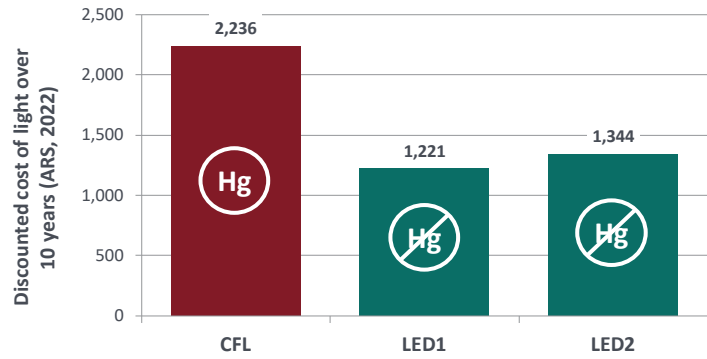
- Resolution 71/2019 established the need for a Prior Informed Consent for import and export of products with added mercury.
- Resolution 75/2019 prohibited the production, import and export of products with mercury as of January 1, 2020, as specified in the Minamata Convention Annex A, including compact 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 the replacement of public lighting by LED technology. The incorporation of this higher efficiency technology can represent up to 50% of 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 Provinces and / or Municipalities of the country 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.
 - Speed of execution of work.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Argentina. Switching to LED in Argentina can offer an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately ARS 1000 over the lifetime of the LED retrofit lamp.

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

Analysis period is 10 years, with light bulb and electricity costs discounted back to the present (2022).

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):	249	369	249	ARS/lamp
Price for one lamp (USD):	2.47	3.65	2.47	USD/lamp
Lamp wattage:	15	7	9	Watts
Rated lamp lifetime:	6,000	11,000	11,000	Hours
Annual electricity consumption for each lamp type:	16.4	7.7	9.9	kWh/year
Life-Cycle cost using lamp for 10 years, discounted to 2022:	2,236	1,221	1,344	ARS (NPV, 2022)
Simple Payback period in months, compared with CFL:	--	14.8	(instant)	months
CO2 emissions due to electricity used for 10 years:	57	27	34	kg CO2/10 yrs

Photographs of the light bulbs selected in the retail store in Argentina for this comparison. Photos taken: Q4 2021



Belize

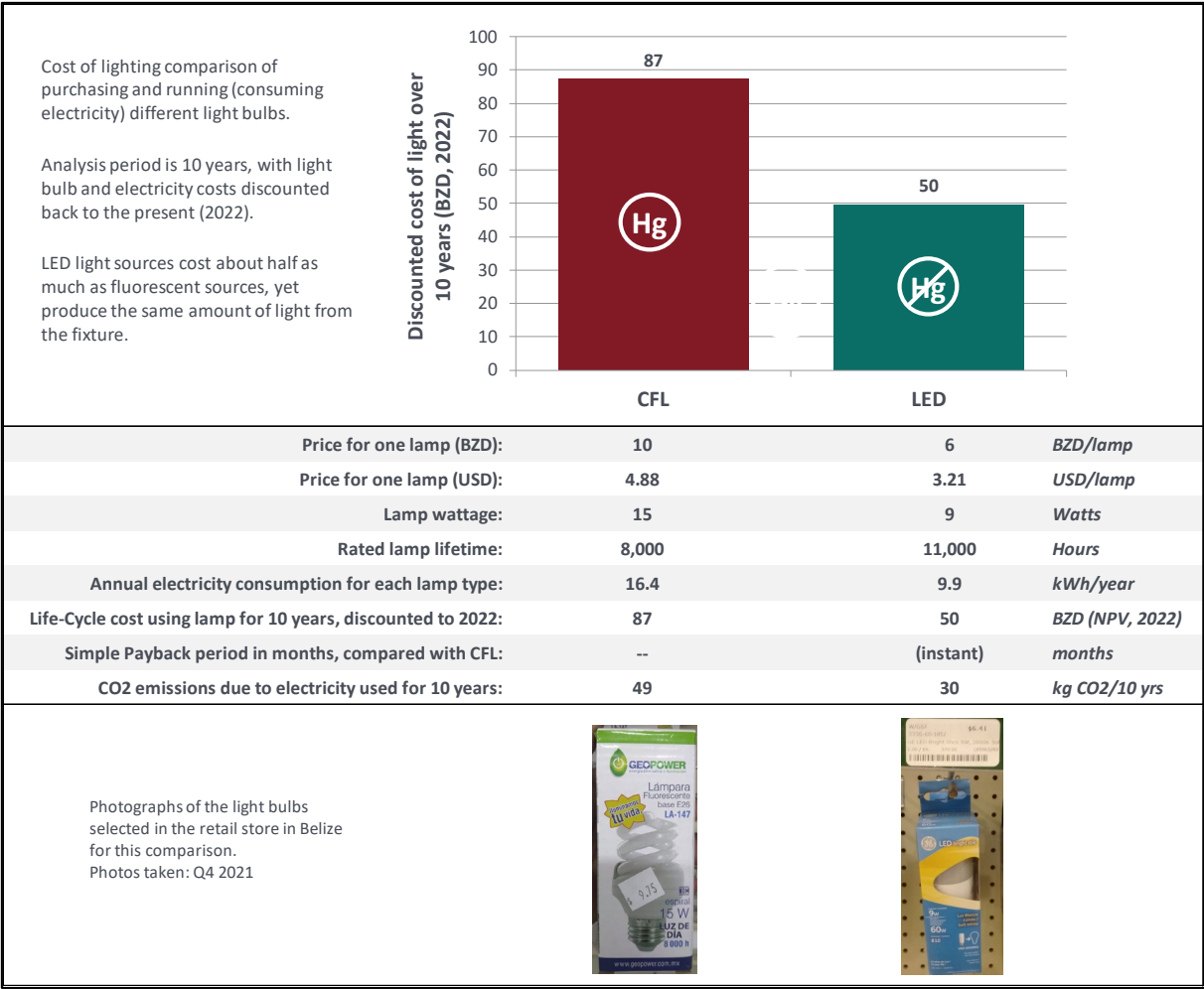
Table 3. Quantifying the Benefits of the African Lighting Amendment in Belize

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	601,034 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	544,158 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	7 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	0.5 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 87.1 million

Important information about mercury and lighting in Belize:

- In 2013, Belize 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).
- Energy efficiency is the first priority of Belize’s five pillars that constitute its Sustainable Energy Roadmap 2030. In this framework, Belize is working to develop energy standards and labels for lighting and other appliances, with the support of the OAS-SECBI.
- The Energy Unit within the Ministry of the Public Service, Energy and Public Utilities in collaboration with the electrical students of ITVET Stann Creek, carried out energy conservation measures by installing LED lights in public buildings. A total of 185 LED tubes were installed. Five years of operations of fluorescents tubes would cost a total of \$55,302.91. The LED replacements will cost \$27,651.46 for the same use within the same 5-year period. This reflects a combined savings of \$27,651.46, accumulated over the next 5 years, for replacing the fluorescent with LEDs.
- Findings of the market study carried out by our NGO partners show that LED lamps for general use are already more affordable than CFLs in Belize.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Belize. Switching to LED in Belize offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes roughly half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately BZD 37 over the lifetime of the LED retrofit lamp.

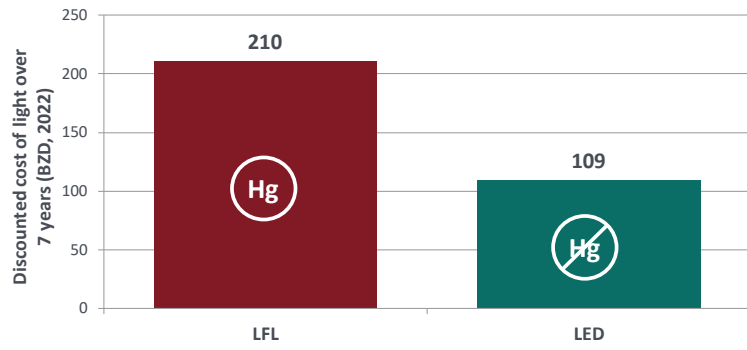


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Belize. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately BZD 100 over the lifetime of the LED lamp, yet the LED only costs BZD 13 more at the time of purchase.

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

Analysis period is 7 years, with light bulb and electricity costs discounted back to the present (2022).

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):	5	18	<i>BZD/lamp</i>
Price for one lamp (USD):	2.25	9.00	<i>USD/lamp</i>
Lamp wattage:	20	9	<i>Watts</i>
Rated lamp lifetime:	13,000	25,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	65.7	29.6	<i>kWh/year</i>
Life-Cycle cost using lamp for 7 years, discounted to 2022:	210	109	<i>BZD (NPV, 2022)</i>
Simple Payback period in months, compared with LFL:	--	10.2	<i>months</i>
CO2 emissions due to electricity used for 7 years:	138	62	<i>kg CO2/7 yrs</i>

Photographs of the light bulbs selected in the retail store in Belize for this comparison.
Photos taken: Q4 2021



Brazil

Table 4. Quantifying the Benefits of the African Lighting Amendment in Brazil

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	398,190,706 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	406,911,926 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	5,043 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	357.3 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 46.4 billion

Important information about mercury and lighting in Brazil:

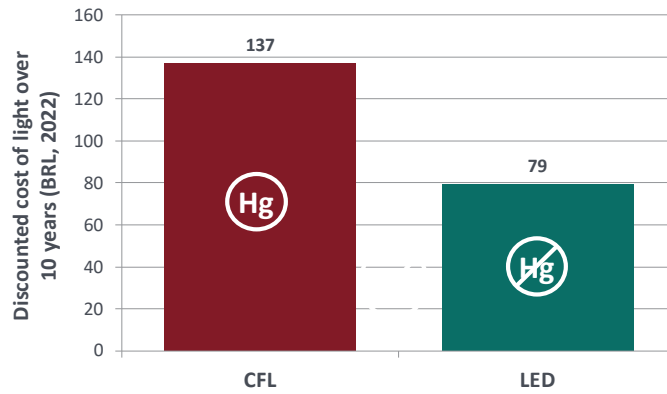
- [The 2050 National Energy Plan \(PNE 2050, in the Portuguese acronym\)](#) was launched by the Ministry of Mines and Energy (MME) and the Brazilian Energy Research Company (EPE). Energy policy making for the next 30 years will be supported by its analysis and projections of economic growth, demand for energy and output potential.
- Thirteen of the top 50 LED companies in the Latin American and Caribbean region are in Brazil, including Taschibra - 2nd in the region (after Signify) with a market share of 4.4% (131.6 million USD).
- The Brazilian Development Bank (BNDES) and the Ministry of Mines and Energy (MME) are offering financial instruments to transition public lighting to LED. 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 thousand fixtures to LED, benefitting over 7 million people. BNDES has also funded energy efficiency projects in small and medium 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.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Brazil. Switching to LED in Brazil offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately BRL 58 over the lifetime of the LED retrofit lamp.

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

Analysis period is 10 years, with light bulb and electricity costs discounted back to the present (2022).

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 (BRL):	11	8	<i>BRL/lamp</i>
Price for one lamp (USD):	1.96	1.44	<i>USD/lamp</i>
Lamp wattage:	15	9	<i>Watts</i>
Rated lamp lifetime:	6,000	11,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	16.4	9.9	<i>kWh/year</i>
Life-Cycle cost using lamp for 10 years, discounted to 2022:	137	79	<i>BRL (NPV, 2022)</i>
Simple Payback period in months, compared with CFL:	--	(instant)	<i>months</i>
CO2 emissions due to electricity used for 10 years:	33	20	<i>kg CO2/10 yrs</i>

Photographs of the light bulbs selected in the retail store in Brazil for this comparison.
Photos taken: Q4 2021

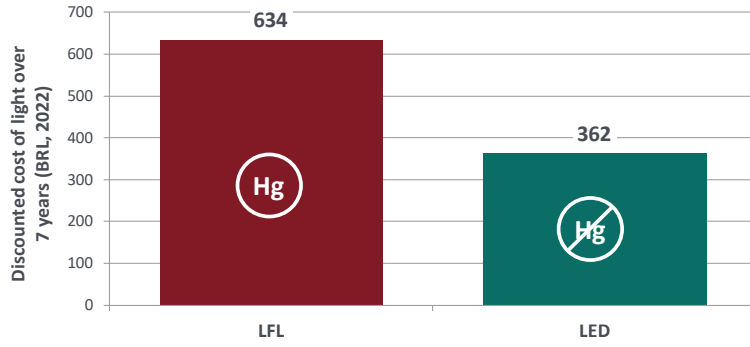


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Brazil. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately BRL 270 over the lifetime of the LED lamp, yet the LED only costs BRL 15 more at the time of purchase.

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

Analysis period is 7 years, with light bulb and electricity costs discounted back to the present (2022).

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 (BRL):	15	30	<i>BRL/lamp</i>
Price for one lamp (USD):	2.68	5.40	<i>USD/lamp</i>
Lamp wattage:	36	20	<i>Watts</i>
Rated lamp lifetime:	10,000	25,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	118.3	65.7	<i>kWh/year</i>
Life-Cycle cost using lamp for 7 years, discounted to 2022:	634	362	<i>BRL (NPV, 2022)</i>
Simple Payback period in months, compared with LFL:	--	4.8	<i>months</i>
CO2 emissions due to electricity used for 7 years:	166	92	<i>kg CO2/7 yrs</i>

Photographs of the light bulbs selected in the retail store in Brazil for this comparison.
Photos taken: Q4 2021



Chile

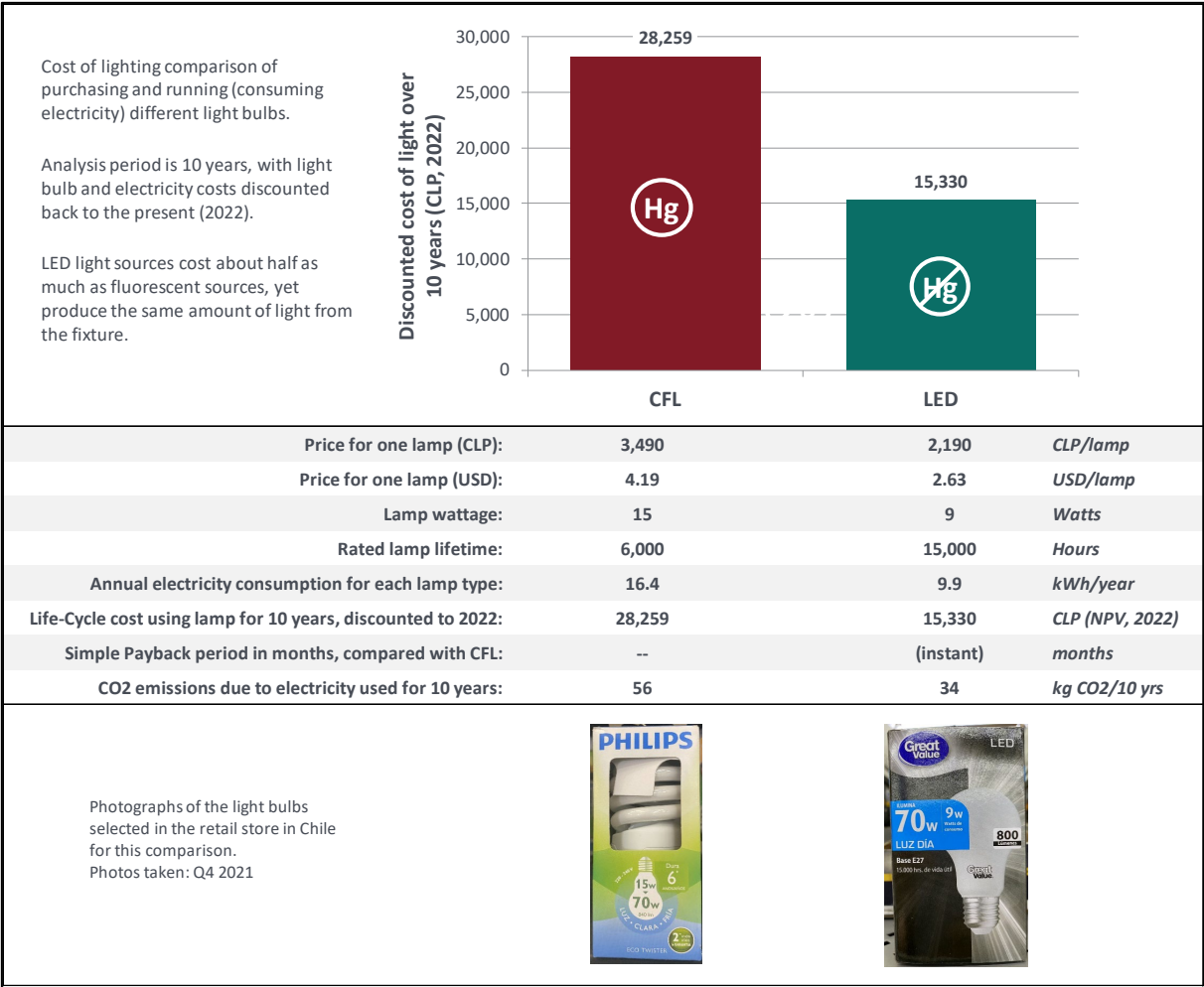
Table 5. Quantifying the Benefits of the African Lighting Amendment in Chile

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	41,440,676 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	49,100,400 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	575 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	42.4 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 6.8 billion

Important information about mercury and lighting in Chile:

- In 2013, the Ministry of Energy of Chile 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: 40 lm/W by 2021, 70 lm/W by 2023, 85 lm/W by 2025. This update effectively phases out fluorescent lamps as they do not currently reach those minimum energy performance standards, and makes 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 should lead to cumulative savings of US\$15.2 billion and a reduction of 28.6Mt of CO₂.
- 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. ...

The box below offers an economic analysis of a CFL and LED retrofit bulbs. Both of these lamps were selected and photographed in a retail store in Chile. Switching to LED in Chile offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately CLP 13,000 over the lifetime of the LED retrofit lamp.

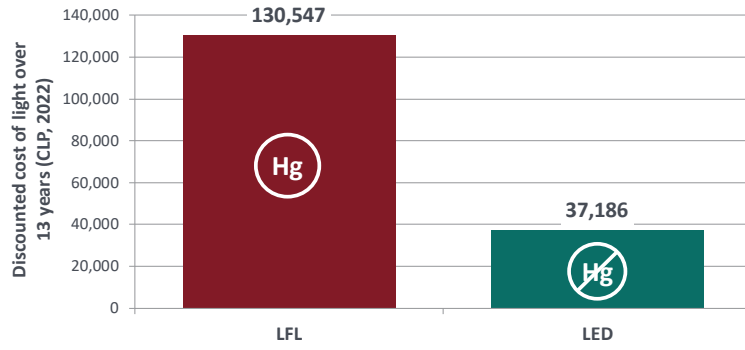


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Chile. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately CLP 93,000 over the lifetime of the LED lamp, yet the LED only costs CLP 900 more at the time of purchase.

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

Analysis period is 13 years, with light bulb and electricity costs discounted back to the present (2022).

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 (CLP):	2,590	3,490	CLP/lamp
Price for one lamp (USD):	3.11	4.19	USD/lamp
Lamp wattage:	60	15	Watts
Rated lamp lifetime:	2,000	6,000	Hours
Annual electricity consumption for each lamp type:	65.7	16.4	kWh/year
Life-Cycle cost using lamp for 13 years, discounted to 2022:	130,547	37,186	CLP (NPV, 2022)
Simple Payback period in months, compared with LFL:	--	1.6	months
CO2 emissions due to electricity used for 13 years:	290	73	kg CO2/13 yrs

Photographs of the light bulbs selected in the retail store in Chile for this comparison.
Photos taken: Q4 2021



Colombia

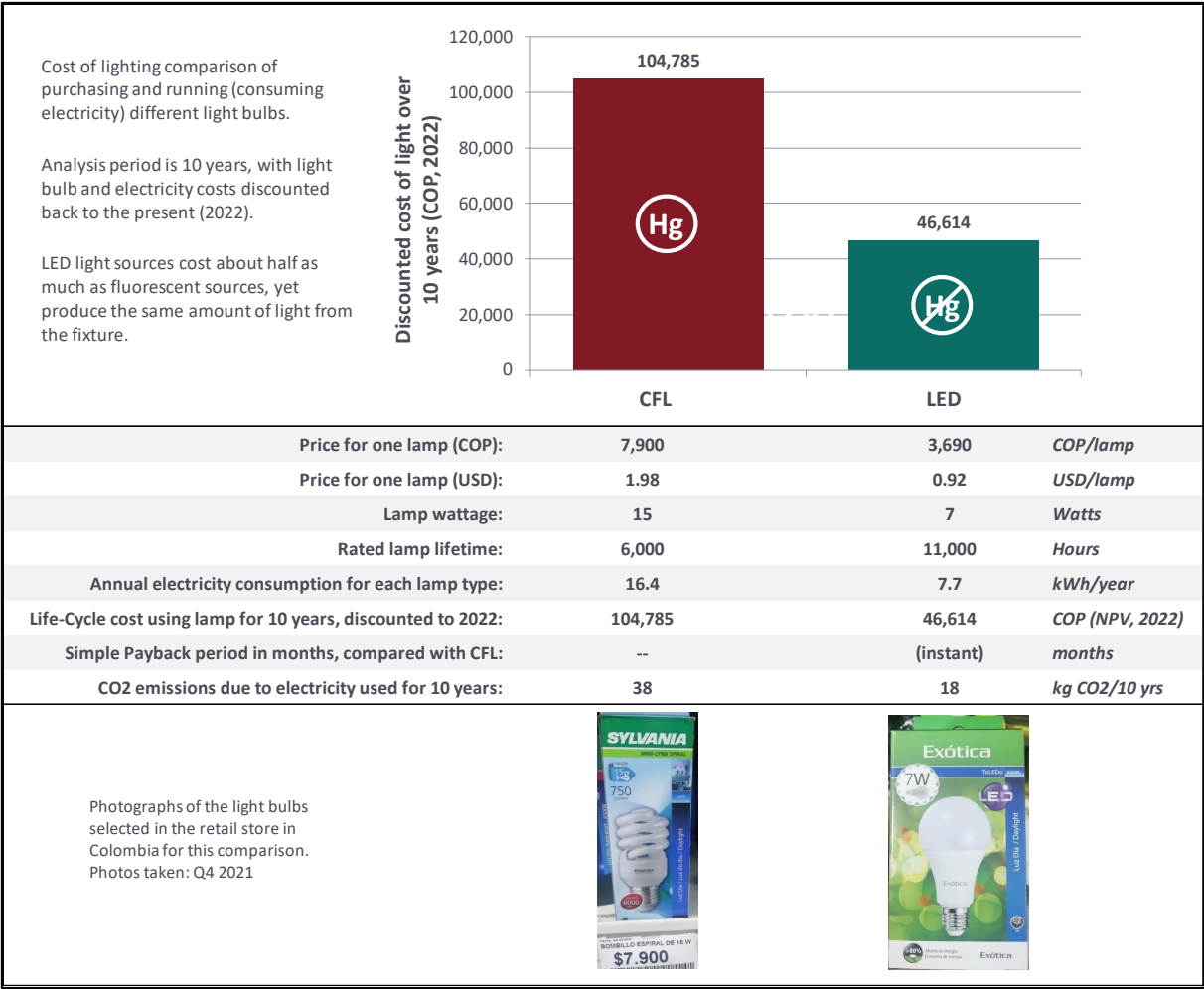
Table 7. Quantifying the Benefits of the African Lighting Amendment in Colombia

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	53,836,977 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	51,095,607 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	652 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	45.3 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 6.34 billion

Important information about mercury and lighting in Colombia:

- On April 23rd, 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 the Technical Guidelines for General and Public Lighting (RETILAP). This document provides thorough minimum energy performance standards, testing parameters, and labelling requirements for all lighting appliances in Colombia. The document has been updated several times since its release.
- Findings of the market study carried out by our NGO partners show that LED lamps for general use are already more affordable than CFLs in Colombia.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Colombia. Switching to LED in Colombia offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately COP 57,000 over the lifetime of the LED retrofit lamp.

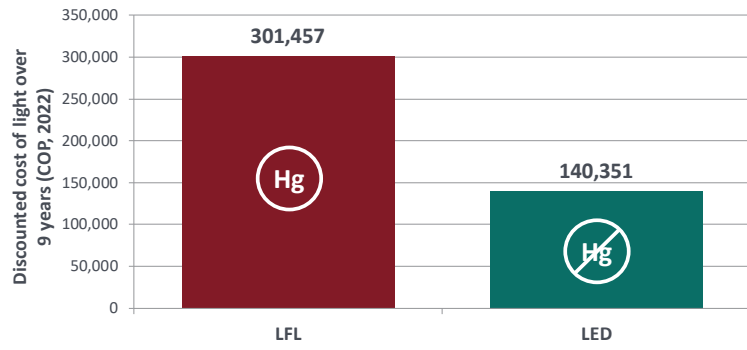


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Colombia. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately COP160,000 over the lifetime of the LED lamp, yet the LED only costs COP 5,700 more at the time of purchase.

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

Analysis period is 9 years, with light bulb and electricity costs discounted back to the present (2022).

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):	2,200	7,900	<i>COP/lamp</i>
Price for one lamp (USD):	0.55	1.98	<i>USD/lamp</i>
Lamp wattage:	18	8	<i>Watts</i>
Rated lamp lifetime:	20,000	30,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	59.1	26.3	<i>kWh/year</i>
Life-Cycle cost using lamp for 9 years, discounted to 2022:	301,457	140,351	<i>COP (NPV, 2022)</i>
Simple Payback period in months, compared with LFL:	--	3.7	<i>months</i>
CO2 emissions due to electricity used for 9 years:	123	55	<i>kg CO2/9 yrs</i>

Photographs of the light bulbs selected in the retail store in Colombia for this comparison. Photos taken: Q4 2021



Guyana

Table 8. Quantifying the Benefits of the African Lighting Amendment in Guyana

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	1,092,383 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	978,623 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	13 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	1.0 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 238 million

Important information about mercury and lighting in Guyana:

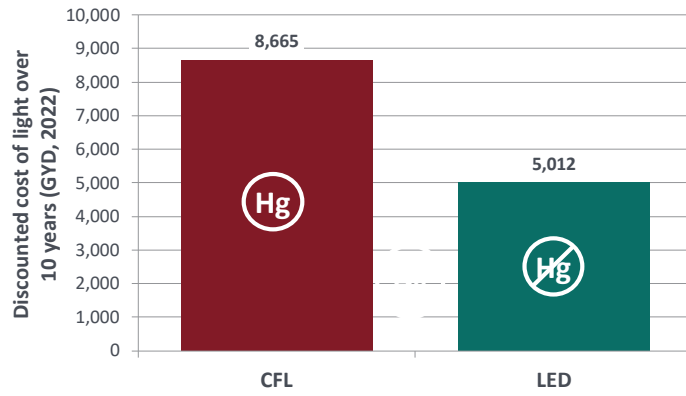
- The Guyana Energy Agency installed in excess of 602 Stand Alone Solar Powered LED Street Lights installed across all 10 Administrative Regions.
- Under the Hinterland LED Lighting Project the Guyana Energy Agency initiated an energy conservation initiative that will replace energy inefficient lights with energy efficient lights. Beneficiaries are customers of the 6 hinterland utilities.
- Findings of the market study carried out by our NGO partners show that LED lamps for general use are already more affordable than CFLs in Guyana. Moreover, Linear fluorescent lamps were not available for purchase in local stores, with TLEDs being the only available option.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Guyana. Switching to LED in Guyana offers a 9.7 month payback, meaning the LED lamp pays back the incrementally higher cost of the LED lamp through electricity savings. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately GYD 3,600 over the lifetime of the LED retrofit lamp.

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

Analysis period is 10 years, with light bulb and electricity costs discounted back to the present (2022).

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):	400	700	<i>GYD/lamp</i>
Price for one lamp (USD):	1.92	3.36	<i>USD/lamp</i>
Lamp wattage:	13	7	<i>Watts</i>
Rated lamp lifetime:	10,000	25,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	14.2	7.7	<i>kWh/year</i>
Life-Cycle cost using lamp for 10 years, discounted to 2022:	8,665	5,012	<i>GYD (NPV, 2022)</i>
Simple Payback period in months, compared with CFL:	--	9.7	<i>months</i>
CO2 emissions due to electricity used for 10 years:	87	47	<i>kg CO2/10 yrs</i>

Photographs of the light bulbs selected in the retail store in Guyana for this comparison.
Photos taken: Q4 2021



Jamaica

Table 9. Quantifying the Benefits of the African Lighting Amendment in Jamaica

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	1,905,188 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	1,838,319 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	23 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	1.7 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 750 million

Important information about mercury and lighting in Jamaica:

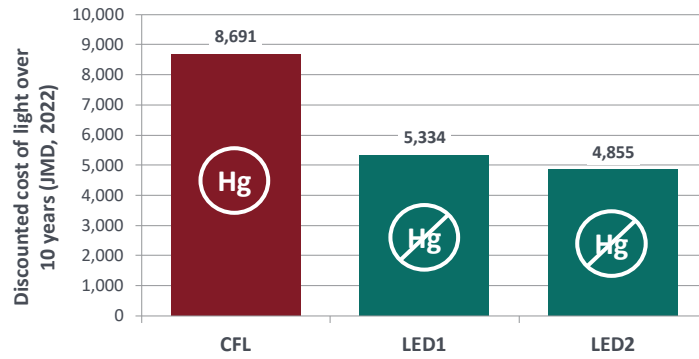
- The Jamaica Public Service Company Limited, with the support of USTDA, is implementing a project to transition 110,000 streetlights to LED, as well as installing intelligent controls and metering capabilities for revenue generation.
- As of 2020, two-thirds of the public lighting in Jamaica was LED.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

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Jamaica. Switching to LED in Jamaica offers 6-7 month payback compared with CFL, meaning the LED lamp pays for its incrementally higher price through electricity bill savings in 6-7 months. The LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately JMD 3,700 over the lifetime of the LED retrofit lamp.

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

Analysis period is 10 years, with light bulb and electricity costs discounted back to the present (2022).

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):	395	560	612	JMD/lamp
Price for one lamp (USD):	2.53	3.58	3.92	USD/lamp
Lamp wattage:	15	9	8	Watts
Rated lamp lifetime:	6,000	11,000	11,000	Hours
Annual electricity consumption for each lamp type:	16.4	9.9	8.8	kWh/year
Life-Cycle cost using lamp for 10 years, discounted to 2022:	8,691	5,334	4,855	JMD (NPV, 2022)
Simple Payback period in months, compared with CFL:	--	6.2	7.0	months
CO2 emissions due to electricity used for 10 years:	89	53	47	kg CO2/10 yrs

Photographs of the light bulbs selected in the retail store in Jamaica for this comparison. Photos taken: Q4 2021

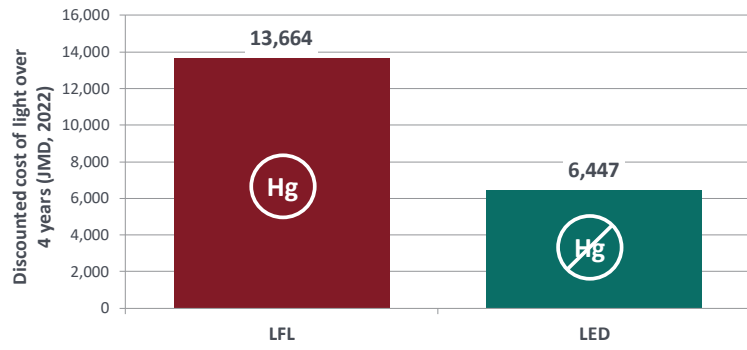


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Jamaica. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately JMD 7,000 over the lifetime of the LED lamp, yet the LED only costs JMD 250 more at the time of purchase.

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

Analysis period is 4 years, with light bulb and electricity costs discounted back to the present (2022).

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):	488	719	<i>JMD/lamp</i>
Price for one lamp (USD):	3.12	4.60	<i>USD/lamp</i>
Lamp wattage:	20	9	<i>Watts</i>
Rated lamp lifetime:	13,000	15,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	65.7	29.6	<i>kWh/year</i>
Life-Cycle cost using lamp for 4 years, discounted to 2022:	13,664	6,447	<i>JMD (NPV, 2022)</i>
Simple Payback period in months, compared with LFL:	--	5.5	<i>months</i>
CO2 emissions due to electricity used for 4 years:	142	64	<i>kg CO2/4 yrs</i>

Photographs of the light bulbs selected in the retail store in Jamaica for this comparison.
Photos taken: Q4 2021



Mexico

Table 10. Quantifying the Benefits of the African Lighting Amendment in Mexico

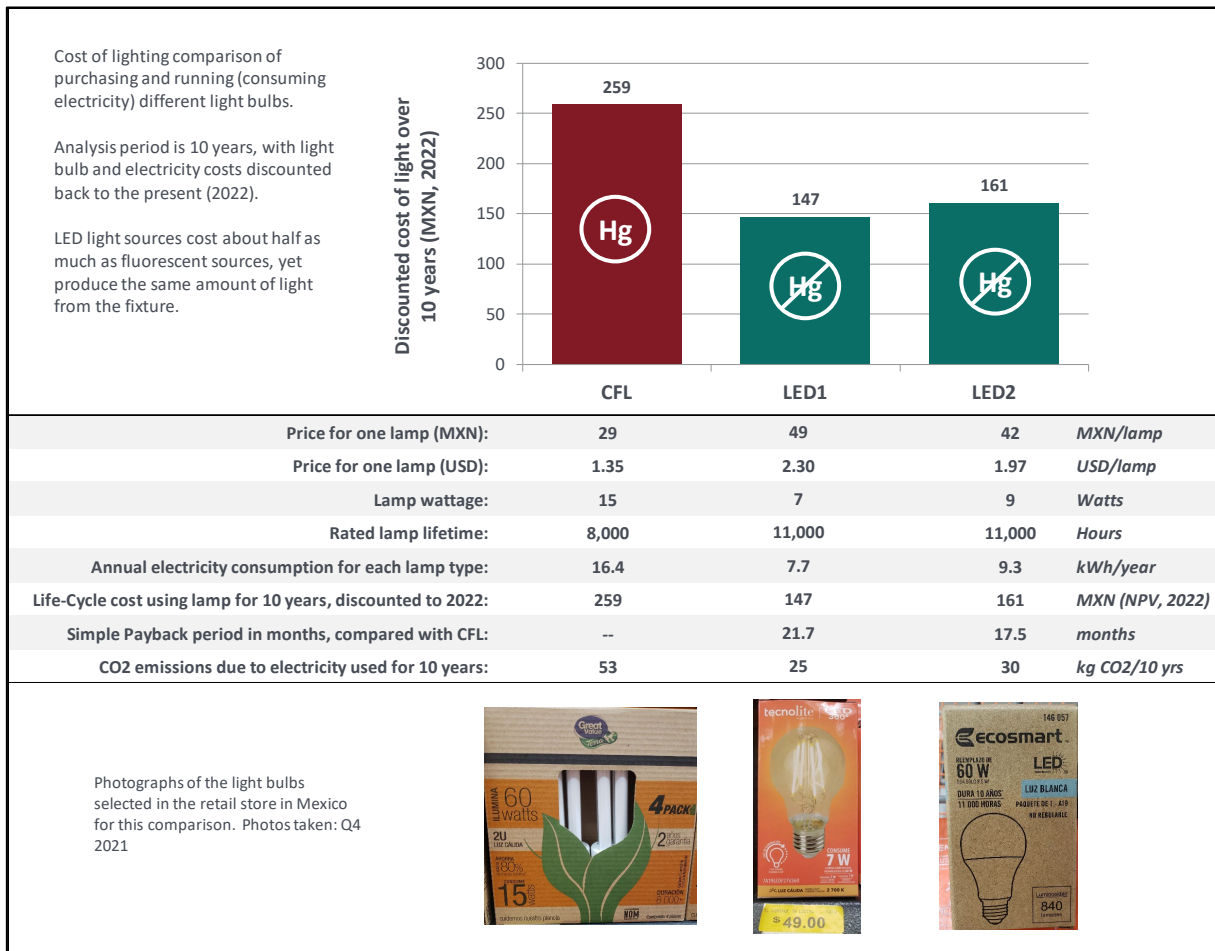
Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	167,831,511 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	182,491,073 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	2,208 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	161.3 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 9.7 billion

Important information about mercury and lighting in Mexico:

- The National Institute of Ecology and Climate Change (INECC) published a report on the Development of the initial assessment of the Minamata Convention in Mexico, to identify the readiness of the current legal framework of the country and propose modifications for the adoption of the Minamata Convention in the country.
- In Mexico, regulations for lighting products are based on 9 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, which define the minimum energy efficiency and safety standards for LED lamps for general use and for public lighting, respectively. These standards are an important step in protecting the national markets from low-quality lighting products.
- Mexico is an important actor in the global LED market, accounting for 4.6% of global exports of LED luminaires and 0.6% of LED packages/dies. A growing number of LED lamp manufacturers/assemblers are based in Mexico.
- There are several supporting policies, institutions and mechanisms in place that support the transition to more efficient and cleaner technologies, such as:
 - The Energy Efficiency Program promoted through the Trusts Instituted in Relation to Agriculture (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). The Program establishes specific annual energy savings goals for participating buildings, vehicle fleets and industrial facilities.[2]
 - The FIDE Substantive Programs, which are promoted through the Trust for the Saving of Electric Energy. FIDE is a private, non-profit fund, created at the initiative of the Federal Electricity Commission (CFE) to contribute to the actions of saving and efficient use of electrical energy. These programs include the FIDE voluntary certification of energy-efficient products..

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Mexico. When switching from CFL to LED in Mexico, the payback in the domestic sector is 18-22 months. The LED lamp consumes approximately half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED

will save approximately MXN 100-110 over the lifetime of the LED retrofit lamp.



Panama

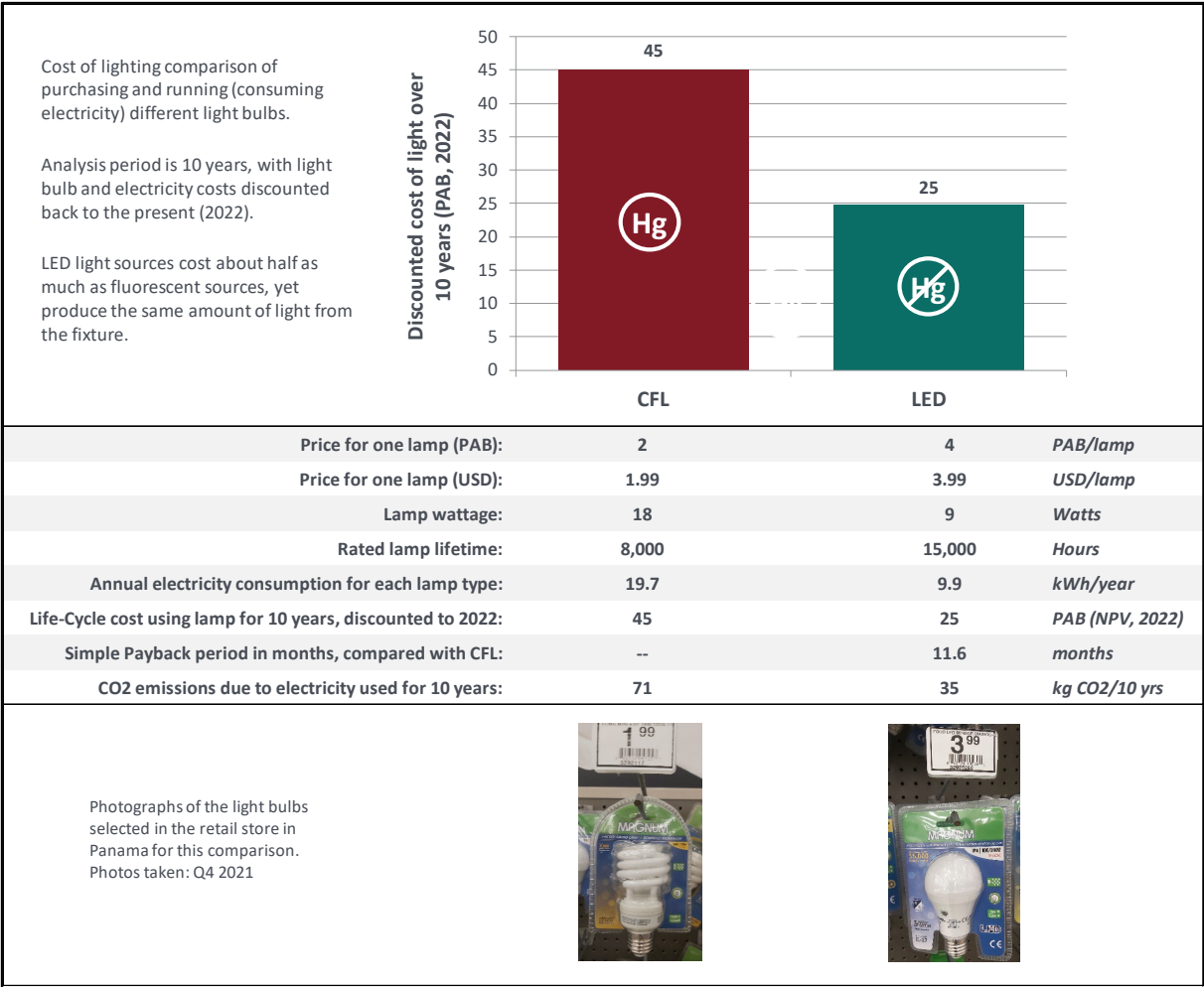
Table 11. Quantifying the Benefits of the African Lighting Amendment in Panama

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	6,176,854 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	5,846,221 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	75 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	5.3 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 1.1 billion

Important information about mercury and lighting in Panama:

- 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 entry into the country of appliances](#) (i.e., air conditioners, lamps, and refrigerators) that do not meet certain minimum energy efficiency requirements. The promotion of efficient equipment is one of the aspects included in 'Law 69', of October 12, 2012, which establishes a policy for the rational use and efficiency of energy (UREE).
- 'Law 69' was [regulated by the Ministry of the Presidency of Panama through 'Executive Decree No. 398', of June 19, 2013](#). This regulation seeks to raise awareness among consumers to achieve a rational and efficient behavior of energy and promote the development of new energy technologies in the Central American country.
- At the end of 2020, the [Panamanian government approved a 10-year energy transition policy roadmap](#) in which it 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 US\$350 million of new investment will be needed to achieve universal access by 2030.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Panama. When switching from CFL to LED in Panama, the payback in the domestic sector is 11.6 months. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately PAB 20 over the lifetime of the LED retrofit lamp.



The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Panama. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately PAB 38 over the lifetime of the LED lamp, yet the LED only costs PAB 2 more at the time of purchase.

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

Analysis period is 4 years, with light bulb and electricity costs discounted back to the present (2022).

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):	2	4	PAB/lamp
Price for one lamp (USD):	1.59	3.99	USD/lamp
Lamp wattage:	20	9	Watts
Rated lamp lifetime:	13,000	15,000	Hours
Annual electricity consumption for each lamp type:	65.7	29.6	kWh/year
Life-Cycle cost using lamp for 4 years, discounted to 2022:	58	29	PAB (NPV, 2022)
Simple Payback period in months, compared with LFL:	--	3.8	months
CO2 emissions due to electricity used for 4 years:	95	43	kg CO2/4 yrs

Photographs of the light bulbs selected in the retail store in Panama for this comparison. Photos taken: Q4 2021



Peru

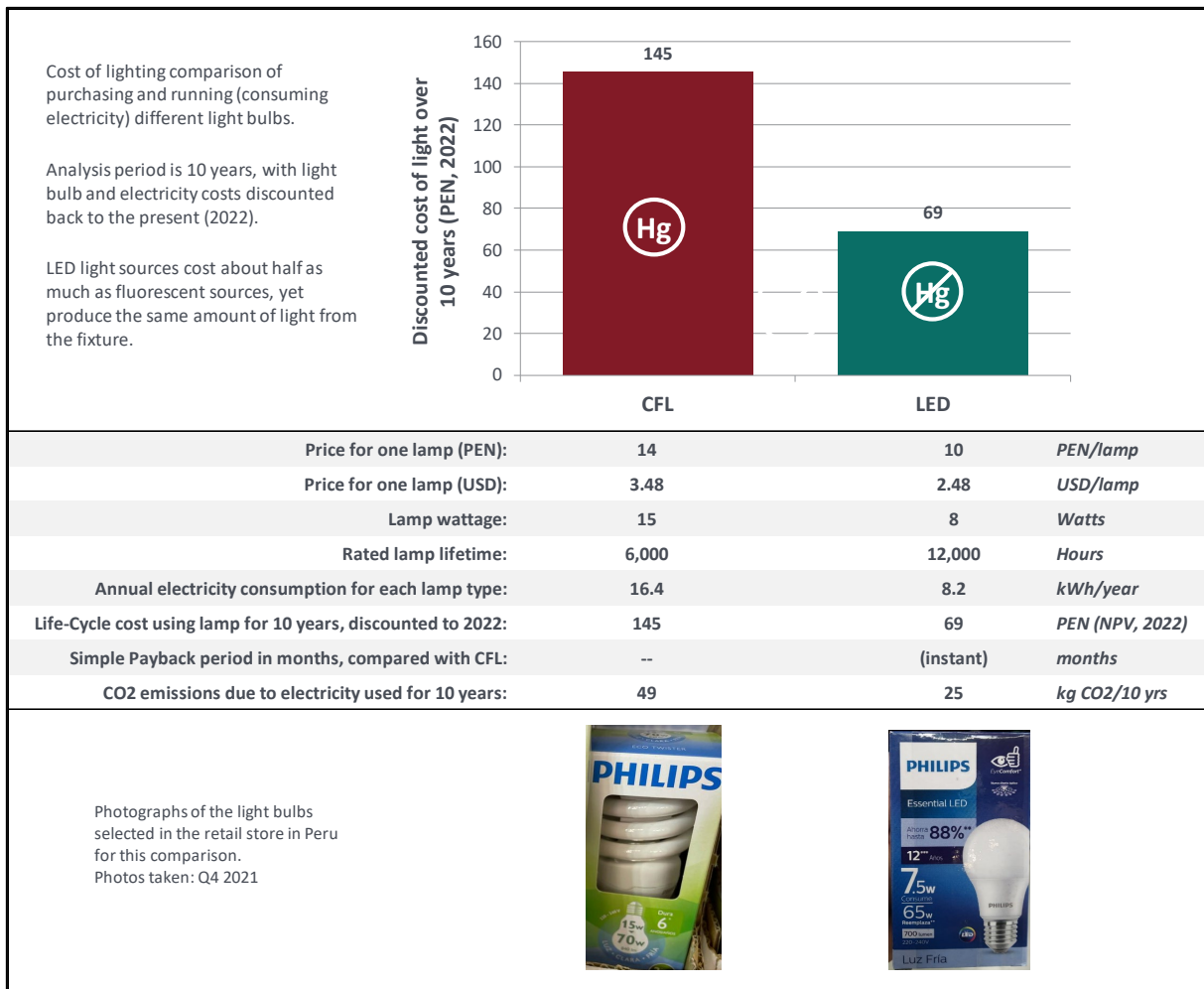
Table 12. Quantifying the Benefits of the African Lighting Amendment in Peru

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	32,993,184 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	27,743,925 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	373 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	25.6 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 4.6 billion

Important information about mercury and lighting in Peru:

- Peru approved in 2019 its National Plan for the Implementation of the Minamata Convention on Mercury, through Supreme Decree No. 004-2019
- According to a lighting market study developed by MINEM in 2015, it was projected that from the year 2021 the purchases of spotlights in the country would migrate massively towards the purchase of LED bulbs and that from the year 2024 the incandescent bulbs would disappear from the national market.
- Peru has a program of climate change mitigation measures, which includes the transformation of the lighting market in the residential sector with 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 (RT) aims to establish the obligation of energy efficiency labelling, as well as the technical requirements and energy efficiency ranges for the classification of the same, in order to protect the environment and safeguard the right to information of consumers and users.
- In 2016, a Supreme Decree approving measures for the efficient use of energy (Supreme Decree No. 004-2016-EM) was promulgated. This regulation requires that entities and / or public companies that need to acquire or replace energy equipment, must do so with the most efficient technology that exists in the market, at the time of purchase.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Peru. Switching to LED in Peru offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately PEN 75 over the lifetime of the LED retrofit lamp.

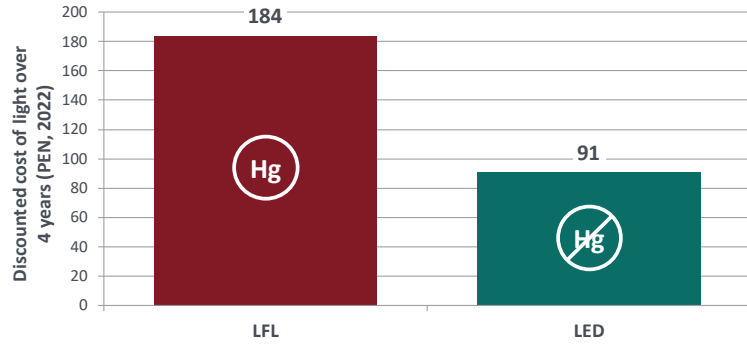


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Peru. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately PEN 93 over the lifetime of the LED lamp, yet the LED only costs PEN 8 more at the time of purchase.

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

Analysis period is 4 years, with light bulb and electricity costs discounted back to the present (2022).

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):	7	15	<i>PEN/lamp</i>
Price for one lamp (USD):	1.73	3.73	<i>USD/lamp</i>
Lamp wattage:	18	8	<i>Watts</i>
Rated lamp lifetime:	10,000	15,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	59.1	26.3	<i>kWh/year</i>
Life-Cycle cost using lamp for 4 years, discounted to 2022:	184	91	<i>PEN (NPV, 2022)</i>
Simple Payback period in months, compared with LFL:	--	4.1	<i>months</i>
CO2 emissions due to electricity used for 4 years:	71	32	<i>kg CO2/4 yrs</i>

Photographs of the light bulbs selected in the retail store in Peru for this comparison.
Photos taken: Q4 2021



Trinidad & Tobago

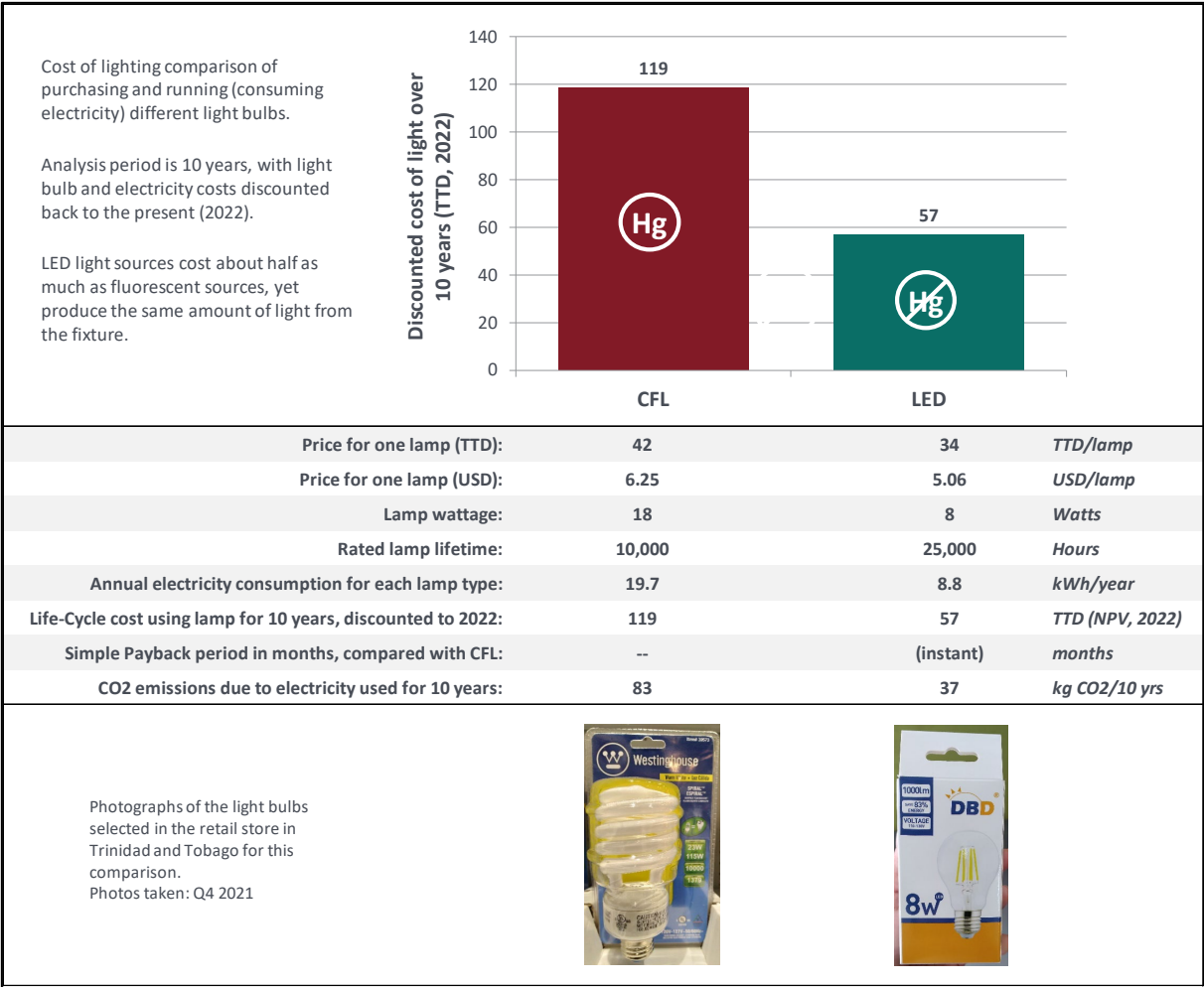
Table 12. Quantifying the Benefits of the African Lighting Amendment in Trinidad & Tobago

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	4,596,098 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	4,662,529 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	58 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	4.1 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 82 million

Important information about mercury and lighting in Trinidad & Tobago:

- The Government of Trinidad and Tobago launched a 2020-2024 Energy Conservation and Energy Efficiency Policy and Action Plan, which includes policies and initiatives to transition the country to LED lighting.
- As part of this Action Plan, in 2020, The Trinidad and Tobago Electricity Commission started its LED Light Bulb Distribution Program, giving away LED bulbs in efforts to reduce electricity consumption in the country, targeting over 400,000 households.
- Findings of the market study carried out by our NGO partners show that LED lamps for general use and tube LEDs are already more affordable than CFLs and LFLs in Trinidad and Tobago.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. All of these lamps were selected and photographed in a retail store in Trinidad & Tobago. Switching to LED in Trinidad & Tobago offers an instantaneous payback, because the LED lamp is less expensive than the CFL. Additionally, the LED lamp consumes half as much power as the CFL – so electricity bills are halved over the lamp lifetime – yet the LED lamp produces the same amount of light. Switching from CFL to LED will save approximately TTD 62 over the lifetime of the LED retrofit lamp.

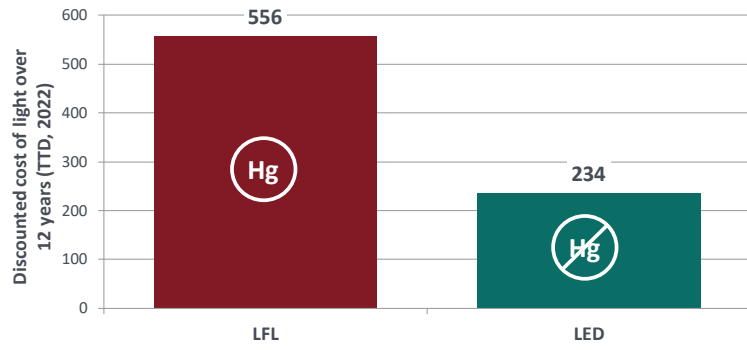


The box below offers an economic analysis of a linear fluorescent lamp and an LED retrofit tube, both of which were selected and photographed in a retail store in Trinidad & Tobago. The LED tube is more expensive than the fluorescent lamp on a first-cost basis, but the LED lamp consumes half as much power as the fluorescent tube – so electricity bills are halved over the lamp lifetime. Switching from fluorescent to an LED retrofit tube will save approximately TTD 320 over the lifetime of the LED lamp, yet the LED only costs TTD 25 more at the time of purchase.

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

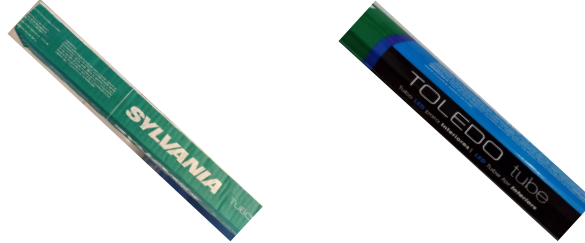
Analysis period is 12 years, with light bulb and electricity costs discounted back to the present (2022).

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 (TTD):	70	45	<i>TTD/lamp</i>
Price for one lamp (USD):	10.50	6.75	<i>USD/lamp</i>
Lamp wattage:	32	18	<i>Watts</i>
Rated lamp lifetime:	10,000	40,000	<i>Hours</i>
Annual electricity consumption for each lamp type:	105.1	59.1	<i>kWh/year</i>
Life-Cycle cost using lamp for 12 years, discounted to 2022:	556	234	<i>TTD (NPV, 2022)</i>
Simple Payback period in months, compared with LFL:	--	(instant)	<i>months</i>
CO2 emissions due to electricity used for 12 years:	530	298	<i>kg CO2/12 yrs</i>

Photographs of the light bulbs selected in the retail store in Trinidad and Tobago for this comparison.
Photos taken: Q4 2021



Uruguay

Table 12. Quantifying the Benefits of the African Lighting Amendment in Uruguay

Benefits of the African Lighting Amendment	Value
Avoided compact fluorescent lamp sales, CFL phase-out in 2024 (cumulative, 2024-2050)	8,120,819 lamps
Avoided linear fluorescent lamp sales, LFL phase-out in 2025 (cumulative, 2025-2050)	8,522,153 lamps
Total mercury in fluorescent lamps avoided (CFL in 2024, LFL in 2025, cumulative to 2050)	105 kilograms
National energy savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	7.5 TWh
National financial savings, fluorescent phase-out (CFL in 2024, LFL in 2025, cumulative to 2050)	US\$ 1.6 billion

Important information about mercury and lighting in Uruguay:

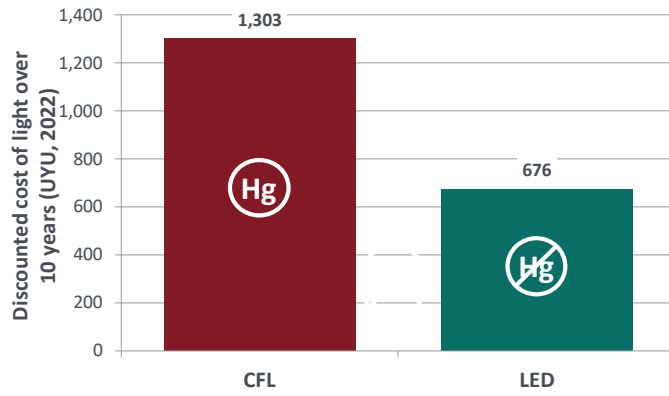
- Decree 15/2019 of the Ministry of Environment of Uruguay (MVOTMA) regulates and promotes the adequate management of mercury-containing products. Items reached by the decree include products covered in Annex A of the Minamata Convention (compact and linear fluorescent lamps, high pressure mercury vapor lamps, cold cathode fluorescent lamps, external electrode fluorescent lamps, high discharge lamps, thermometers and pressure measuring devices). Such products may not exceed the maximum mercury content established in the Minamata Convention.
- Decree 15/2019 also establishes the obligation of 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 Ministry of Environment of Uruguay, with the support of the UNEP/GEF en.lighten initiative (United for Efficiency), developed its National Efficient Lighting Strategy. This strategy set the goals of 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.

The box below offers an economic analysis of a CFL and LED retrofit bulbs. Both of these lamps were selected and photographed in a retail store in Uruguay. The LED lamp is slightly more expensive than the CFL on a first-cost basis, but the LED consumes half as much power as the CFL, so electricity bills are halved over the lamp lifetime. Switching from CFL to LED in Uruguay will save approximately UYU 600 over a ten year analysis period, yet the LED only costs UYU 7 more at the time of purchase. Thus, switching to LED in Uruguay offers a payback period of just 1.3 months and then goes on to save the user hundreds of UYU over its lifetime.

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

Analysis period is 10 years, with light bulb and electricity costs discounted back to the present (2022).

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):	70	77	UYU/lamp
Price for one lamp (USD):	1.61	1.76	USD/lamp
Lamp wattage:	12	6	Watts
Rated lamp lifetime:	8,000	25,000	Hours
Annual electricity consumption for each lamp type:	13.1	6.6	kWh/year
Life-Cycle cost using lamp for 10 years, discounted to 2022:	1,303	676	UYU (NPV, 2022)
Simple Payback period in months, compared with CFL:	--	1.3	months
CO2 emissions due to electricity used for 10 years:	21	10	kg CO2/10 yrs

Photographs of the light bulbs selected in the retail store in Uruguay for this comparison.
Photos taken: Q4 2021



C Li C

ENDING TOXIC LIGHTING TOGETHER