



**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 model¹

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.

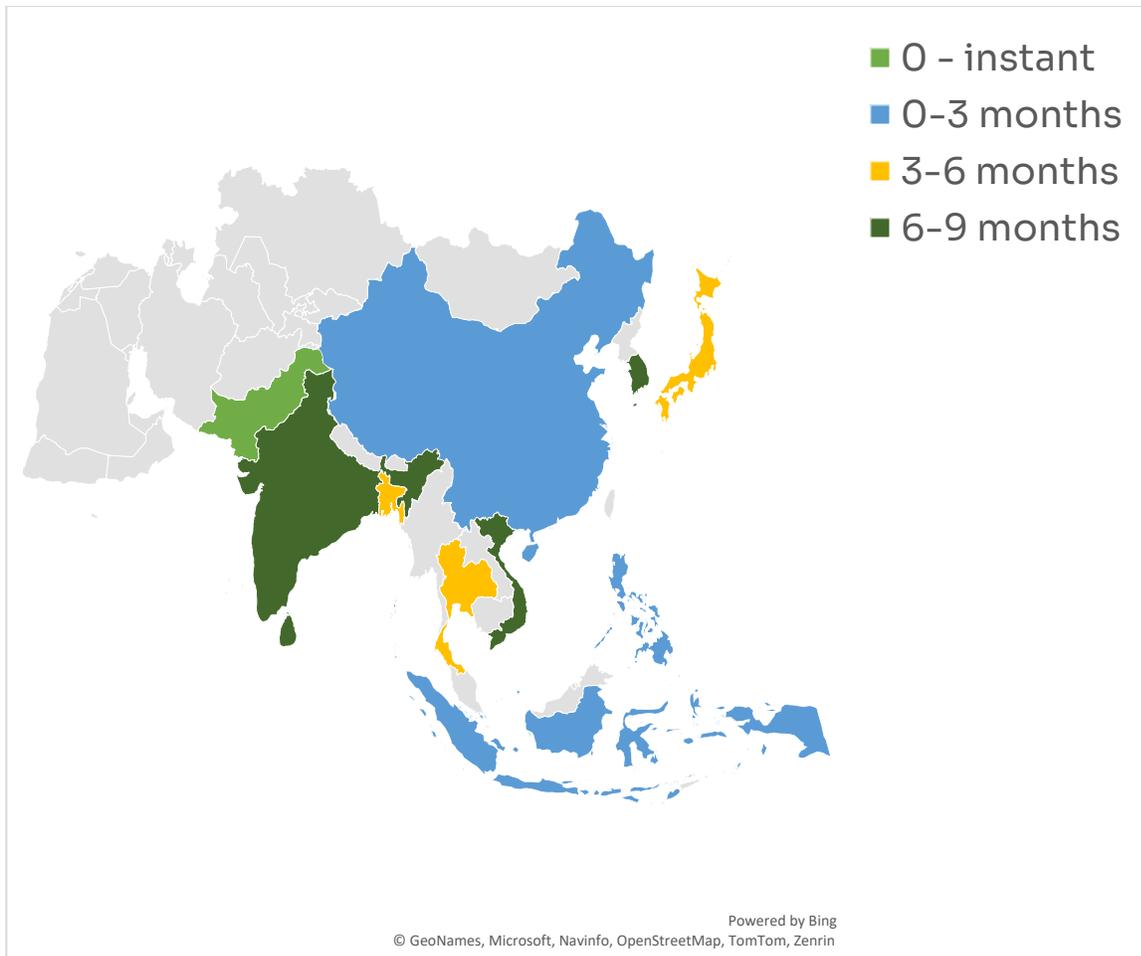


Figure 1 T8 Payback Period in Assesses Countries

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.

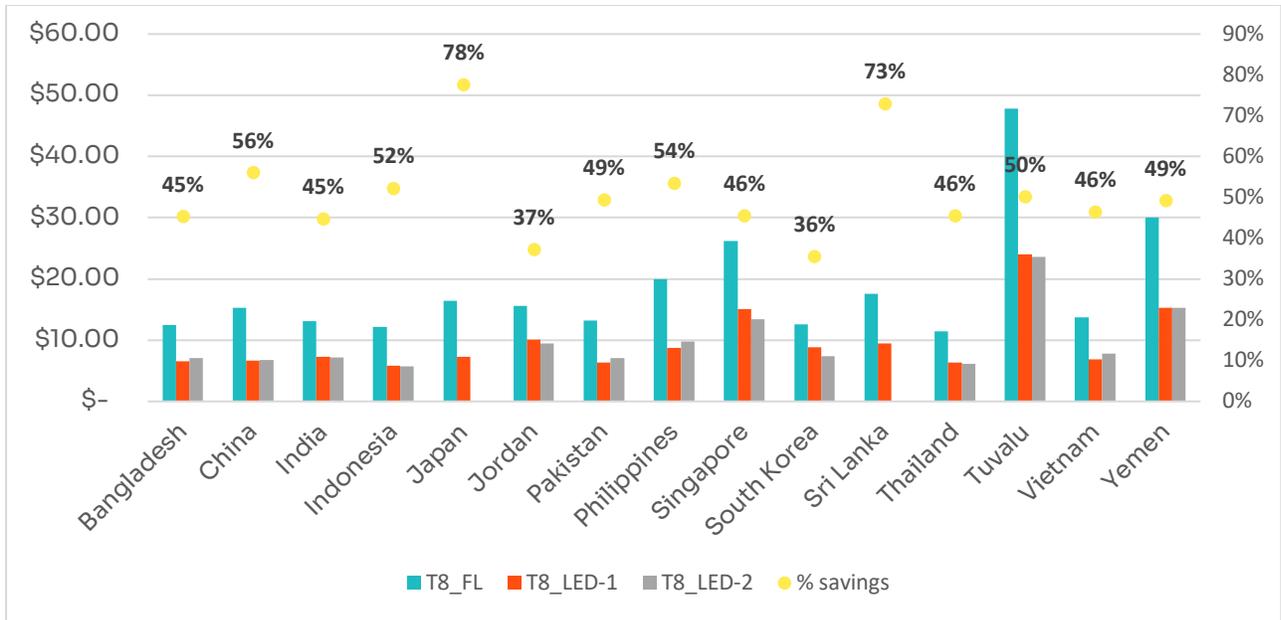


Figure 2 Life Cycle Savings of LEDs over Fluorescents

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 7.5 months. 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.

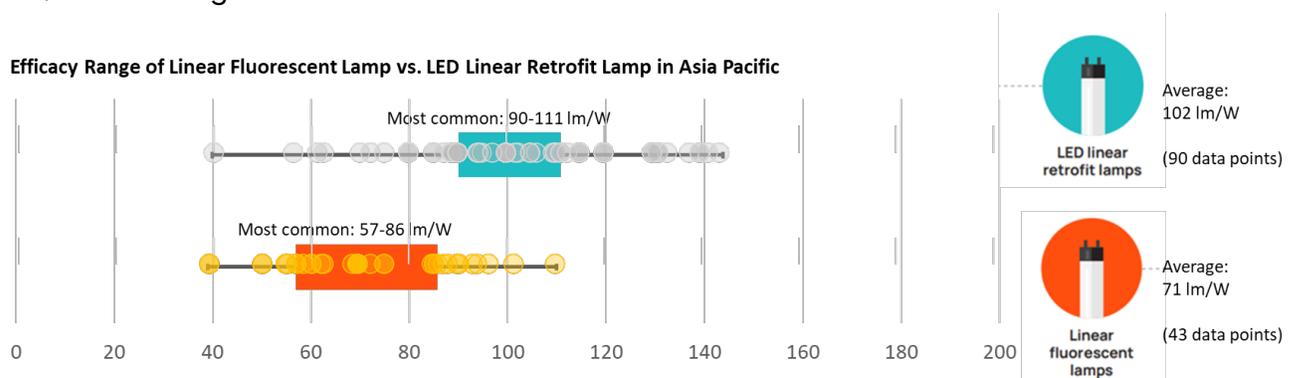


Figure 3 Efficacy Comparison of LEDs over Fluorescents

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:

- India:** India's Electric Lamp and Component Manufacturers Association (ELCOMA) published [Vision 2024 Roadmap](#) to transition lighting market to LED by 2024.
- 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-BKHCHN](#) 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 luminaires. 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



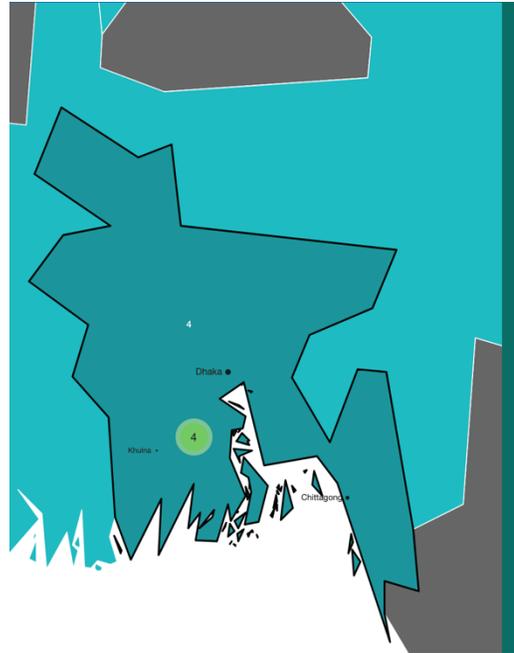
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Bangladesh

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](#)

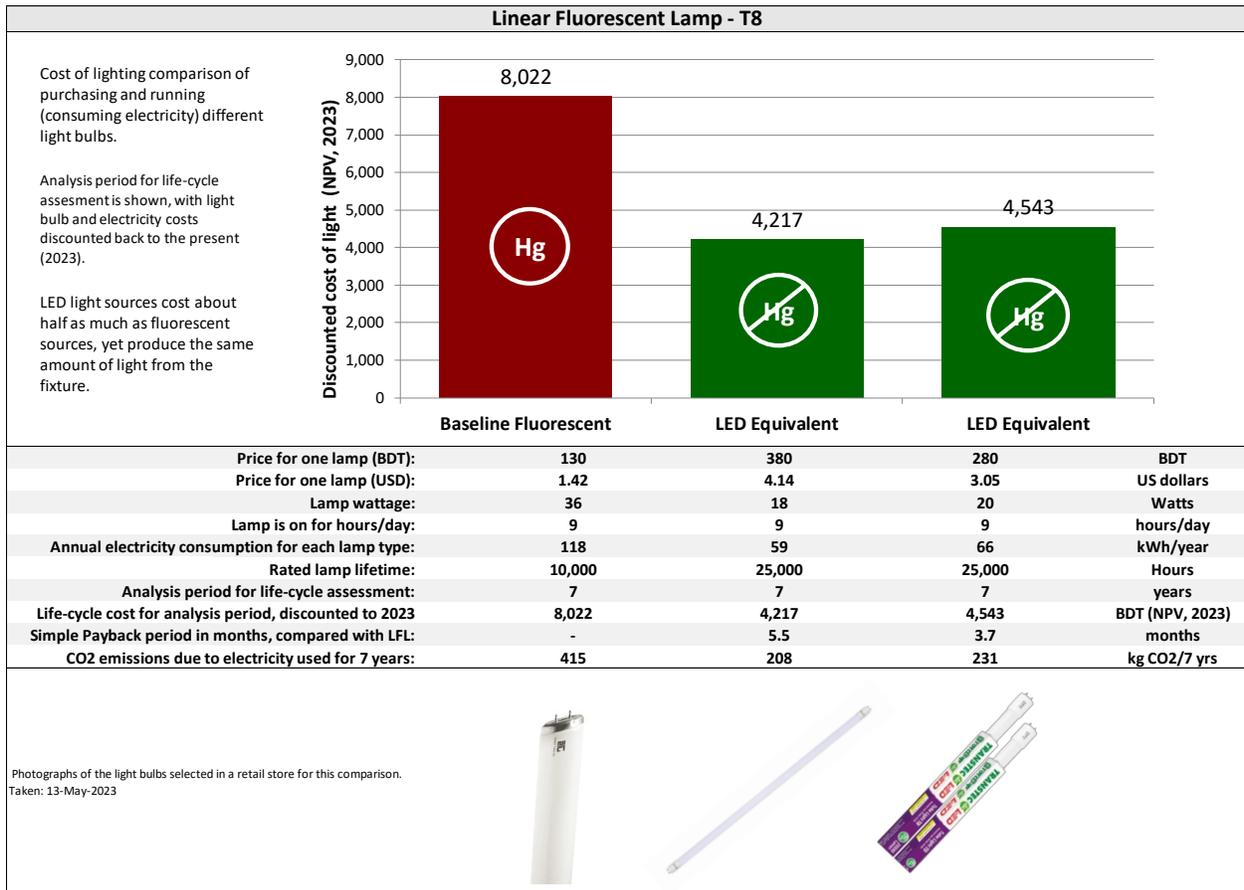
of Companies: 4
 Mercury Savings (2025): 466 kg
 Financial Savings (2025): 5 Billion USD
 Energy Savings (2025): 59 TWh
 CO2 Savings (2025) : 23 Mt CO2

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.

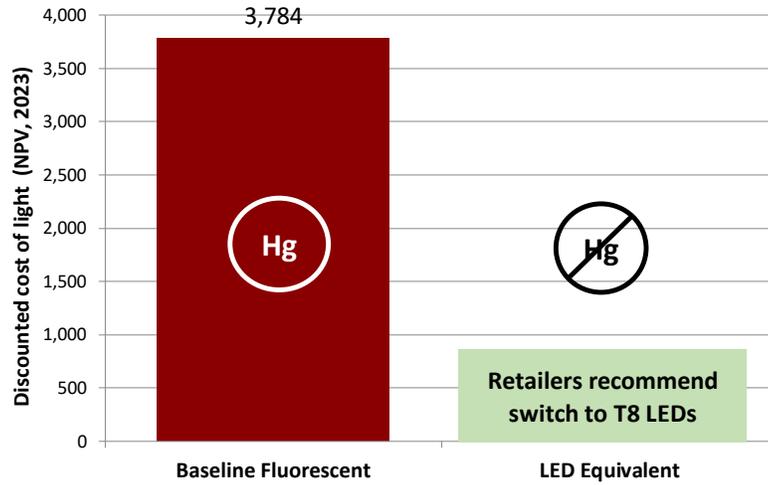


Linear Fluorescent Lamp - T12

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

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



China



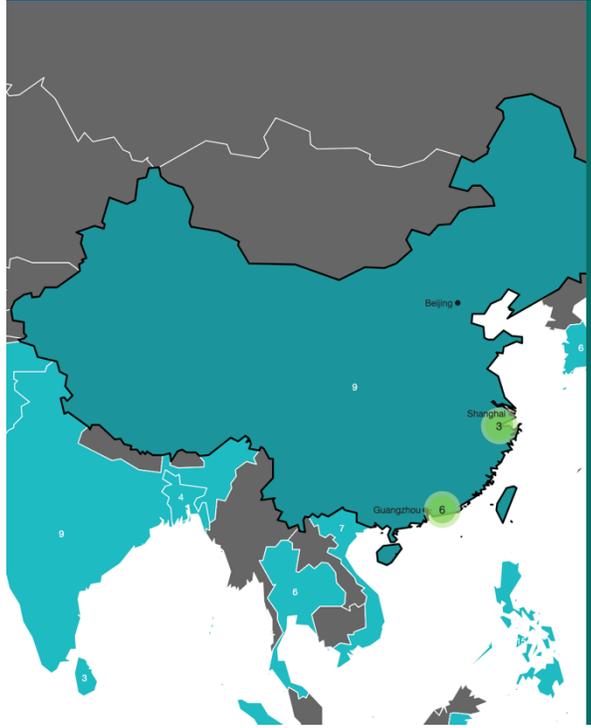
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in China

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](#)

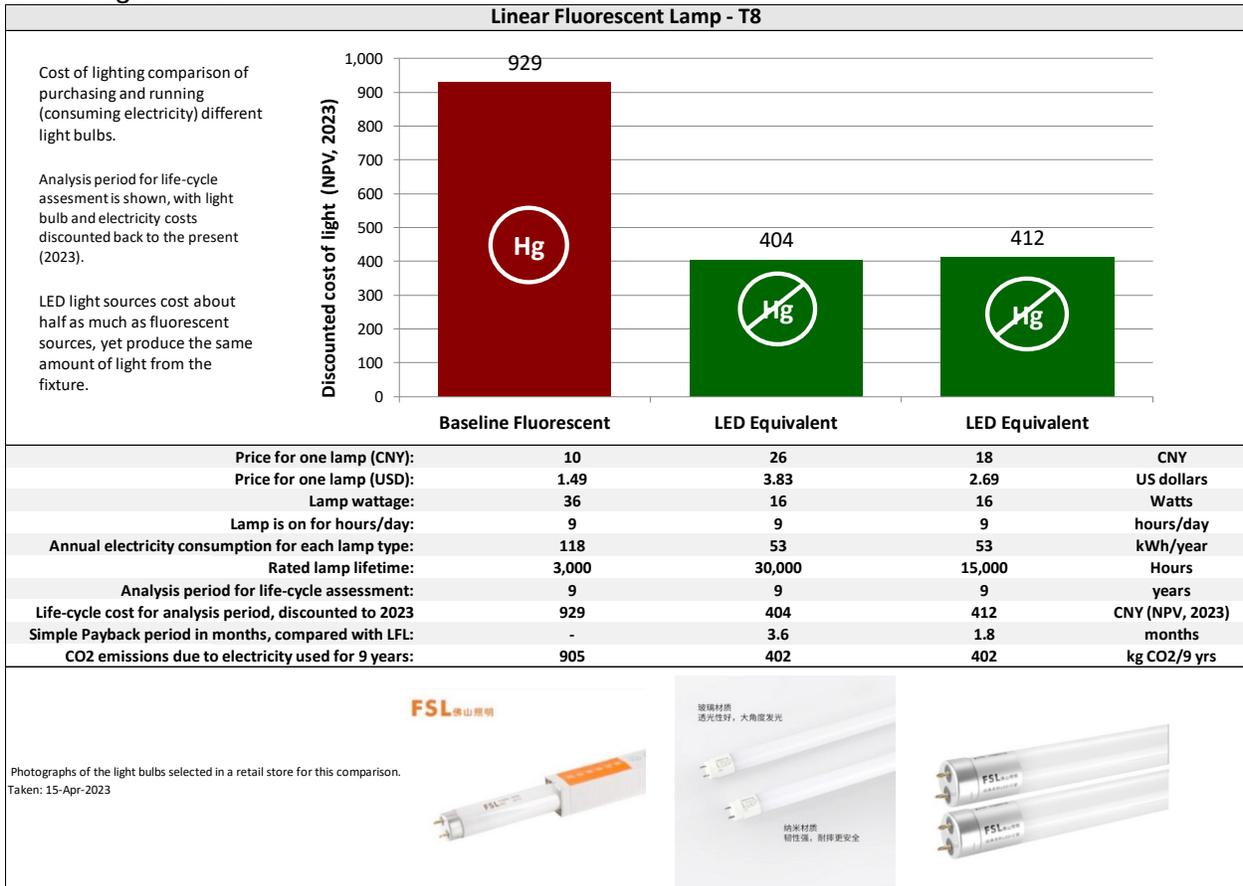
of Companies: 9
 Mercury Savings (2025): 40,631 kg
 Financial Savings (2025): 578 Billion USD
 Energy Savings (2025): 5,121 TWh
 CO2 Savings (2025): 1,831 Mt CO2

LED Manufacturers

[Download Manufacturer Data](#)

1. OPPLÉ 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.

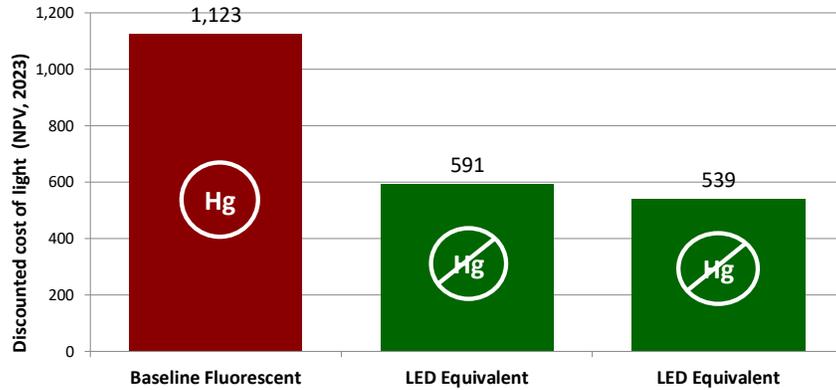


Linear Fluorescent Lamp - T12

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

Analysis period for life-cycle assessment 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

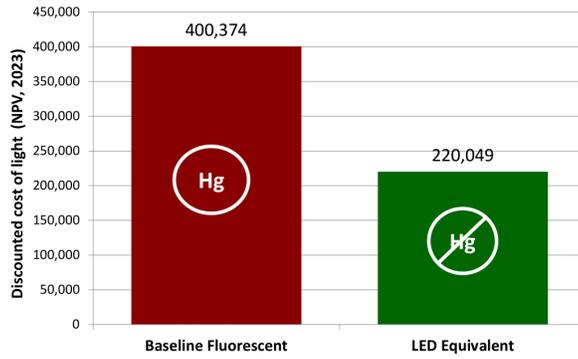
- The National Action Plan to Eliminate and Reduce Use of Mercury from 2018 to 2030 (RAN PPM, Perpres 21/2019) aims to reduce mercury use in manufacturing (among others) by 50% by 2030 as compared to 2018 levels. According to the plan, the use of Mercury for lamp production was 163 kg per year in 2018.
- 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.

Linear Fluorescent Lamp - T8 - 600 mm

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

Analysis period for life-cycle assessment 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

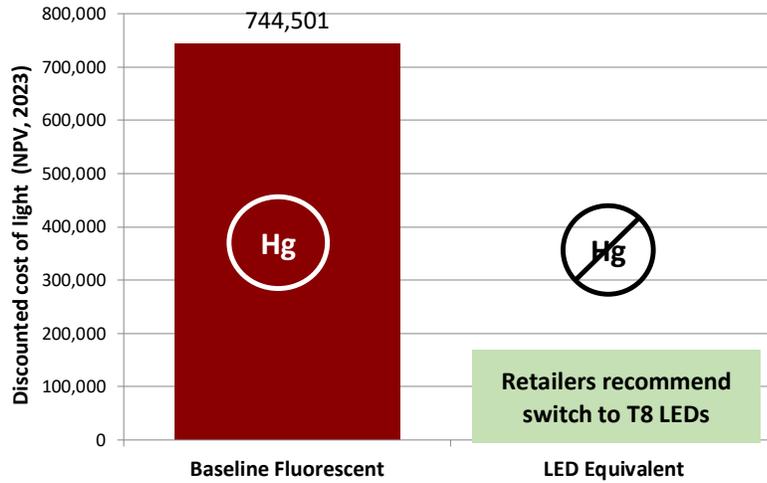


Linear Fluorescent Lamp - T12

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



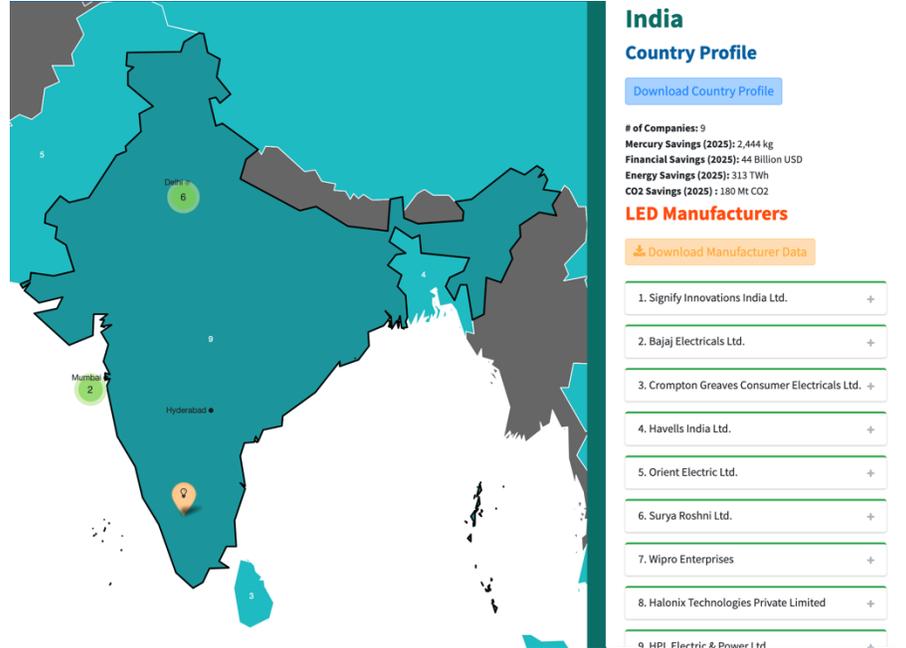
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Benefits of Fluorescent Lighting Phase Out	LFL Phase Out in 2025	LFL Phase Out in 2026	LFL Phase Out in 2027	Unit
Avoided lamp sales	326,000,000	287,000,000	252,000,000	Units of lamps
Total avoided mercury uses in fluorescent lamp manufacturing	2,440	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

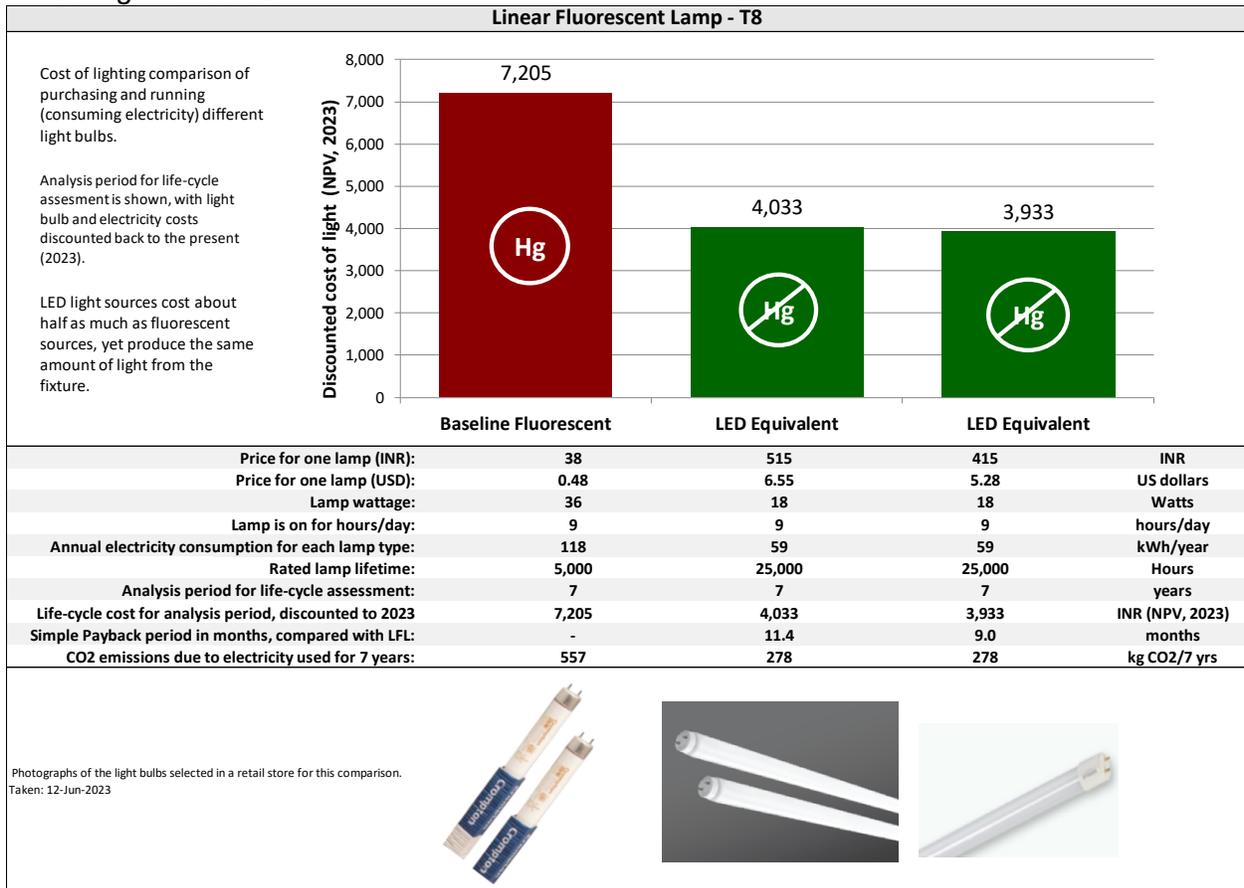
National Policies, Regulations, and Initiatives Around Mercury and Lighting

- 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.



Japan



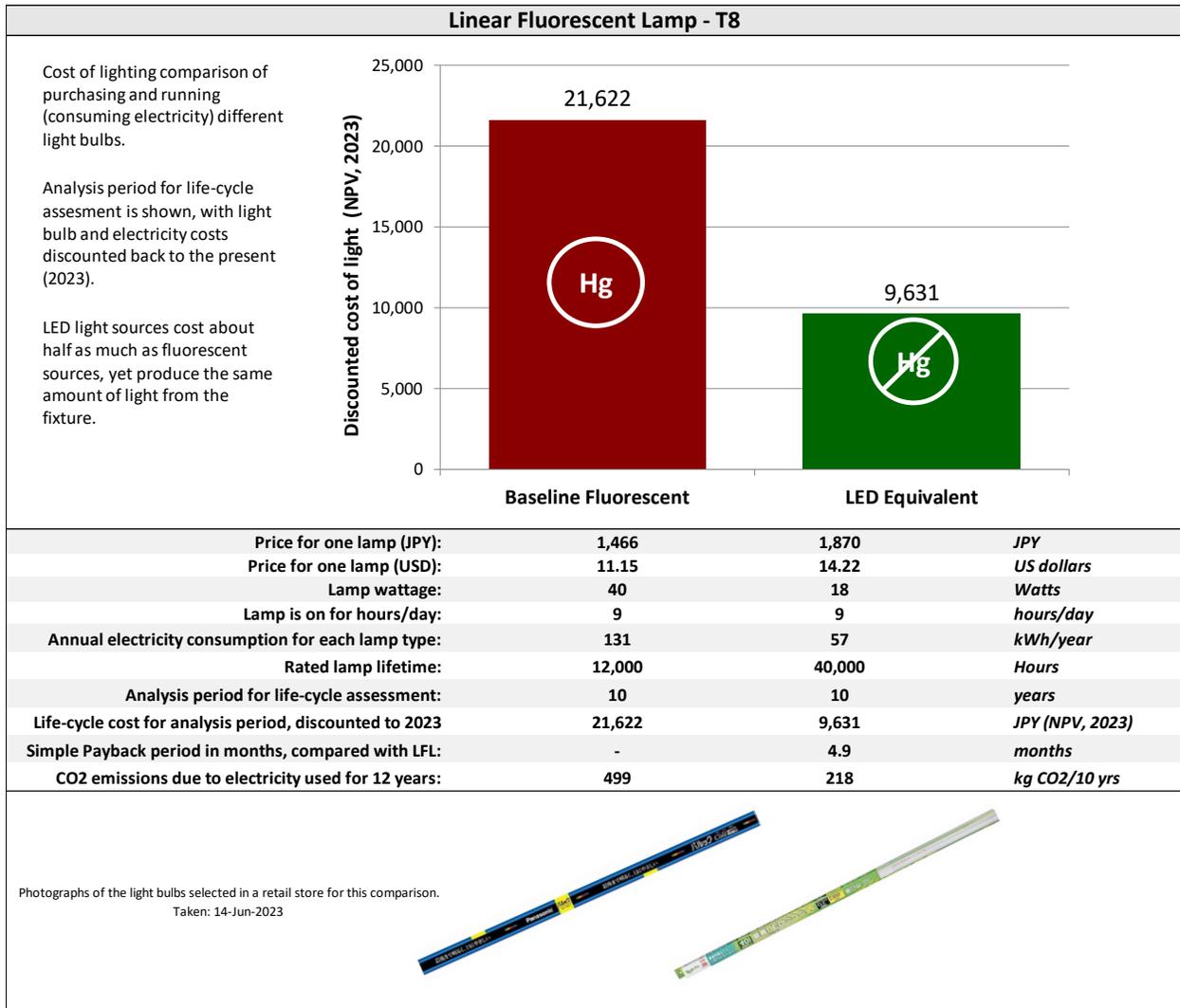
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Japan

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.



South Korea



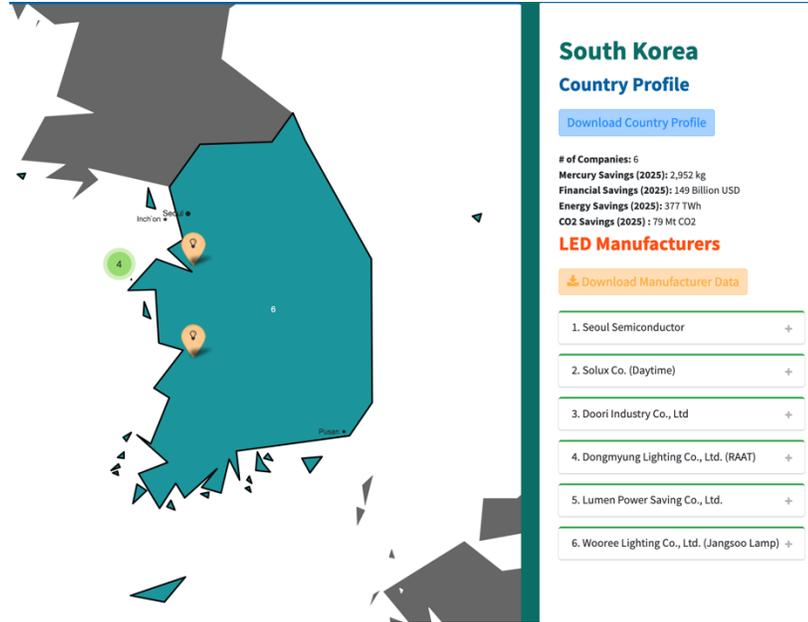
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in South Korea

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

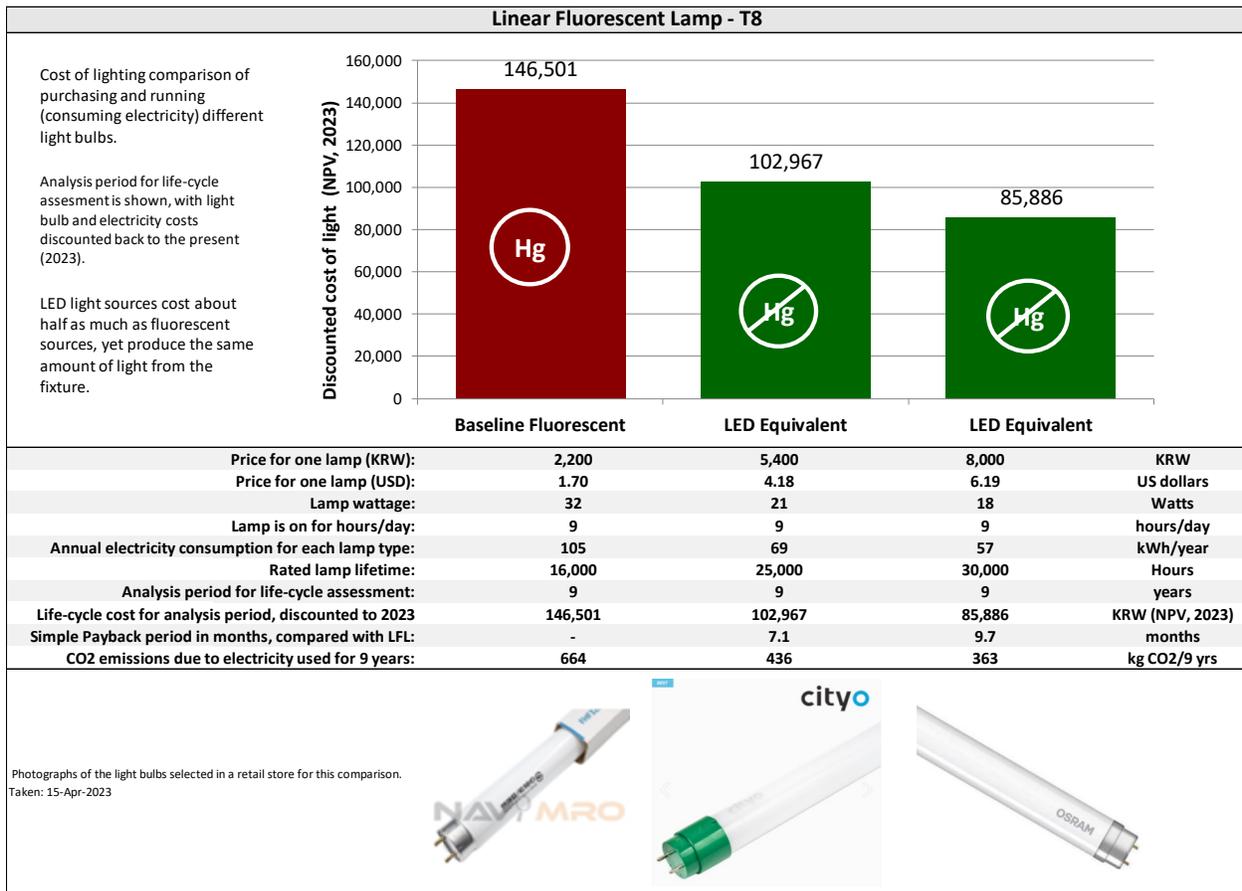
National Policies, Regulations, and Initiatives Around Mercury and Lighting

- 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.

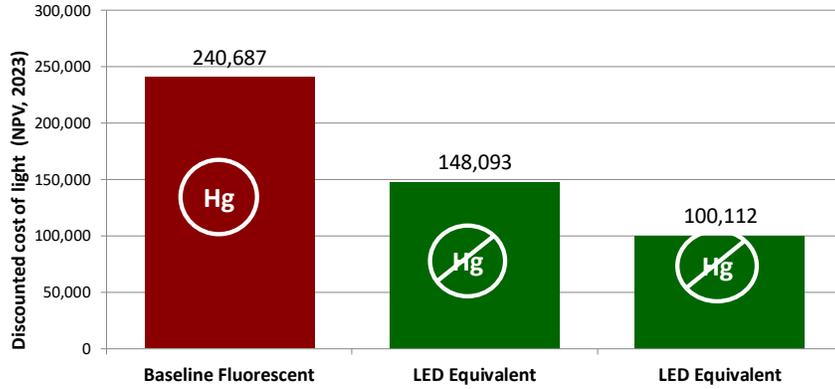


Linear Fluorescent Lamp - T12

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

Analysis period for life-cycle assessment 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



Sri Lanka



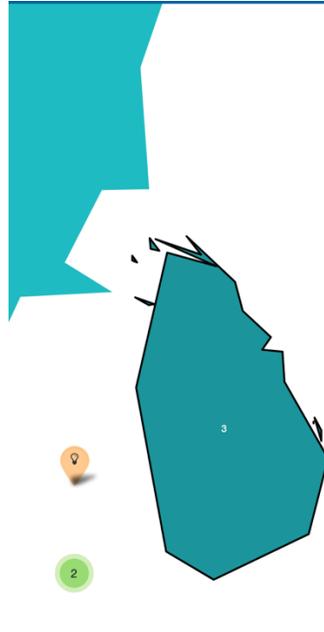
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Sri Lanka

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



Sri Lanka Country Profile

[Download Country Profile](#)

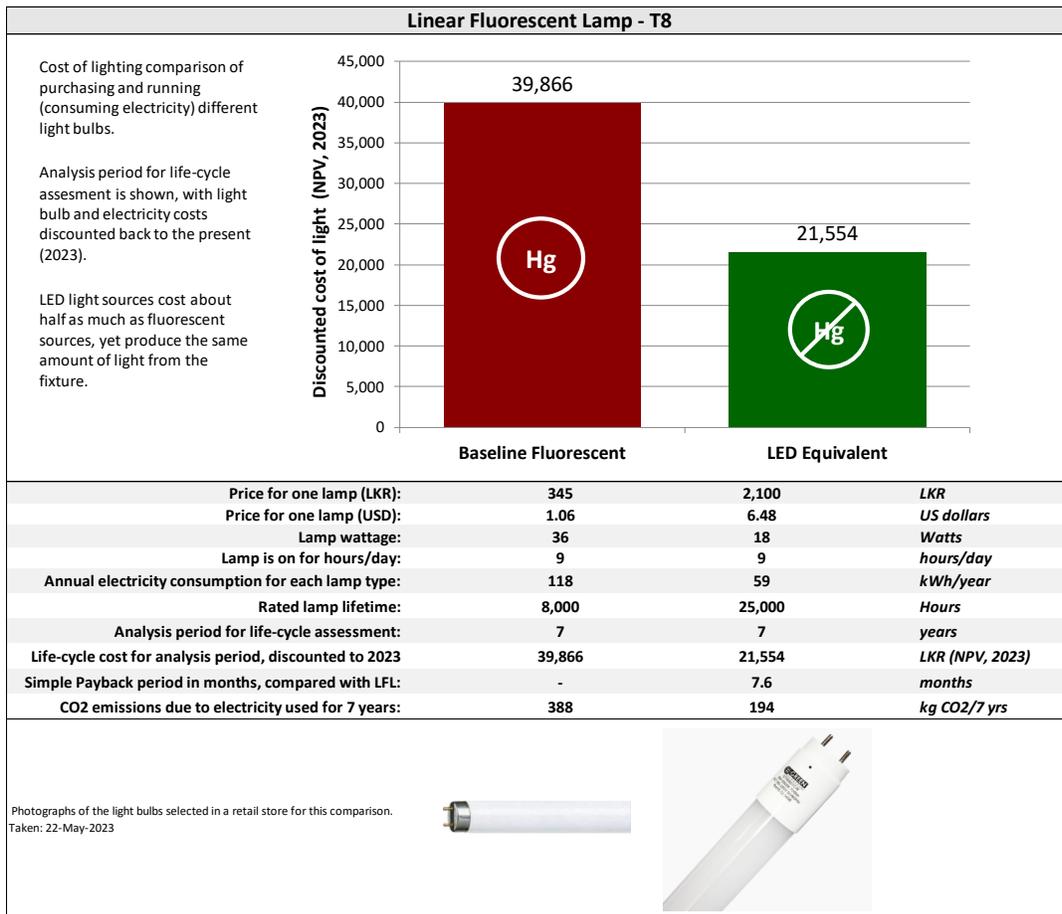
of Companies: 3
 Mercury Savings (2025): 115 kg
 Financial Savings (2025): 2.4 Billion USD
 Energy Savings (2025): 14 TWh
 CO2 Savings (2025): 4.6 Mt CO2

LED Manufacturers

[Download Manufacturer Data](#)

1. Eco Solve +
2. Nimi Infra (Pvt) Ltd +
3. Nimi Infra (Pvt)Ltd Laxapana batteries (PLc) +

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

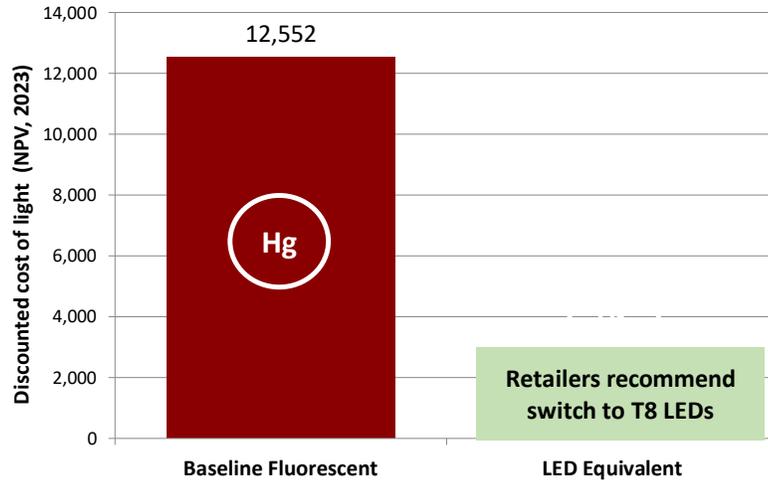


Linear Fluorescent Lamp - T12

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



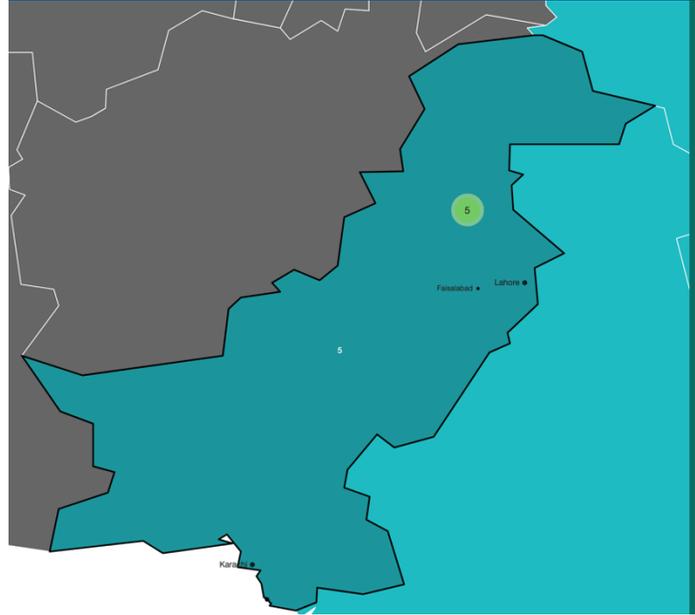
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Pakistan

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



Pakistan Country Profile

[Download Country Profile](#)

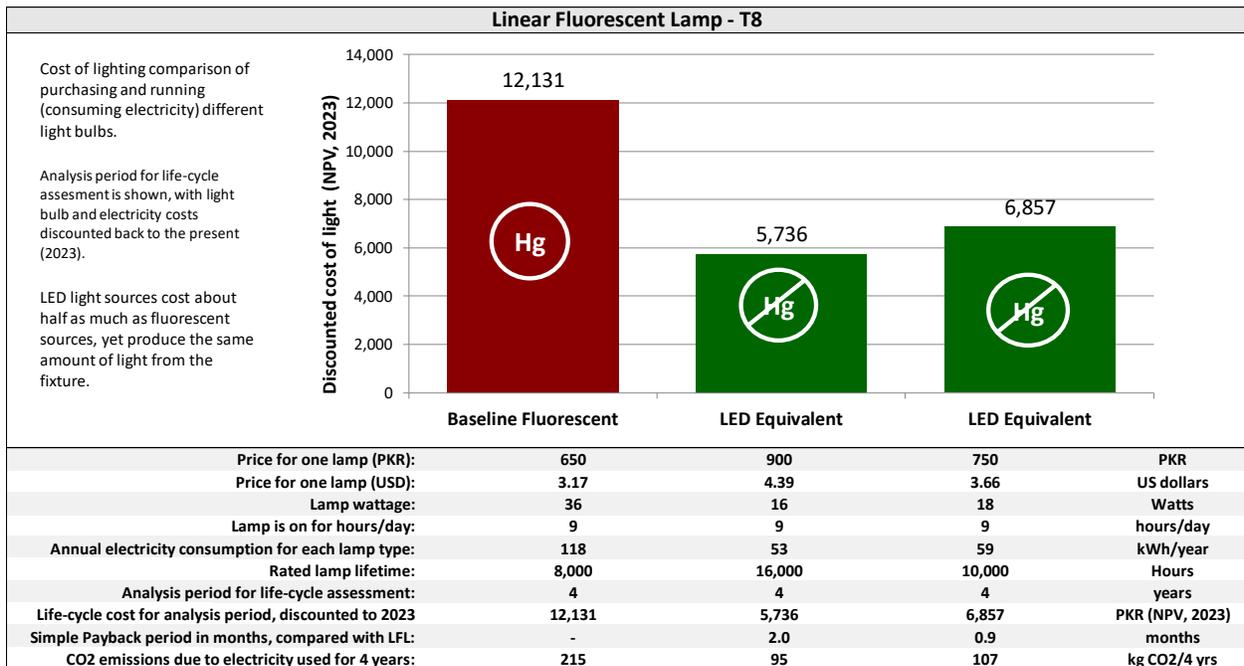
of Companies: 5
 Mercury Savings (2025): 585 kg
 Financial Savings (2025): 11 Billion USD
 Energy Savings (2025): 75 TWh
 CO2 Savings (2025) : 29 Mt CO2

LED Manufacturers

[Download Manufacturer Data](#)

1. Crest LED +
2. Paramount Lighting Company +
3. Solimo LED lights [Malik Ahmed Traders] +
4. OSSO Electronics SMC Pvt Ltd +
5. GK LED Light +

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

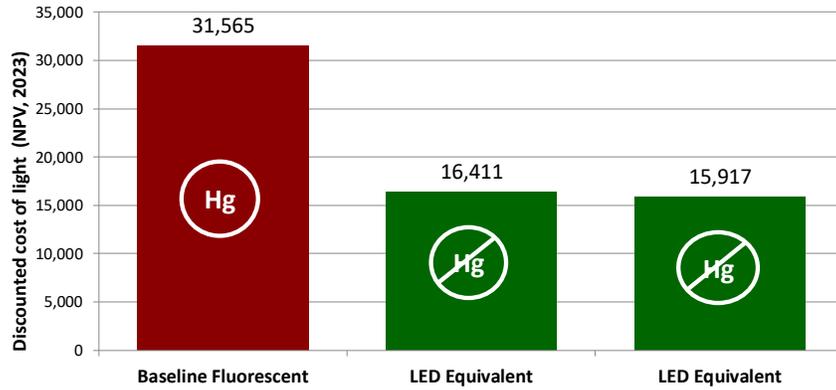


Linear Fluorescent Lamp - T12

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

Analysis period for life-cycle assessment 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



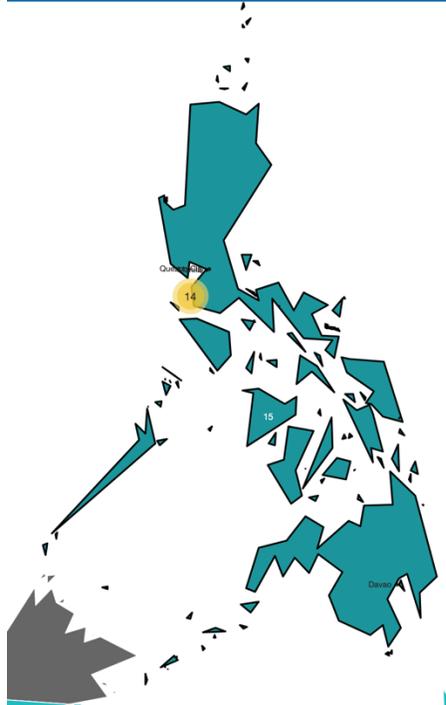
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in the Philippines

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](#)

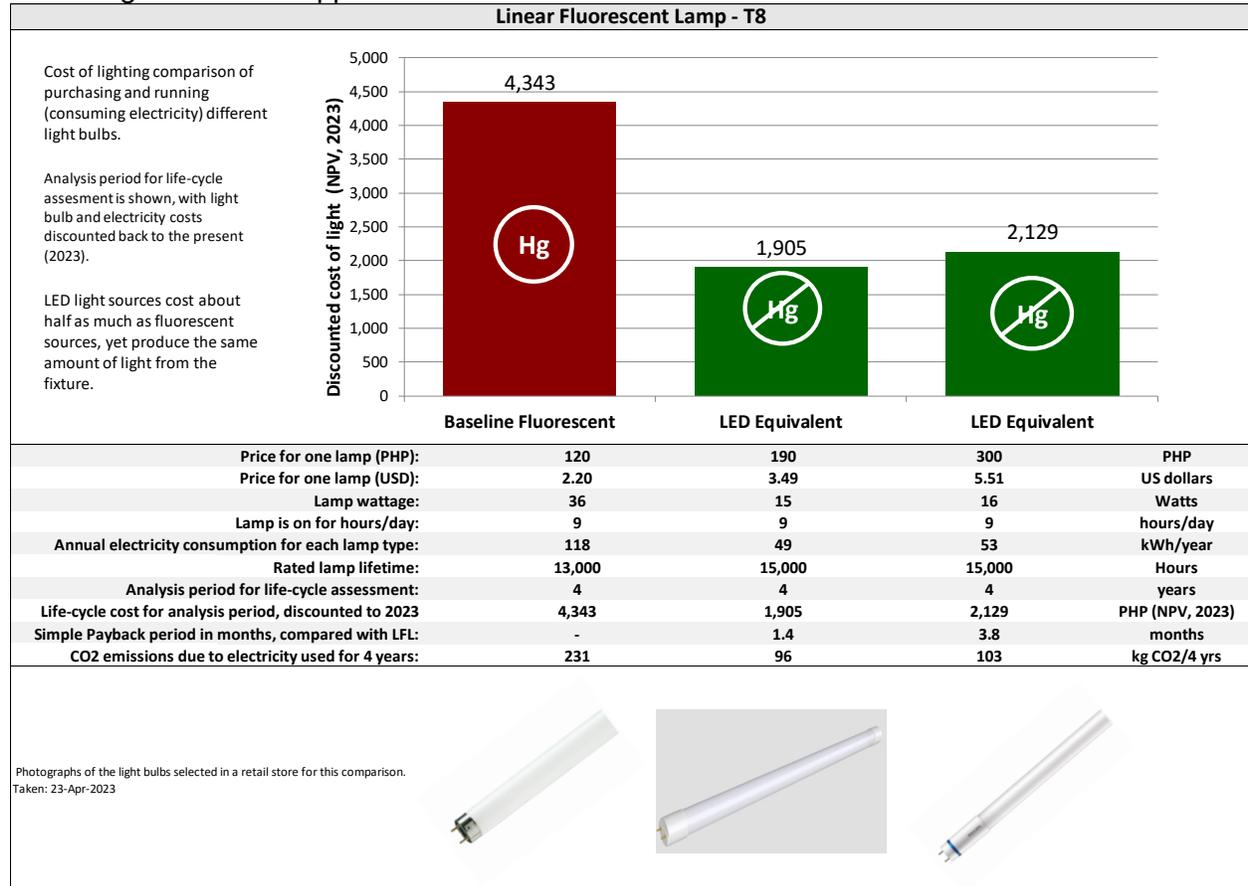
of Companies: 15
 Mercury Savings (2025): 641 kg
 Financial Savings (2025): 21 Billion USD
 Energy Savings (2025): 82 TWh
 CO2 Savings (2025) : 31 Mt CO2

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.

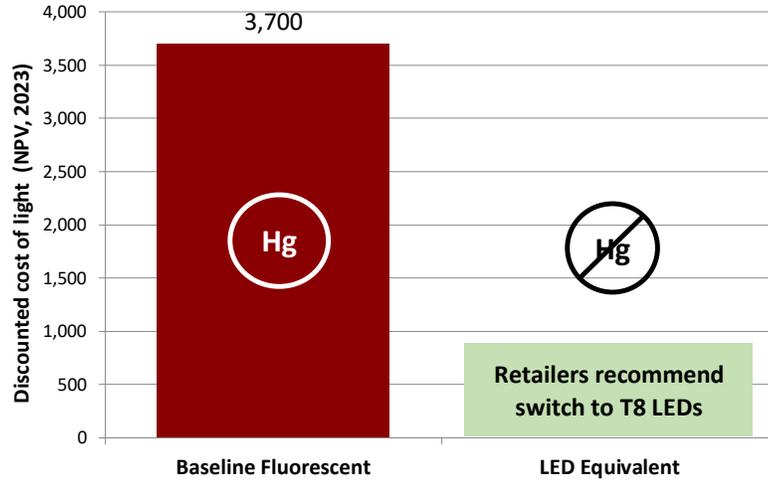


Linear Fluorescent Lamp - T12

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 assesment:	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



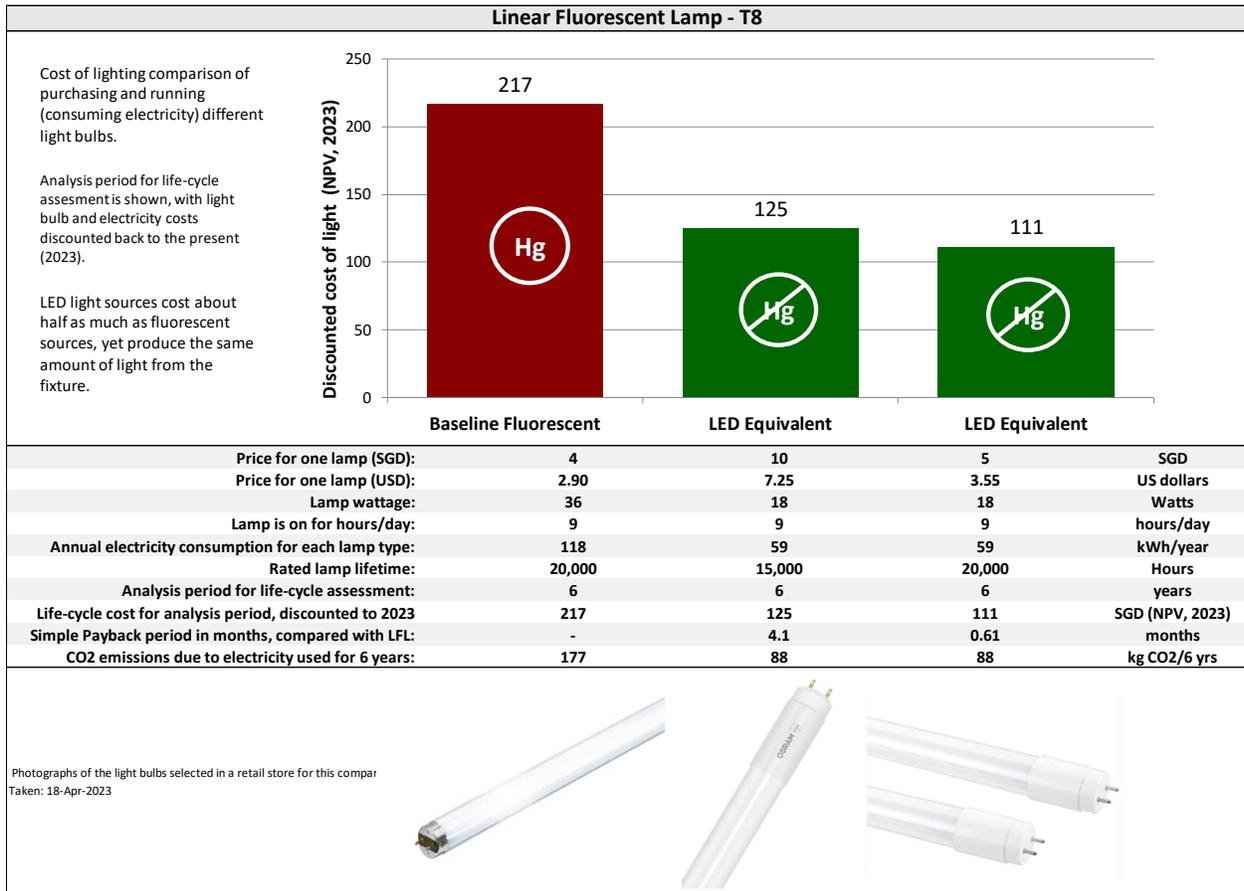
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Singapore

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.



Thailand



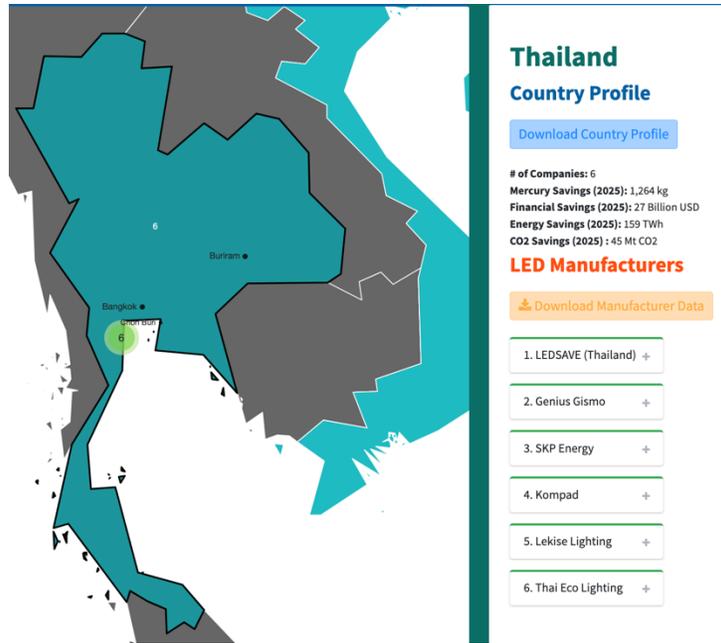
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Thailand

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

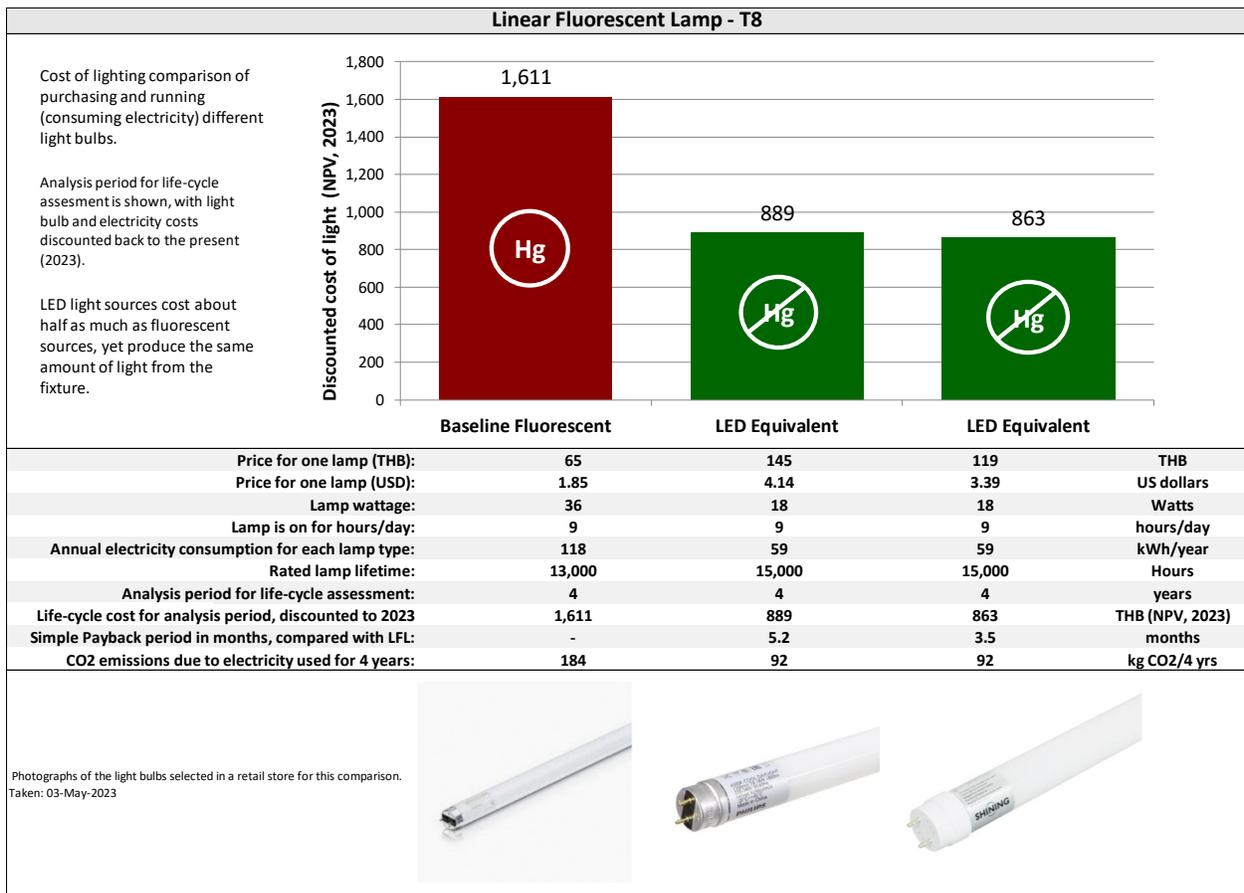
National Policies, Regulations, and Initiatives Around Mercury and Lighting

- 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.



Vietnam



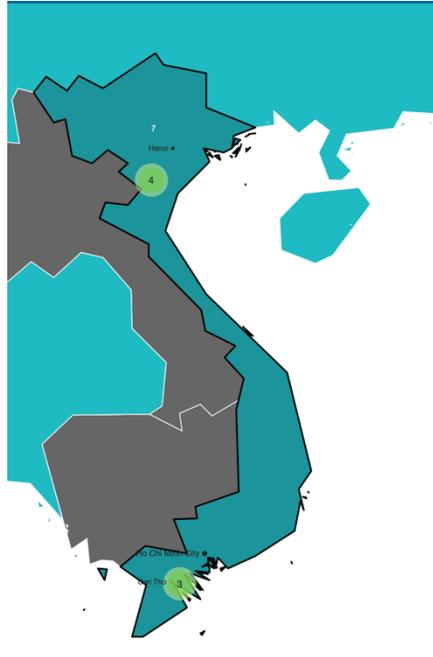
Table 1. Benefits of LFL Phase Out in 2025, 2026, and 2027 in Vietnam

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 CO₂eq, 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-BKHCHN 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



Vietnam Country Profile

[Download Country Profile](#)

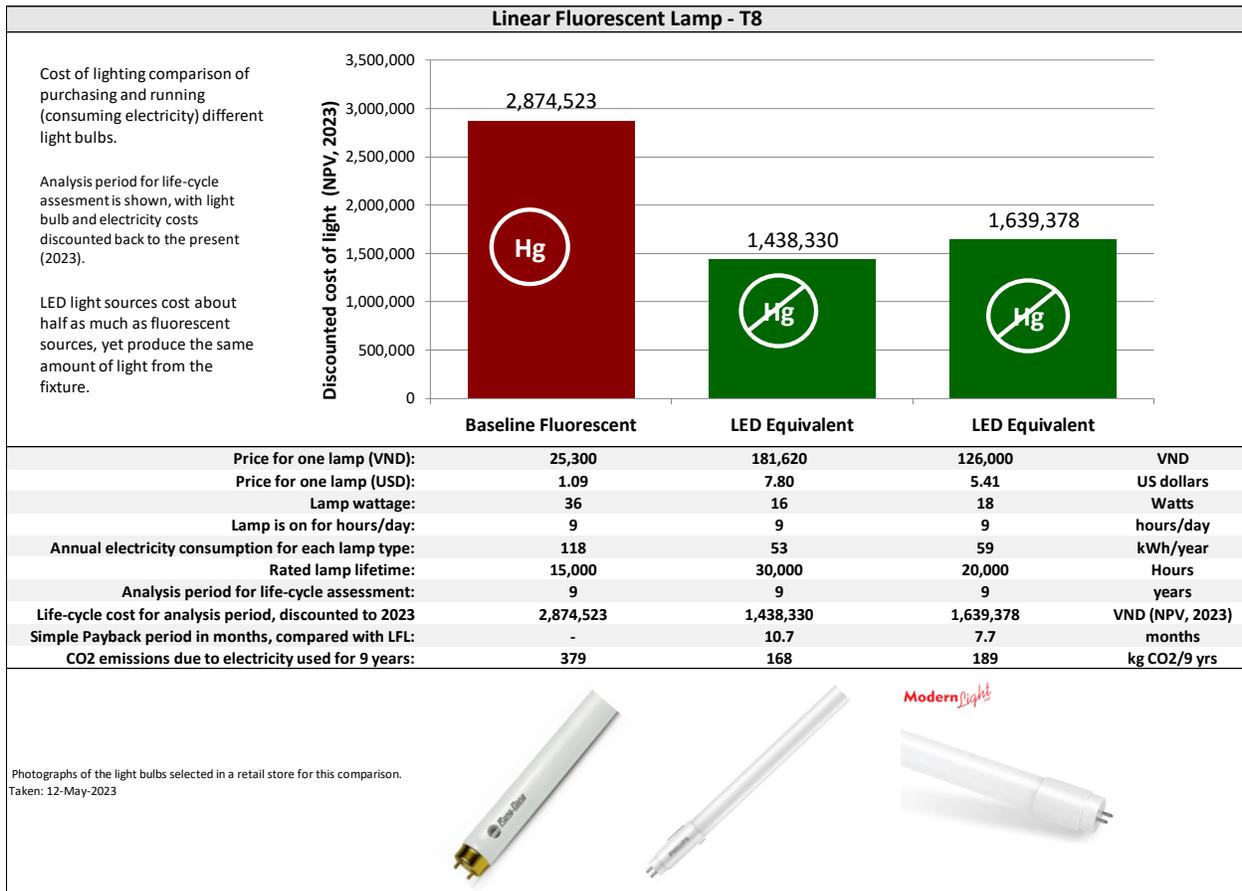
of Companies: 7
 Mercury Savings (2025): 1,090 kg
 Financial Savings (2025): 16 Billion USD
 Energy Savings (2025): 138 TWh
 CO2 Savings (2025): 37 Mt CO2

LED Manufacturers

[Download Manufacturer Data](#)

1. Vinshine electrical equipment joint stock company +
2. Daisy Group +
3. DHTECH Industrial Equipment and Trading Co., Ltd +
4. CCG - Production Trading Company Limited +
5. Paragon Vietnam +
6. Dien Quang +
7. RANGDONG LIGHT SOURCE & VACUUM FLASK JOINT STOCK COMPANY +

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



C Li C

END TOXIC LIGHTING TOGETHER