

Technical Session

Transitioning to Mercury-Free Lighting in Asia-Pacific Countries

19th and 20th June 2023

Geneva, Switzerland

DAY 1



GLOBAL
MERCURY
PARTNERSHIP



Schweizerische Eidgenossenschaft
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Federal Office for the Environment FOEN



DAY 1

Monday

19th June 2023

- 09:30 Welcome and opening remarks
- 09:45 Tour de Table
- 10:15 Introduction and scene setting
- 10:30 **Coffee break**
- 10:50 Minamata Convention and Lighting
- 11:15 Lighting: Global Supply Chain and Technology Overview
- 12:00 **Lunch Break**
- 13:30 Fluorescent Lamps Country Profiles and Country Market Potential - Technical Deep dives
- 15:00 **Coffee Break**
- 15:20 Health Risks of Mercury Exposure and Waste Management Challenges of end-of-life fluorescent lamps
- 15:40 Sharing of experiences – Concerns and Challenges
Moderated discussion

Welcome and opening remarks

Overall moderator

David Kapindula, Environmental
Management Agency, Zambia

Opening remarks

Jacqueline Alvarez
Chief of Branch, UNEP

Rodges Ankrah, Chair of the
Partnership Advisory Group, Global
Mercury Partnership y Partnership





Tour de Table

All participants



Introduction and scene setting

Rodges Ankrah

Chair of the Partnership Advisory
Group, Global Mercury Partnership



Minamata Convention and Lighting

Eisaku Toda

Senior Programme Management
Officer, Secretariat of the Minamata
Convention



Minamata Convention and Lighting

Secretariat of the Minamata Convention on Mercury

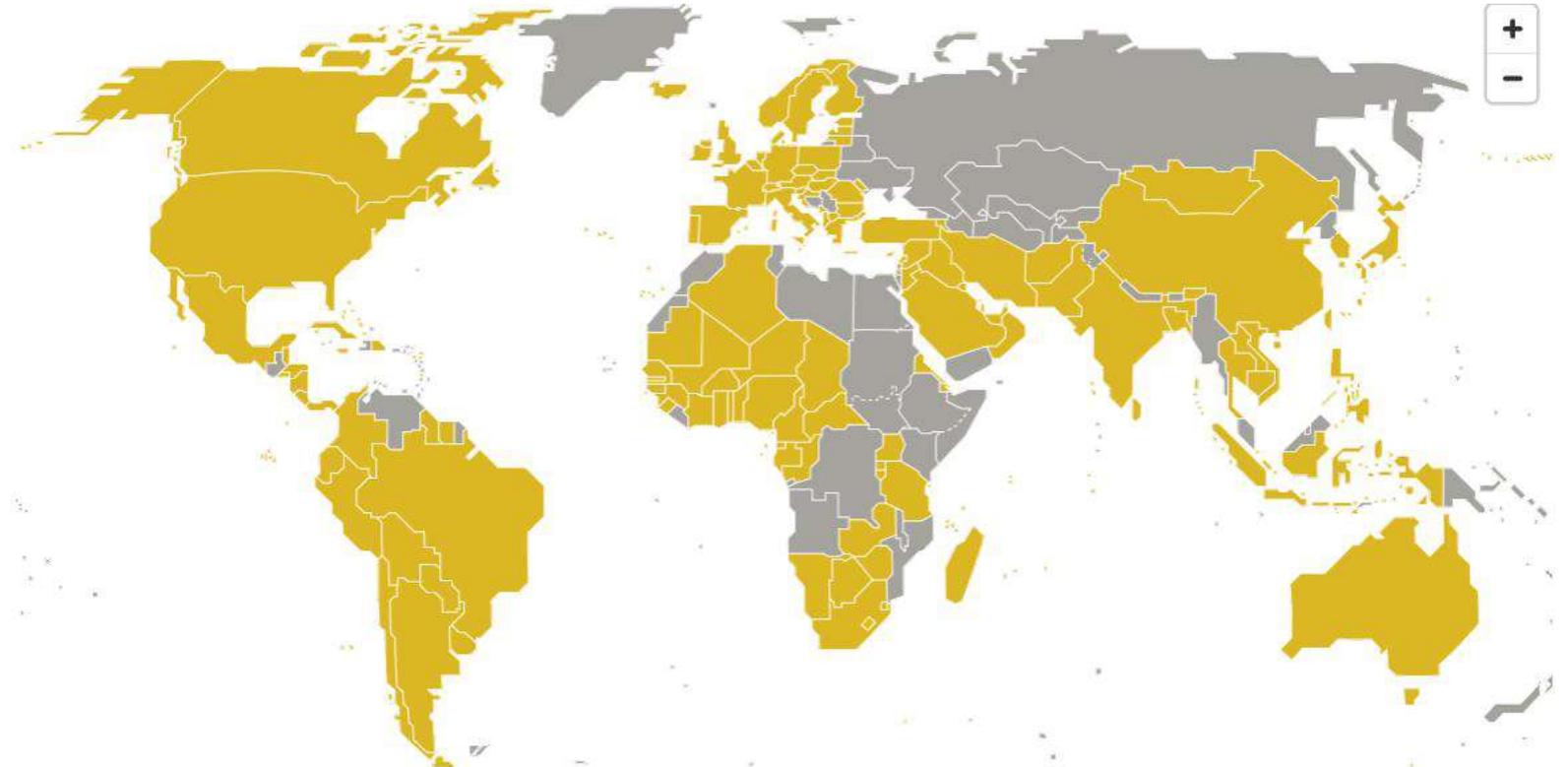
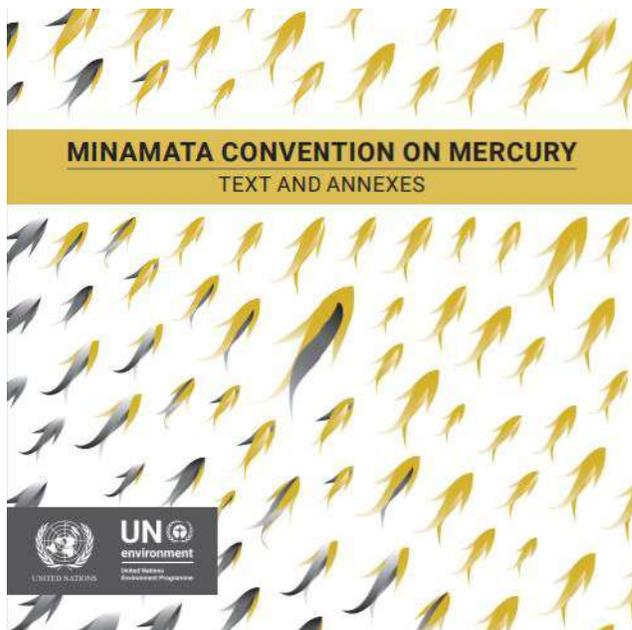
Technical Session "Transitioning to Mercury-Free Lighting in Asia-Pacific Countries"

Geneva, 19-20 June 2023

Minamata Convention of Mercury

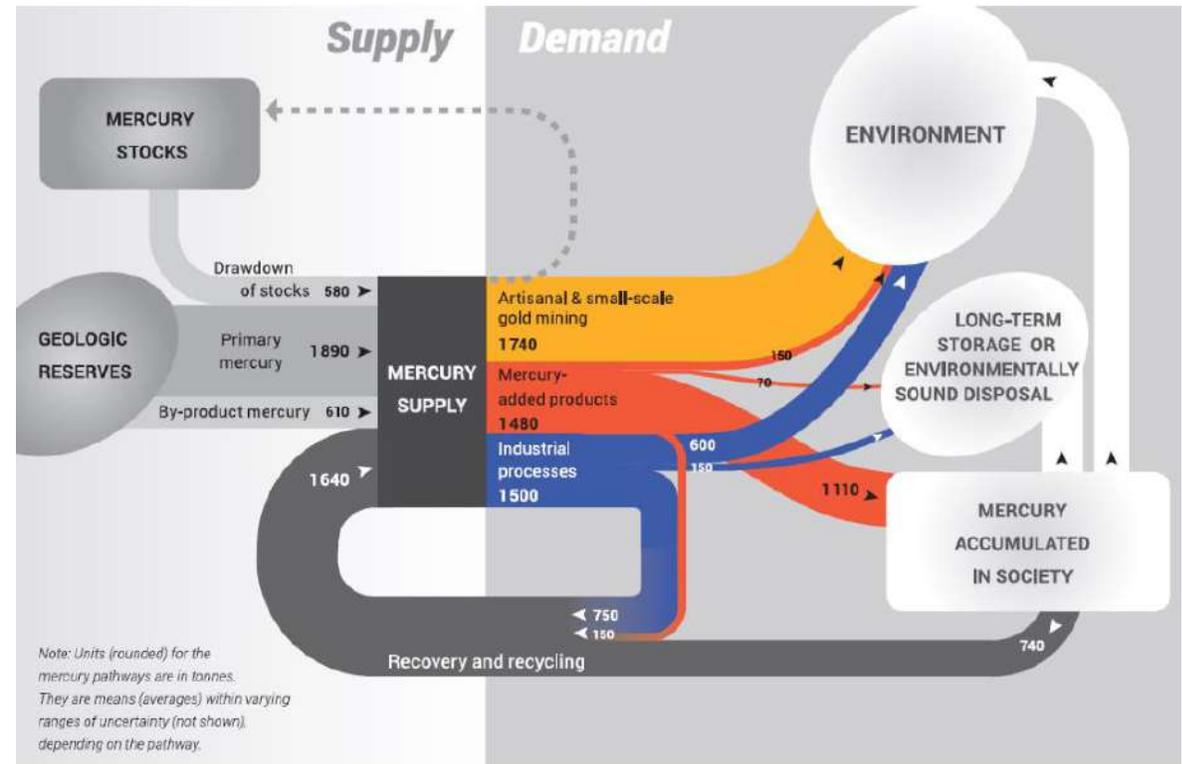


- Objective: to **protect the human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.**
- Adopted in October 2013, entered into force in August 2017.
- 142 parties, as of June 2023
- Addresses the whole life cycle of mercury from supply and trade to use, emissions releases and disposal.



Why we need to act on mercury added products

- ▶ The use of mercury in products accounts for 30% of the global demand of mercury.
- ▶ Mercury is emitted and released to the environment during the manufacturing of the products, their use and waste disposal, causing harm to human health and the environment.
- ▶ Some mercury added products, such as cosmetics, will cause direct human exposure to mercury.
- ▶ Control on mercury added products is one of the Parties' obligations that have the earliest deadline – 2020. The Convention was amended with additional products to be phased out by 2025.
- ▶ Mercury added products are present in all countries, so all the parties need to take action.



Source: Global mercury supply, trade and demand, (UNEP, 2017)

Parties' obligations on mercury added products

Parties shall:

- ▶ **Not allow the manufacture, import or export of mercury added products listed in Part I of Annex A**
 - after the specified phase-out date
 - unless the Party registered exemption.
 - Parties may choose, when becoming a party to the Convention, to take other measures and report those measures to COP. (Para 2)
- ▶ Take measures for the mercury added products listed in Part II of Annex A – to **phase down the use of dental amalgam**.
- ▶ Take measures to prevent the incorporation into assembled products of mercury added products listed in Part I of Annex A
- ▶ Discourage the manufacture and the distribution in commerce of mercury added products not covered by any known use before the Convention.

Article 4 Mercury added products

1. Each Party shall not allow, by taking appropriate measures, the manufacture, import or export of mercury added products listed in Part I of Annex A after the phase-out date specified for those products, except where an exclusion is specified in Annex A or the Party has a registered exemption pursuant to Article 6.

2. A Party may, as an alternative to paragraph 1, indicate at the time of ratification or upon entry into force of an amendment to Annex A for it, that it will implement different measures or strategies to address products listed in Part I of Annex A. A Party may only choose this alternative if it can demonstrate that it has already reduced to a de minimis level the manufacture, import, and export of the large majority of the products listed in Part I of Annex A and that it has implemented measures or strategies to reduce the use of mercury in additional products not listed in Part I of Annex A at the time it notifies the Secretariat of its decision to use this alternative. In addition, a Party choosing this alternative shall:

(a) Report at the first opportunity to the Conference of the Parties a description of the measures or strategies implemented, including a quantification of the reductions achieved;

(b) Implement measures or strategies to reduce the use of mercury in any products listed in Part I of Annex A for which a de minimis value has not yet been obtained;

(c) Consider additional measures to achieve further reductions; and

(d) Not be eligible to claim exemptions pursuant to Article 6 for any product category for which this alternative is chosen.

No later than five years after the date of entry into force of the Convention, the Conference of the Parties shall, as part of the review process under paragraph 8, review the progress and the effectiveness of the measures taken under this paragraph.

3. Each Party shall take measures for the mercury added products listed in Part II of Annex A in accordance with the provisions set out therein.

5. Each Party shall take measures to prevent the incorporation into assembled products of mercury added products the manufacture, import and export of which are not allowed for it under this Article.

6. Each Party shall discourage the manufacture and the distribution in commerce of mercury-added products not covered by any known use of mercury added products prior to the date of entry into force of the Convention for it, unless an assessment of the risks and benefits of the product demonstrates environmental or human health benefits. A Party shall provide to the Secretariat, as appropriate, information on any such product, including any information on the environmental and human health risks and benefits of the product. The Secretariat shall make such information publicly available.

Phasing out mercury added products

- Article 4 of the Minamata Convention provides that parties **shall not allow the manufacture, import or export of mercury added products** listed in Annex A Part I after the specified phase-out date.
- The fourth meeting of the Conference of the Parties in March 2022 amended Annex A, adding eight product categories.



Mercury-added products	Phase-out date
Batteries, except for button zinc silver oxide batteries with a mercury content < 2% and button zinc air batteries with a mercury content < 2%	2020
Switches and relays, except very high accuracy capacitance and loss measurement bridges and high frequency radio frequency switches and relays in monitoring and control instruments with a maximum mercury content of 20 mg per bridge, switch or relay	2020
Compact fluorescent lamps (CFLs) for general lighting purposes that are ≤ 30 watts with a mercury content exceeding 5 mg per lamp burner	2020
Compact fluorescent lamps with an integrated ballast (CFL.i) for general lighting purposes that are ≤ 30 watts with a mercury content not exceeding 5 mg per lamp burner	2025
Linear fluorescent lamps (LFLs) for general lighting purposes: (a) Triband phosphor < 60 watts with a mercury content exceeding 5 mg per lamp; (b) Halophosphate phosphor ≤ 40 watts with a mercury content exceeding 10 mg per lamp	2020
High pressure mercury vapour lamps (HPMV) for general lighting purposes	2020
Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: (a) short length (≤ 500 mm) with mercury content exceeding 3.5 mg per lamp (b) medium length (> 500 mm and ≤ 1 500 mm) with mercury content exceeding 5 mg per lamp (c) long length (> 1 500 mm) with mercury content exceeding 13 mg per lamp	2020
Cold cathode fluorescent lamps (CCFL) and external electrode fluorescent lamps (EEFL) of all lengths for electronic displays, not included in the listing directly above	2025

Mercury-added products	Phase-out date
Cosmetics (with mercury content above 1ppm), including skin lightening soaps and creams, and not including eye area cosmetics where mercury is used as a preservative and no effective and safe substitute preservatives are available	2020
Pesticides, biocides and topical antiseptics	2020
The following non-electronic measuring devices installed in large-scale equipment or those used for high precision measurement, where no suitable mercury-free alternative is available: (a) barometers; (b) hygrometers; (c) manometers; (d) thermometers; (e) sphygmomanometers.	2020
Strain gauges to be used in plethysmographs	2025
The following electrical and electronic measuring devices except those installed in large-scale equipment or those used for high precision measurement, where no suitable mercury free alternative is available: (a) melt pressure transducers, melt pressure transmitters and melt pressure sensors	2025
Mercury vacuum pumps	2025
Tire balancers and wheel weights	2025
Photographic film and paper	2025
Propellant for satellites and spacecraft	2025

Mercury-added products in Minamata Convention - Lamps

Mercury vapour, when excited by electric current, produces light for use in a wide variety of applications. In fluorescent lamps, ultraviolet light produced by mercury vapour is transformed to visible light by phosphor lining.

Mercury used in fluorescent lamps have been reduced as technology advanced, and the Minamata Convention sets the limit of mercury used per lamp burner.

Light emitting diode (LED) lamps are a non-mercury alternative that can replace most of the mercury-containing lamps. Annex A was amended in 2022 to phase out compact fluorescent lamps with integrated ballasts.



CFLs



LFLs



HPMVs

Mercury-added products	Phase-out date
Compact fluorescent lamps (CFLs) for general lighting purposes that are ≤ 30 watts with a mercury content exceeding 5 mg per lamp burner	2020
Compact fluorescent lamps with an integrated ballast (CFL.i) for general lighting purposes that are ≤ 30 watts with a mercury content not exceeding 5 mg per lamp burner	2025
Linear fluorescent lamps (LFLs) for general lighting purposes: <ul style="list-style-type: none"> (a) Triband phosphor < 60 watts with a mercury content exceeding 5 mg per lamp; (b) Halophosphate phosphor ≤ 40 watts with a mercury content exceeding 10 mg per lamp 	2020
High pressure mercury vapour lamps (HPMV) for general lighting purposes	2020
Mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays: <ul style="list-style-type: none"> (a) short length (≤ 500 mm) with mercury content exceeding 3.5 mg per lamp (b) medium length (> 500 mm and $\leq 1\ 500$ mm) with mercury content exceeding 5 mg per lamp (c) long length ($> 1\ 500$ mm) with mercury content exceeding 13 mg per lamp 	2020
Cold cathode fluorescent lamps (CCFL) and external electrode fluorescent lamps (EEFL) of all lengths for electronic displays, not included in the listing directly above	2025

Phasing down dental amalgam

- Annex A Part II listed nine measures of which parties were to take two or more.
- Two mandatory measures were added on the use of amalgam in **bulk form** and its use for **children and pregnant/breastfeeding women**.



Mercury added products	Provisions	Dental amalgam	
Dental amalgam	<p>Measures to be taken by a Party to phase down the use of dental amalgam shall take into account the Party's domestic circumstances and relevant international guidance and shall include two or more of the measures from the following list:</p> <ul style="list-style-type: none"> (i) Setting national objectives aiming at dental caries prevention and health promotion, thereby minimizing the need for dental restoration; (ii) Setting national objectives aiming at minimizing its use; (iii) Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration; (iv) Promoting research and development of quality mercury-free materials for dental restoration; (v) Encouraging representative professional organizations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices; 		<ul style="list-style-type: none"> (vi) Discouraging insurance policies and programmes that favour dental amalgam use over mercury-free dental restoration; (vii) Encouraging insurance policies and programmes that favour the use of quality alternatives to dental amalgam for dental restoration; (viii) Restricting the use of dental amalgam to its encapsulated form; (ix) Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land. <p>In addition, Parties shall:</p> <ul style="list-style-type: none"> (i) Exclude or not allow, by taking measures as appropriate, the use of mercury in bulk form by dental practitioners; (ii) Exclude or not allow, by taking measures as appropriate, or recommend against the use of dental amalgam for the dental treatment of deciduous teeth, of patients under 15 years and of pregnant and breastfeeding women, except when considered necessary by the dental practitioner based on the needs of the patient.

- ▶ Article 6 allows Parties to register exemptions from the phase-out dates listed in Part I of Annex A.
- ▶ Exemptions are to be submitted, using the format adopted at COP-1,
 - ▶ On becoming a Party
 - ▶ In the case of any mercury added product that is added by an amendment to Annex A, before that amendment enters into force.
- ▶ Exemptions:
 - ▶ expire five years after the relevant phase-out date listed in Annex A, unless Party registers for a shorter period
 - ▶ COP may decide to extend the phase-out date, at the request by a Party, only once to a maximum of 10 years after the phase-out date.
- ▶ 12 Parties have registered their exemption

Article 6
Exemptions available to a Party upon request

1. Any State or regional economic integration organization may register for one or more exemptions from the phase-out dates listed in Annex A and Annex B, hereafter referred to as an "exemption", by notifying the Secretariat in writing:

(a) On becoming a Party to this Convention; or

(b) In the case of any mercury added product that is added by an amendment to Annex A or any manufacturing process in which mercury is used that is added by an amendment to Annex B, no later than the date upon which the applicable amendment enters into force for the Party.

Any such registration shall be accompanied by a statement explaining the Party's need for the exemption.

2. An exemption can be registered either for a category listed in Annex A or B or for a sub-category identified by any State or regional economic integration organization.

3. Each Party that has one or more exemptions shall be identified in a register. The Secretariat shall establish and maintain the register and make it available to the public.

4. The register shall include:

(a) A list of the Parties that have one or more exemptions;

(b) The exemption or exemptions registered for each Party; and

(c) The expiration date of each exemption.

5. Unless a shorter period is indicated in the register by a Party, all exemptions pursuant to paragraph 1 shall expire five years after the relevant phase-out date listed in Annex A or B.

6. The Conference of the Parties may, at the request of a Party, decide to extend an exemption for five years unless the Party requests a shorter period. In making its decision, the Conference of the Parties shall take due account of:

(a) A report from the Party justifying the need to extend the exemption and outlining activities undertaken and planned to eliminate the need for the exemption as soon as feasible;

(b) Available information, including in respect of the availability of alternative products and processes that are free of mercury or that involve the consumption of less mercury than the exempt use; and

(c) Activities planned or under way to provide environmentally sound storage of mercury and disposal of mercury wastes.

An exemption may only be extended once per product per phase-out date.

Registered exemptions on mercury added products



Party	Category/subcategory registered for exemption	Exemption expiry date
Argentina	Manufacture of clinical thermometers	2025
Botswana	Import of all mercury added products as listed in Part I of Annex A	2025
Canada	Manufacture, import and export of linear fluorescent lamps (CFLs) for general lighting purposes and; Manufacture, import and export of CCFLs and EEFLs for electronic displays	2025
China	Manufacture of clinical thermometers and sphygmomanometers	2025
Eswatini	Import of batteries; switches and relays; lamps; measuring devices	2025
Ghana	Manufacture, import and export for all mercury added products, as listed in Part I of Annex A	2025
India	Manufacture, import and export of all mercury added products as listed in Part I of Annex A	2025
Iran	Import of batteries; Manufacture, import and export of switches and relays, and lamps; Manufacturing and exporting of measuring devices	2025
Lesotho	Import of: batteries, switches and relays, and lamps	2025
Madagascar	Import of all mercury added products, as listed in Part I of Annex A	2025
Peru	Manufacture, import and export of thermometers and sphygmomanometers	2025
Thailand	Manufacture, Import and Export of switches and relays; lamps; topical antiseptics; and measuring devices	2025

Annex A Exclusions

Annex A

Mercury-added products

The following products are excluded from this Annex:

- (a) Products essential for civil protection and military uses;
- (b) Products for research, calibration of instrumentation, for use as reference standard;
- (c) Where no feasible mercury-free alternative for replacement is available, switches and relays, cold cathode fluorescent lamps and external electrode fluorescent lamps (CCFL and EEFL) for electronic displays, and measuring devices;
- (d) Products used in traditional or religious practices; and
- (e) Vaccines containing thiomersal/thimerosal as preservatives



Amendment of Annex A



- Paragraph 7 of Article 4 provides that **any Party may submit a proposal to the Secretariat for listing a mercury-added product in Annex A**, which shall include information related to the **availability, technical and economic feasibility and environmental and health risks and benefits of the non-mercury alternatives to the product**, taking into account information that the Secretariat collect pursuant to paragraph 4 of Article 4.
- The Conference of the Parties will consider the amendment proposal pursuant to Articles 26 and 27.
- Pursuant to paragraph 2 of Article 26, the text of any proposed amendment shall be communicated to the Parties by the Secretariat **at least six months before the meeting of the Conference of the Parties** at which it is proposed for adoption. The Secretariat shall also communicate the proposed amendment to the signatories to this Convention and, for information, to the Depositary.
- Pursuant to paragraph 3 of Article 26, the Parties shall make every effort to reach agreement on any proposed amendment to this Convention by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting.

Amendment of Annex A decided by COP-4



Pursuant to paragraph 4 of Article 26, the Secretary General of the United Nations, acting in his capacity as Depositary, has issued a communication following the adoption of [decision MC-4/3 “Review and amendment of annexes A and B to the Minamata Convention on Mercury](#). The communication, including the texts of the amended Annex A in the six UN official languages, was posted on 28 September 2022 on the UN Treaty Collection website at <https://treaties.un.org/doc/Publication/CN/2022/CN.313.2022-Eng.pdf>

Pursuant to paragraph 4 of Article 27, **amendments to annexes to the Convention shall enter into force:**

- for a Party on the expiry of one year from the date of the communication by the Depositary, on **28 September 2023**, pursuant to paragraph 3 (c) of Article 27;
- except for any Party that, pursuant to paragraph 3(b) of Article 27, has notified the Depositary in writing that it is unable to accept the amended text;
- for any Party that made a declaration with regard to amendment of annexes in accordance with paragraph 5 of article 30, in which case any amendment shall enter into force for such a party on the ninetieth day after the date it has deposited with the Depositary its instrument of ratification, acceptance, approval or accession with respect to the amendment.

Amendment of Annex A to be considered at COP-5



Consideration of phase-out dates carried over from COP-4

<i>Mercury-added products</i>	<i>Phase-out date</i>
Button zinc silver oxide batteries with a mercury content < 2% and button zinc air batteries with a mercury content < 2%	[2025] [2029]
Very high accuracy capacitance and loss measurement bridges and high frequency radio frequency switches and relays in monitoring and control instruments with a maximum mercury content of 20 mg per bridge switch or relay [except those used for research and development purposes]	[2025] [2029]
Linear fluorescent lamps (LFLs) for general lighting purposes: (a) Halophosphate phosphor ≤ 40 watts with a mercury content not exceeding 10 mg per lamp (b) Halophosphate phosphor > 40 watts	[2025] [2027] [2030]
Linear fluorescent lamps (LFLs) for general lighting purposes: (a) Triband phosphor < 60 watts with a mercury content not exceeding 5 mg/lamp	[2027] [2030]

See COP decision [MC-4/3](#).

New amendment proposals submitted by African region

<i>Mercury-added products</i>	<i>Phase-out date</i>
[Compact fluorescent lamps (CFLs) for general lighting purposes that are > 30 watts]	[2025]
[Compact fluorescent lamps with a non-integrated ballast (CFL.ni) for general lighting purposes that are ≤ 30 watts with a mercury content not exceeding 5 mg per lamp burner]	[2025]
[Linear fluorescent lamps (LFLs) for general lighting purposes: (b) Triband phosphor ≥ 60 watts]	[2025]
[Non-linear fluorescent lamps (NFLs) (e.g., U-bend and circular) for general lighting purposes: (a) Triband phosphor, all wattages (b) Halophosphate phosphor, all wattages]	[2026]
[Cosmetics, including skin lightening soaps and creams, and not including eye area cosmetics where mercury is used as a preservative and no effective and safe substitute preservatives are available]	[2025]
[Dental amalgam]	[2030]

See proposals for amendment on [fluorescent lighting](#), [cosmetics](#) and [dental amalgam](#).

<i>Mercury-added products</i>	<i>Provisions</i>
[Dental amalgam]	In addition, Parties shall: (iii) Submit to the Secretariat a national plan concerning the measures it intends to implement to phase out the use of dental amalgam (iv) Exclude or not allow, by taking measures as appropriate, the use of dental amalgam in government insurance policies and programmes
[Cosmetics including skin lightening soaps and creams, and not including eye area cosmetics where mercury is used as a preservative and no effective and safe substitute preservatives are available]	[Measures to be taken by a Party to phase out the sale and offering of sale of mercury-added cosmetics from both local markets and online platforms shall include the following measures: i. Setting national objectives to phase out sales and offering of sales including, but not limited to carrying out two or more of the following: a. Developing and implementing strategies to discourage marketing, advertising and display; b. Developing and publicizing advisories, detention and prohibited substances lists of mercury-added cosmetics; c. Licensing and product ingredient approvals for manufacturing facilities for cosmetics and beauty products; d. Engaging online platforms in developing and implementing product safety pledges. ii. Coordinating and collaborating on phase out initiatives inter-ministerially and bilaterally and/or regionally; iii. Raising public awareness about the hazards of SLP use among physicians, dermatologists and beauty centers, as well as consumers and family members.

Global Workshop: Implementing the Minamata Convention obligations on mercury-added products



- ▶ Out of 113 Parties that submitted national reports under Article 21, 33 Parties responded that they have not taken measures for phase-out.
- ▶ The Implementation and Compliance Committee of the Minamata Convention reviewed the implementation status of the 2020 deadline and invited relevant Parties to inform of a strategy on how they plan to address challenges they face and a proposed time schedule with milestones to implement relevant paragraphs of Article 4.
- ▶ This workshop is part of a global effort to support Parties to catch up with the 2020 deadline and address the new 2025 deadline.
- ▶ The Minamata Convention Secretariat is also organizing a three-day workshop with financial support from the European Commission with select participation of Parties from some other regions.
 - **Venue: International Environment House I, Geneva**
 - **Date: 21-23 June 2023**
- ▶ Parties that reported on challenges in implementing the 2020 deadline are invited to develop:
 - Elements of **national strategy, time schedule and needs for support** to implement Article 4 of the Convention.
 - Plans for **regional support activities** to support the development of national strategies to implement Article 4.



MINAMATA
CONVENTION
ON MERCURY

Thank you for your attention

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Lighting: Global Supply Chain and Technology Overview

Fred Bass

Independent Consultant, Bass Lighting

Steve Coyne

Director, Light Naturally



Clean
Lighting
Coalition

Let's end toxic lighting together.



Compact Fluorescent Lamps (CFLs)

Annex A: Mercury limits for Compact Fluorescent Lamps

Mercury Added Products	Year
Compact fluorescent lamps (CFLi) for general lighting purposes that are ≤ 30 watts with a mercury content exceeding 5 mg per lamp burner.	2020
Compact fluorescent lamps with an integrated ballast (CFL.i) for general lighting purposes that are ≤ 30 watts with a mercury content not exceeding 5 mg per lamp burner.	2025

- Minamata Annex A defines CFL by wattage; ≤ 30 watts represents the highest sales volume of CFLs
- Mercury content per lamp is generally between 2.0 – 8.0 mg/lamp
In Europe, RoHS limits the level to 2.5 mg/lamp
- CFLs struggled to gain consumer acceptance – long warm-up time, fragile, not easily dimmed, light colour, toxicity – mercury
- Two types of CFLs covered by Minamata:
 - Screw/Bayonet base => integrated ballast, or **CFLi** – **phase out end 2025**
 - Pin base => non-integrated ballast, or **CFLni** – **phase out proposed**



Are there mercury-free alternatives to CFLs?

- **Yes**, there are literally **thousands of mercury-free alternatives** to both CFLi and CFLni
- LED replacements come in different colour temperatures, different base types and offer both diffuse light (frosted) or not (sparkle effect).
- LED lamps were **designed as a retrofit product**
 - 100% of CFLi sockets are retrofittable
 - 85% of CFLni sockets are retrofittable now, three remaining base types can be made for an order of 10,000 units or more
- LED has longer service life, instant full brightness, double the efficiency of CFL
- LED replacement lamps are highly cost effective, and offer the least life-cycle cost



OSCO



Annex A: Mercury limits for Linear Fluorescent Lamps (LFL)

Mercury Added Products	Year
Linear fluorescent lamps (LFLs) for general lighting purposes: (a) Triband phosphor < 60 watts with a mercury content exceeding 5 mg per lamp; (b) Halophosphate phosphor ≤ 40 watts with a mercury content exceeding 10 mg per lamp	2020

- Minamata Annex A defines LFL by type of phosphor and wattage:
 - Triband – modern, three colour rare earth phosphor
 - Halophosphate – older, poorer quality phosphor
- Wattage limits encompass the high-volume LFLs
- Contain generally between 5.0 – 10.0 mg/lamp
- Over one billion bulbs sold each year – roughly 8 tonnes Hg / year
- Requires a “ballast” to operate; there are two types: magnetic (“choke”) and electronic (“high frequency”)
 - Magnetic ballast is most common – more tolerant of humidity and high temperature
- LFL has relatively short service life compared to LED retrofits (2-3x longer life)

T5
5/8" diameter



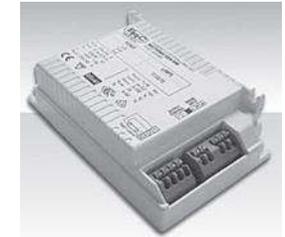
T8
1" diameter



T12
1.5" diameter



Magnetic
Ballast



Electronic
Ballast

Are there mercury-free alternatives to LFLs?

- **Yes**, there are literally **tens of thousands of mercury-free alternatives** to LFL
- LED replacements come in different diameters, lengths, colour temperatures, colour rendering, levels of light output and are compatible with all magnetic ballasts and virtually all electronic ballasts
- Life Cycle cost of LED is around half that of LFL, plus T8 typically payback in less than a year, even 4 months is possible, T5 payback in less than 1.5 years.
- LED retrofit tubes were **designed as a retrofit product for fluorescent fixtures** - products sold today do not need to rewire the old fluorescent fixture:
 - **Philips/Signify**: “No need to change drivers or rewire”, and a “plug and play solution that works straight out of the box”
 - **OSRAM/LEDvance** state “SubstiTUBE” is a “Quick, simple and safe lamp replacement without rewiring”
 - **Tungsrām** says in addition to “the 2.5-3x longer life (compared to T8 fluorescent) LED T8 tubes provide lower system loss while existing fixtures remain intact.”

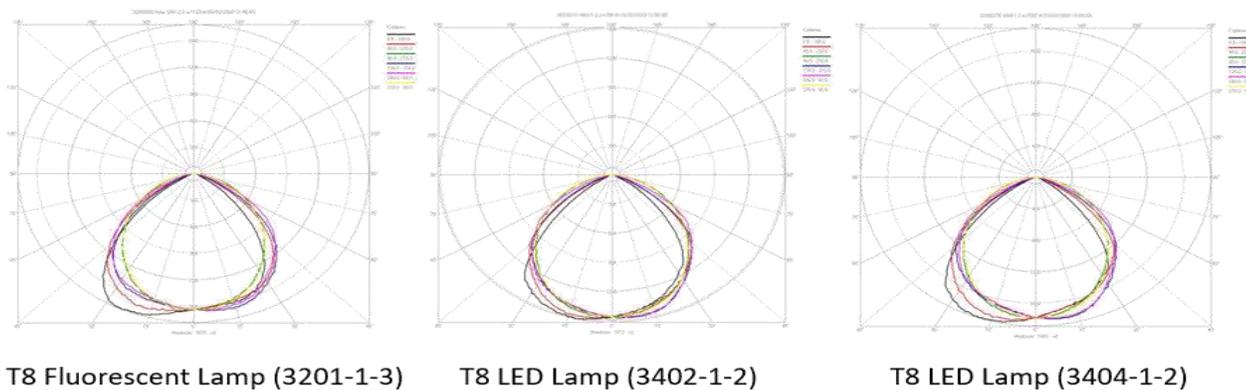




LED trends, manufacturing & supply chains

Technology Trends in LED

- Billions and billions invested; transition to LED well underway globally
- Efficacy continues improving – for example: a [210 lm/W LED filament lamp](#)
 - PC-LEDs now / RGB-mix coming
- Prices declining – LED lamps cheaper than CFLs; LED tube paybacks as low as 4 months¹
- LED tube compatibility 91-93% with existing fixtures ([EU study](#))
- LED tube match system optical output



T8 Fluorescent Lamp (3201-1-3)

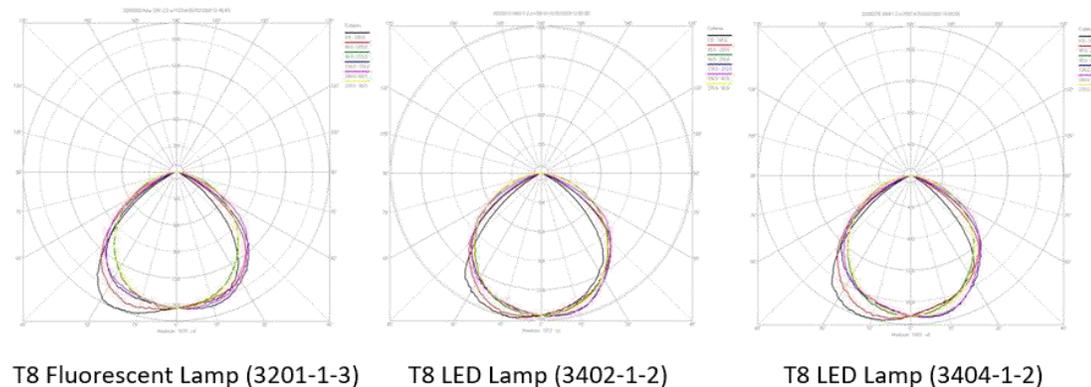
T8 LED Lamp (3402-1-2)

T8 LED Lamp (3404-1-2)

¹[OSRAM website](#): “Payback of acquisition and replacement costs possible after only four months”

LED Technology Trends: a Decade of Rapid Improvement

- Billions and billions invested; transition to LED well underway globally
- Efficacy improved significantly and projected to continue through 2040
 - LED offers 50% energy savings over fluorescent, 85% over incandescent
 - Phosphor-converting LEDs today, colour-mixing LEDs coming
 - Next generation products available today: Philips [210 lm/W LED lamp](#)
- Prices declining, good for consumers; LED lamps generally cheaper than CFLs; LED retrofit tubes have payback periods as low as 4 months¹
- LED tube compatibility 91-93% with existing fixtures ([EU study](#))
- LED tube retrofits designed to match system optical output, shown below:



¹[OSRAM website](#): “Payback of acquisition and replacement costs possible after only four months”

Global Manufacturing Opportunities for Asia Pacific

- LED manufacturing is dominated by the Asia Pacific region
- Global chip and package exports are 90% from Asia Pacific ([Figure 4-1](#))
 - Malaysia (25%)
 - Japan (21%)
 - China (18%)
- China dominates global lamp and luminaire exports

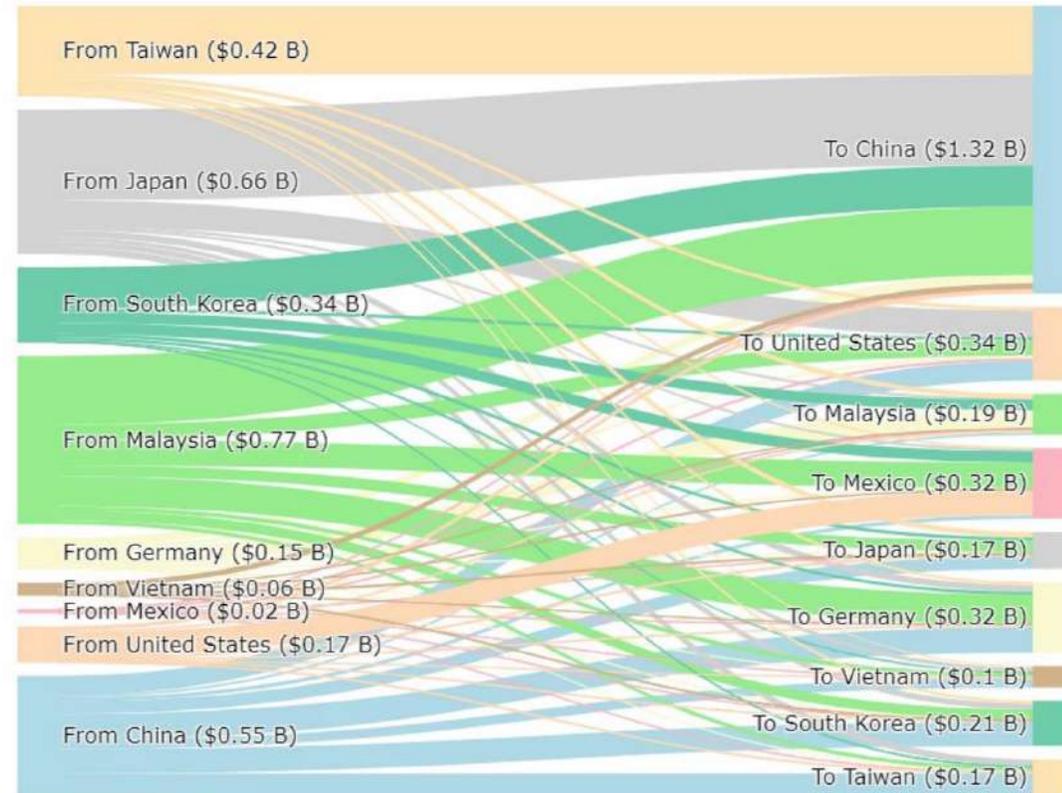


Figure 4-1. Trade flow of LED packages and die for lighting, 2019 [3] [4]. This data only includes exports to other countries and does not include LED packages manufactured for domestic consumption. The total global market for LED packages for general lighting in 2019 was \$5.6 billion [4], and the total global exports between these nine countries were approximately \$3.1 billion [3]. LED packages for general lighting applications were approximated from total LED package trade data based on global market share in 2019.

LED Lamp Market and Supply Chain

- Worldwide, China is the world's largest exporter of LED lamps (est. 56% in 2020)
 - Second and third exporters are Germany and Poland, with about 6% each
- BUT
 - There is a huge opportunity for local assembly of LED light sources, this creates opportunity for local employment.
 - Yes, the chip/package has to be bought in from one of about 6 reactors around the world, then the rest of the process is assembly.
 - SMT machines are needed but these are widely available from suppliers of all electronic equipment.
- Tunisia as an example;
 - I visited 4 of their main lighting manufacturers, all had finished with incandescent & all but one CFL. They had all invested in SMT lines and were assembling LED sources
 - KEY ISSUE... local regulation to ensure a quality product, uncontrolled poor quality imports were a major problem. Local regulation, verification and test is essential.

Lighting Metrics – What is Quality Lighting?

Efficacy – higher is better, more lumens of light per watt of energy

Power Quality:

- Displacement Factor (Fundamental Power Factor)
- Standby power
- Harmonics

Light Quality:

- Color Rendering Index (CRI)
- Correlated Color Temperature (CCT)
- Flicker (PstLM and SVM)
- Colour Consistency

Lifetime:

- Lumen maintenance
- Survival factor (switching cycles)

Other

- Electromagnetic interference - emission and tolerance
- Hazardous Substances restriction – no mercury, no lead





Safety and Compatibility

European Commission: RoHS Directive update

Ban

- 25 Feb 2023 – CFLni & circular T5 fluorescent lamps
- 25 Aug 2023 – Linear T5 & T8 FL fluorescent lamps



The screenshot shows the European Commission website. At the top left is the European Commission logo. To its right is the text 'European Commission' and a language selector set to 'English'. Below the header is a navigation bar with the text 'Energy, Climate change, Environment'. A dark blue banner below the navigation bar contains the word 'Environment' in white. Below the banner is a breadcrumb trail: 'Home > News > Clean and circular electronics: Commission ends use of mercury in lamps as mercury-free alternatives prevail'. Below the breadcrumb trail is the text 'NEWS ARTICLE | 16 December 2021 | Directorate-General for Environment'. The main heading of the article is 'Clean and circular electronics: Commission ends use of mercury in lamps as mercury-free alternatives prevail'. The article text begins with 'The Commission has adopted a package of rules ending a broad range of existing exemptions for the use of mercury in lamps. Under EU rules restricting the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive), electronics that contain mercury cannot be placed on the market, except if time-limited and application-specific exemptions are granted by the Commission. Most of these exemptions for general lighting will be discontinued as assessments conducted by the Commission since 2016 concluded that safe, mercury-free alternatives are widely available for fluorescent lamps. The new rules aim to increase the protection of health and the environment from this hazardous substance, as well as boost innovation and promote cleaner products.'

Do I have to change my fixtures?



- **No**, in 91-94% of cases, LED retrofit tubes can be installed directly in the same sockets and do not need to rewire the old fluorescent fixture:

• **Philips/Signify**: “No need to change drivers or rewire”, and a “plug and play solution that works straight out of the box”

• **OSRAM/LEDvance** state “SubstiTUBE” is a “Quick, simple and safe lamp replacement without rewiring”

• **Tungsrām** says in addition to “the 2.5-3x longer life (compared to T8 fluorescent)...LED T8 tubes provide lower system loss while existing fixtures remain intact.”

PHASE-OUT AND LEDVANCE REPLACEMENT PRODUCTS			
PRODUCTS AFFECTED		BANNED ¹	LED REPLACEMENT PRODUCTS
COMPACT FLUORESCENT LAMPS CFLU – E27, E14 etc. with integrated control gear		SEPT 1, 2021	
HIGH-VOLTAGE HALOGEN LAMPS ² R7e > 2700 lm corresponds to approx. 140W		SEPT 1, 2021	
LOW-VOLTAGE HALOGEN LAMPS GU4, GU5.3, G53 with reflector >10° beam angle		SEPT 1, 2021	
LINEAR FLUORESCENT LAMPS T12 and T2		SEPT 1, 2021	
CIRCULAR FLUORESCENT LAMPS T5 and T9 ³		FEB 25, 2023	
COMPACT FLUORESCENT LAMPS with plug-in bases (CFLni – 2pin/4pin)		FEB 25, 2023	
LINEAR FLUORESCENT LAMPS T5 and T8		AUG 25, 2023	
HALOGEN PINS G4, GY6.35, G9		SEPT 1, 2023	

¹ Products that are already on the market may still be sold after this date, but may not be placed on the market again.
² Suitable for the light zone, offering lighting performance. Limitations: maximum luminous flux, general technical requirements, dimensions of the replacement lamp.
³ For comparison by LEDVANCE

Source:
<https://www.ledvance.com/professional/services/eu-legislations>

Switching to LED made easy

Use these overviews to see which lamps are affected by the regulations, when they will phase out, and which Philips LED lamps and luminaires offer hassle-free replacement.

Products affected by RoHS	Phase out ¹ 24.02.2023	24.08.2023	Philips LED alternatives	RoHS exemptions prolonged 24.02.2025	24.02.2027
Fluorescent lamps portfolio					
Compact fluorescent lamps non-integrated PL-C, PL-S, PL-T, PL-L, PL-R, PL-Q					
Compact fluorescent lamps non-integrated – long life PL-C, PL-T, PL-L Xtra					
Linear fluorescent lamps T8					
Linear fluorescent lamps T5					
Linear fluorescent lamps – long life T8 Xtreme, T5 Xtra					
Continued: Non-linear fluorescent lamps ² TL-E Circular (T9), TL-D U					
Continued: Linear fluorescent lamps for food display/industry Master TL-D food, TL5 Secura					
Continued: Linear fluorescent lamps for emergency application					
Continued: Linear fluorescent lamps for explosive environment/public transport ³ TL-X XL, TL-D 35W 1m					

Source:
www.assets.signify.com/is/content/Signify/Assets/philips-lighting/global/20220602-ph-ledconv-rohs-overview-a4-q2-2022-global.pdf

Do I have to change my fixtures?

- There are literally tens of thousands of mercury-free LED retrofit lamps
- TLED are available in all different diameters, lengths, ballast types (magnetic and electronic), colour temperatures, colour rendering, light output, etc.
- A small percentage (6-9%) of fixtures where LED tubes are not compatible can be replaced or have by-passed, and use a mains-voltage LED tube so the **fixture does not need to be replaced**



EPREL - European Product Registry for Energy Labelling

Home > Light sources

Search **G13 cap** Light sources (3 885)
REGULATION (EU) 2019/2015

Showing result 1 to 100

Items per page 100

Brand or trademark

Sort by Energy Efficiency + +

Energy Efficiency Class Any

- Models distribution by performance class

REGULATION (EU) 2019/2015 with regard to energy labelling of light sources
Distribution of the selected 3 885 models out of a total of 324 247 models

Class	Entries	%
A	30	0,8
B	199	5,1
C	385	9,9
D	599	14,6
E	1 086	28,0
F	1 503	38,7
G	113	2,9

Advanced

Useful luminous flux (lm) 1 999 999

EPREL - European Product Registry for Energy Labelling

Home > Light sources

Search **G5 cap** Light sources (865)
REGULATION (EU) 2019/2015

Showing result 1 to 25

Items per page 25

Brand or trademark

Sort by + +

Energy Efficiency Class Any

- Models distribution by performance class

REGULATION (EU) 2019/2015 with regard to energy labelling of light sources
Distribution of the selected 865 models out of a total of 324 247 models

Class	Entries	%
A	2	0,2
B	5	0,6
C	5	0,6
D	237	27,4
E	236	27,3
F	174	20,1
G	206	23,8

Advanced

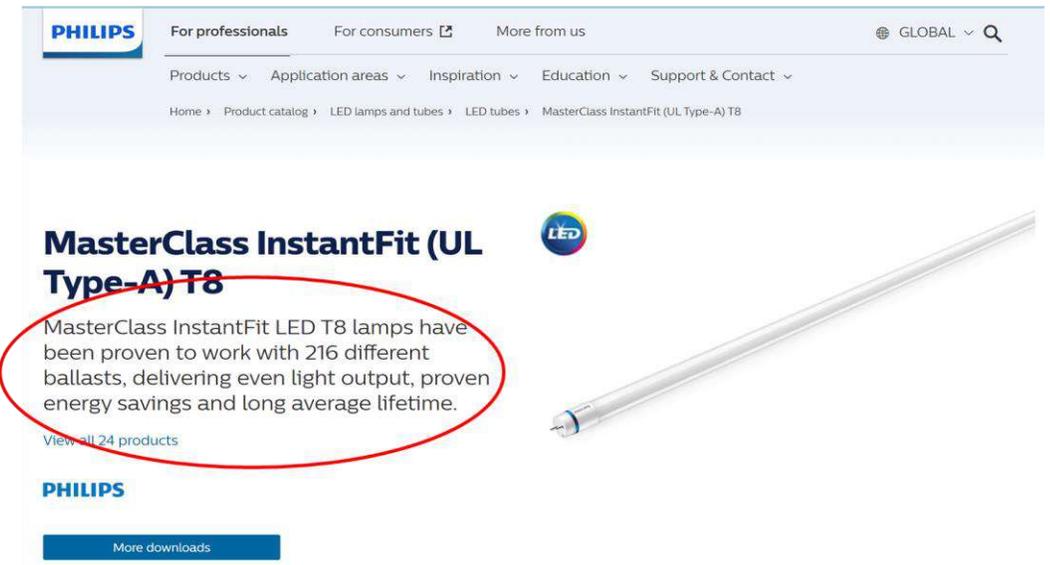
Useful luminous flux (lm) 1 999 999

What LED tubes are available?

- The IEC has defined 2 groups of LED tubes.
 - Double-capped retrofit LED lamp
 - tubular LED lamp which can be used as a replacement for double-capped fluorescent lamps without requiring any internal modification in the luminaire and which, after installation, maintains the same level of safety of the replaced lamp in the luminaire.
(Note: replacement of the glow starter with the LED replacement starter is not considered a modification of the luminaire)
 - Double-capped conversion LED lamp
 - double-capped LED lamp which can be used as a replacement for another type of lamp with modification to the luminaire
(For example: the fluorescent lamp ballast has been removed from the luminaire)

Are there different types of double-capped retrofit LED lamps?

- Yes, there are different types of retrofit LED tubes based on the type of fluorescent lamp ballast they are to operate with.
 - Retrofit LED lamp for electromagnetic ballast
 - Known as conventional control gear, (CCG)
 - Operates at mains frequency (50 or 60 Hz)
 - Retrofit LED lamp for electronic ballast
 - Known as electronic control gear, (ECG)
 - Operates at high frequency (> 10 kHz)



Which ballast type do I have?

- This can be easily determined, without accessing the ballast.
- Typically, the type of replacement LED tube depends on the ballast type.

OSRAM Ballast Discriminator
ELECTRONIC & MAGNETIC BALLAST CHECKER
The ideal tool to determine your retrofit opportunities

NEW



The must have gadget. Hurry while stocks last!

This handheld device can quickly and easily distinguish between magnetic and electronic ballasts!

No Ladder required. Just point and press!

Simply aim the OSRAM Ballast Discriminator at any lamp, HID, LED, HAL, FLUORO, CFL, and at the press of a button, easily determine the type of the ballast currently installed.

Batteries and safety lanyard included.

INSTRUCTIONS

1. Point the Discriminator at Light Fixture
2. Press and Hold button until LED on the Discriminator illuminates.

"No ladder required!"



GREEN LIGHT Ballast is ELECTRONIC

ORANGE LIGHT Ballast is MAGNETIC

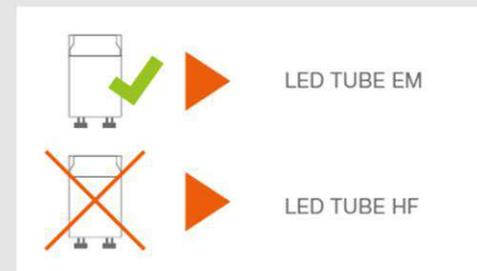
UNIQUE CODE: OSRDiscriminator
EAN: 4055462044686

FIND THE RIGHT TECHNOLOGY: EM OR HF

Are you wondering which technology you need for your luminaire with T8 fluorescent lamp – an EM lamp or an HF lamp? Our insider tip reveals two easy ways to find out.

STARTER TEST

Check whether the luminaire you want to fit the new lamp in has a starter. If it does, you need an **LED TUBE T8 EM** for operation on a CCG. If not, use an ECG-compatible version, either **LED TUBE HF** or **UNIVERSAL**.



CAMERA TEST

If the luminaire still has a working T8 lamp, take a look at it through a digital camera (such as the one on your smartphone or tablet). If the light flickers, you need an **LED TUBE T8 EM** for operation on a CCG. Otherwise use an ECG-compatible version, either **LED TUBE HF** or **UNIVERSAL**. For the test, we recommend a maximum distance from the digital camera to the light of 30 cm.



Are LED retrofit tubes safe to use?

Yes. IEC has safety standards for LED Lamps and Tubes

Suppliers use these to ensure safety

Millions and millions in use today

“100% safe installation”

IEC 62560:2011 - IEC safety standard for self-ballasted LED lamps for general lighting services

IEC 62776:2014 – IEC safety standard for linear LED retrofit tubes

IEC 63220:202x – LED Light sources – Safety requirements

➔ (combines and updates IEC 62560 & IEC 62776)

The right tube, right now

Our portfolio of LED tubes is now available with a range of options in High and Ultra Output.

Save on energy costs

LED tubes are up to 65% more efficient than TL-D lamps, so you can save on energy costs without compromising on light quality.

Long-lasting and reliable

With a lifetime of 50,000 hours they outshine TL-D lamps by 25,000 hours for lower maintenance and operation costs.

High quality of light

Our LED tubes won't flicker or cause glare. The 100% instant light has a high colour consistency and uniform visual appearance in a choice of colour temperatures.

NEW Ultra output, ultra efficient

Choose Ultra Output for ultra efficiency of 148 lm/W and exceptional light quality. Philips has a long history of ground-breaking innovation in lighting technologies. Our Ultra Output LED tubes are specially designed for demanding applications that require a high light output to comply with ergonomic norms. In fact they raise the bar in lighting efficiency and comfort by meeting all office, supermarket and healthcare standards.

A green choice

LED tubes are a mercury-free alternative to traditional fluorescent tubes, a responsible choice that can also contribute towards your green credentials.

100% safe installation

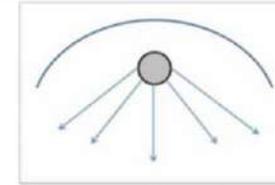
LED tubes are the fastest and easiest way to upgrade existing luminaires to LED technology. Installation is 100% safe and 0% hassle with a simple lamp-for-lamp replacement.



Compatibility Issues – Light Emission Pattern

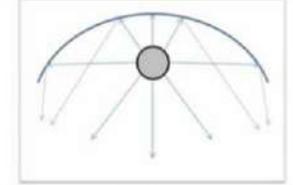
- A lumen intensity distribution (LID) below compares a fluorescent luminaire with one fluorescent lamp and two LED retrofit lamps in a typical office fixture.

LED Tube Retrofit



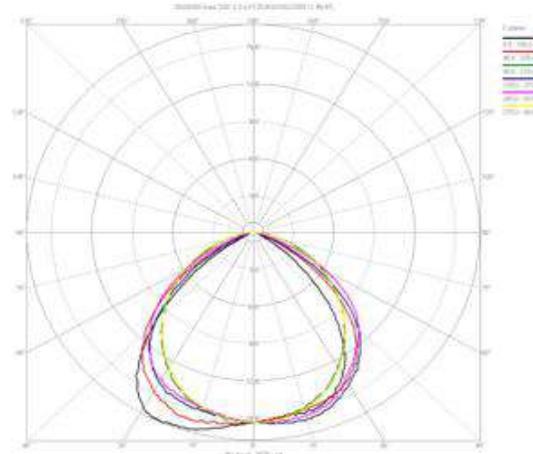
LED lamps emit light downward, so no reflectance in the fitting

Linear Fluorescent Tube

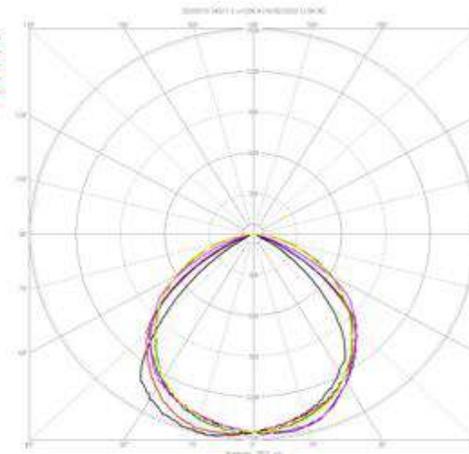


Fluorescent tubes emit light all around, requiring a reflector

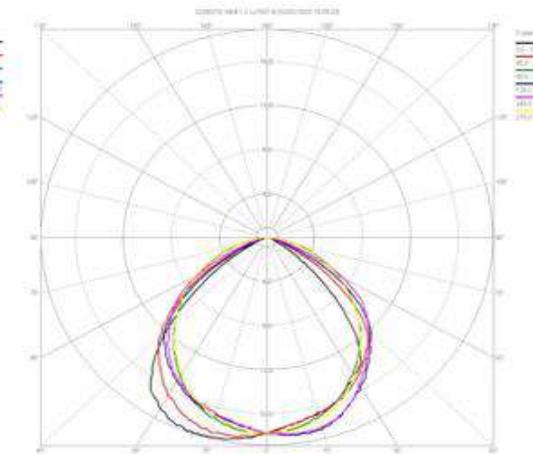
- The light distribution pattern from the fixture is virtually identical for both lamp types.
- This helps to explain why the market is satisfied with the performance of LED retrofit tubes



T8 Fluorescent Lamp (3201-1-3)



T8 LED Lamp (3402-1-2)



T8 LED Lamp (3404-1-2)

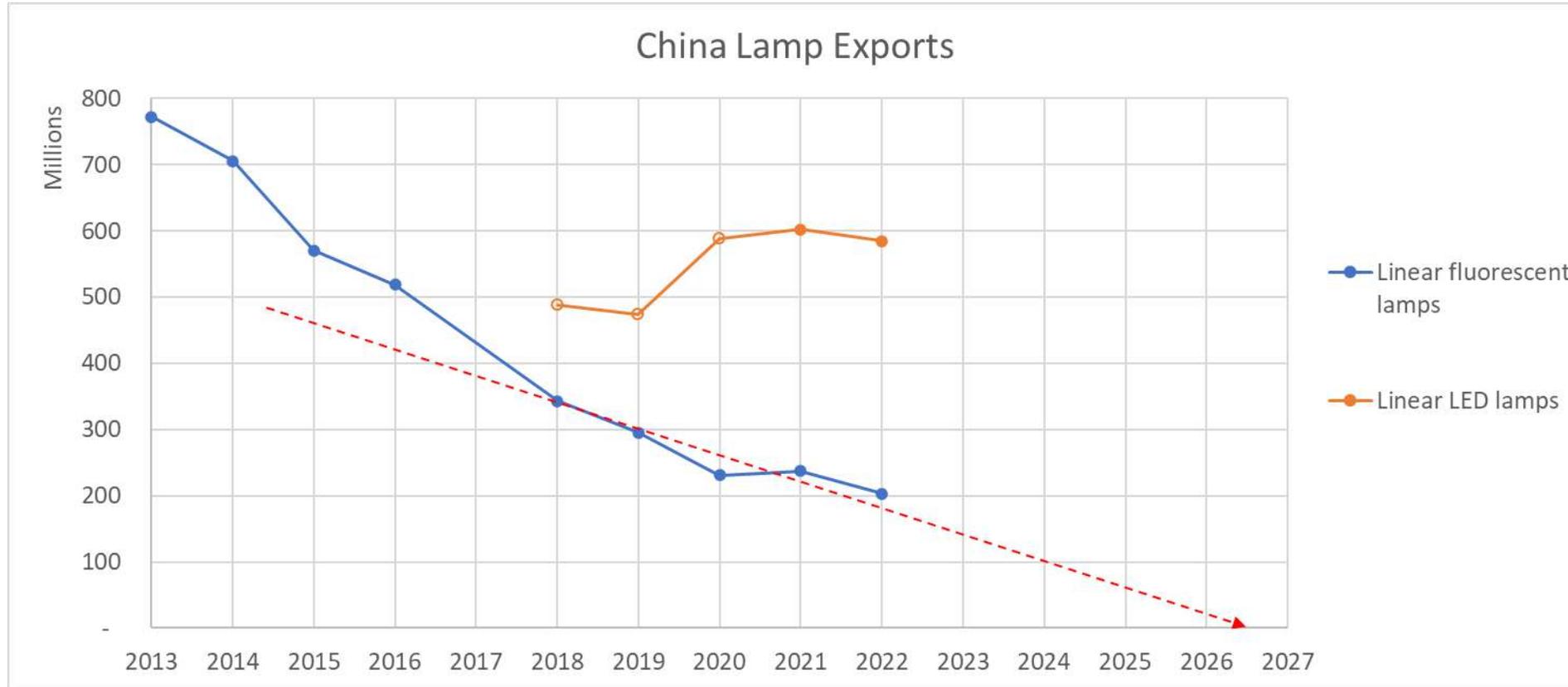
Compatibility Issues – Ballast Compatibility

- Goal: Keep the same (fluorescent) luminaire, but just change the lamp to LED
- Magnetic ballasts – 100% compatible with LED
- Mains voltage – 100% compatible with LED
- Electronic ballasts – 91-93% compatible with LED
- Magnetic ballasts are the majority of the installed stock globally, but particularly in non-OECD countries
- Keeping the magnetic ballast in the circuit will contribute to system losses, but still more efficient than fluorescent

Lamp Size	Percentage of T5 & T8 in EU Stock	Ballast Type	Percentage of stock by ballast type	Estimated EU Stock of total T5 & T8	Compatibility, Low - High Estimate	Overall EU Stock Compatibility
T5	30%	HF/ECC	100% of T5	30%	79% - 80%	23.7% - 24%
T8	70%	EM/CGG	70% of T8	49%	100%*	49%
		HF/ECC	30% of T8	21%	89% - 97%	18.7% - 20.4%
EU Total:	100%			100%		91.4% - 93.4%

Ballast Count	T5 Ballasts	Combined file list	Philips / Signify						OSRAM / LEDvance						Sylvania					
			MAS LEDtube HF 15.9W Box T5	MAS LEDtube HF 20W Box T5	MAS LEDtube HF 20W Box T5	MAS LEDtube HF Box T5	MAS LEDtube HF 1500mm LO 20W Box T5	MAS LEDtube HF 600mm HE 20W Box T5	SubstiTUBE * TS H049 20W 1.5m	SubstiTUBE * TS H054 20W 1.2m	SubstiTUBE * TS E14 7W 0.6m	SubstiTUBE * TS E21 30W 0.9m	SubstiTUBE * TS E28 37W 1.2m	SubstiTUBE * TS E35 38W 1.5m	SubstiTUBE * TS H080 37W 1.5m	ToLED SUPERIA TS 00UM	ToLED SUPERIA TS 2600UM/28 00UM	ToLED SUPERIA TS HO 4FT 37W 37UM	ToLED SUPERIA TS HO 5FT 30W 4000UM/42 00UM	ToLED SUPERIA TS HO 5FT 37W 5150UM/56 00UM
31	OSRAM; QT-FIT5 3x14; 4x14; Lamps: 3																			
32	OSRAM; QT-FIT5 3x14; 4x14; Lamps: 4																			
53	OSRAM; QT-FQ 1x49/230-240 CW; Lamps: 1																			
54	OSRAM; QT-FQ 1x80/230-240; Lamps: 1																			
55	OSRAM; QT-FQ 2x80; Lamps: 2																			
56	OSRAM; QT1 1x14/2/21/39 GII; Lamps: 1																			
57	OSRAM; QT1 1x21/39 DIM1(-SDV); Lamps: 1																			
58	OSRAM; QT1 1x28/54/35-49 GII; Lamps: 1																			
59	OSRAM; QT1 1x35/49/80 GII; Lamps: 1																			
60	OSRAM; QT1 1x35/49/80 GII; Lamps: 1																			
61	OSRAM; QT1 1x14/2/21/39 GII; Lamps: 2																			
62	OSRAM; QT1 1x21/39 DIM1(-SDV); Lamps: 2																			
63	OSRAM; QT1 1x28/54/35-49 GII; Lamps: 2																			
64	OSRAM; QT1 1x35/49 DIM; Lamps: 2																			
65	OSRAM; QT1 1x35/49/80 GII; Lamps: 2																			
66	OSRAM; QT1 DAU 2x35/49/80 DIM; Lamps: 1																			
67	OSRAM; QT1 DAU 2x35/49/80 DIM; Lamps: 2																			
68	OSRAM; QTP5 1x14-35; Lamps: 1																			
69	OSRAM; QTP5 1x49; Lamps: 1																			
70	OSRAM; QTP5 1x80; Lamps: 1																			
71	OSRAM; QTP5 2x14-35; Lamps: 2																			
72	OSRAM; QTP5 2x49; Lamps: 2																			
73	OSRAM; QTP5 3x14; 4x14; Lamps: 3																			
74	OSRAM; QTP5 3x14; 4x14; Lamps: 4																			
75	OSRAM; QTP-OPTIMAL 1x54-58; Lamps: 1																			
76	OSRAM; QTP-OPTIMAL 2x54-58; Lamps: 2																			
77	OSRAM; QT45 2x28; Lamps: 1																			
78	OSRAM; QT45 2x28; Lamps: 2																			
79	PHILIPS; EB-C 128 T15; Lamps: 1																			
80	PHILIPS; EB-C 228 T15; Lamps: 2																			
81	PHILIPS; EB-C 1x2 14x28W; Lamps: 1																			
82	PHILIPS; EB-C 1x2 14x28W; Lamps: 2																			
83	PHILIPS; HF-E 1/2 49 T15 II; Lamps: 1																			
84	PHILIPS; HF-E 1/2 49 T15 II; Lamps: 2																			
85	PHILIPS; HF-E 1/2 54 T15 II; Lamps: 1																			
86	PHILIPS; HF-E 1/2 54 T15 II; Lamps: 2																			
87	PHILIPS; HF-E 114 T15 II; Lamps: 1																			
88	PHILIPS; HF-E 214 T15 II; Lamps: 2																			
89	PHILIPS; HF-E 3/414 T15 II; Lamps: 3																			
90	PHILIPS; HF-E 3/414 T15 II; Lamps: 4																			
91	PHILIPS; HF-P 1x35 T15 HE II 220-240V 50/60Hz; Lamps: 1																			
92	PHILIPS; HF-P 1x35 T15 HE II 100; Lamps: 1																			
93	PHILIPS; HF-P 1x49 T15 220-240; Lamps: 1																			
94	PHILIPS; HF-P 1x49 T15 HO 220-240; Lamps: 1																			
95	PHILIPS; HF-P 1x49 T15 HO EII 220-240; Lamps: 1																			
96	PHILIPS; HF-P 1x49 T15 HO III DC; Lamps: 1																			
97	PHILIPS; HF-P 154 T15 HO EII 220-240; Lamps: 1																			
98	PHILIPS; HF-P 154/155 T15 HO/PLI III DC; Lamps: 1																			
99	PHILIPS; HF-P 180 T15/PLI III DC; Lamps: 1																			
100	PHILIPS; HF-P 2x35 T15 HE II 220-240V 50/60Hz; Lamps: 2																			

Transition to LED light sources



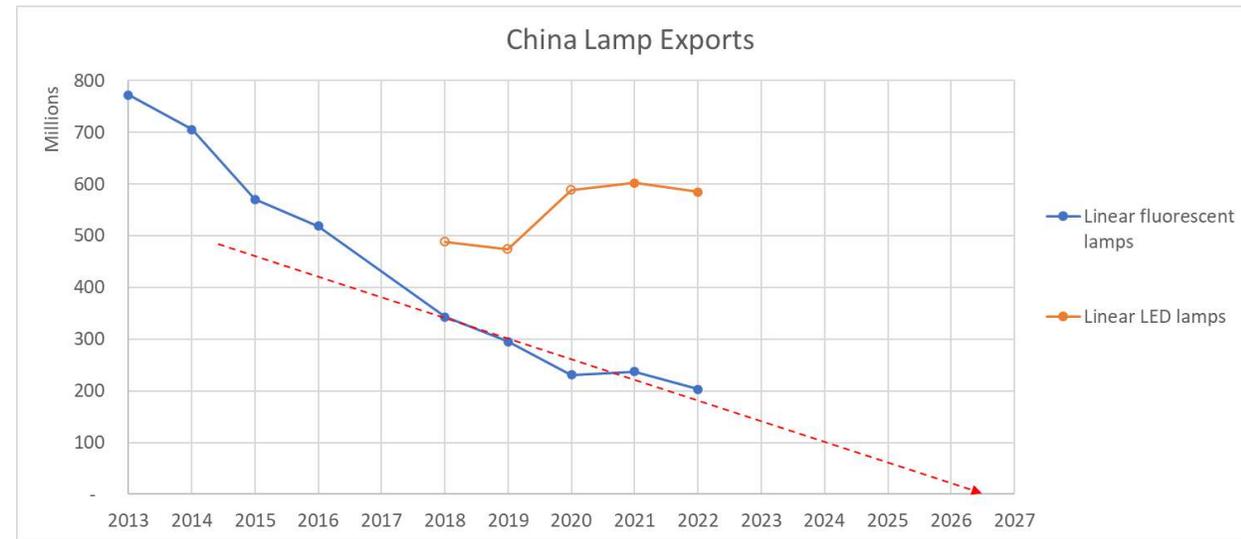
The demand for export of linear fluorescent lamps from China is in steep decline.

Transition to LED light sources - Supply

Minamata Convention sets the date after which the manufacture, import or export of specified mercury containing products shall not be allowed (phase-out date).

So installed linear fluorescent lamps can continue to operate until failure.

Median life of Linear fluorescent lamp is 15,000 to 25,000 hours which at 3,000 hours use per year is a 5 to 8.3 (average 6.65) year changeover by natural attrition.



Thank you

**Clean
Lighting
Coalition**



Fluorescent Lamps Country Profiles and Country Market Potential - Technical Deep dives

Rachel Kamande

Campaign Lead, CLiC

Katherine Hassan

Asia Pacific Regional Coordinator, CLiC

Kishore Kumar

CLiC India

A photograph of five young children, likely students, sitting at a desk in a classroom. They are all smiling and looking towards the camera. They are wearing pink school uniforms. In the background, there are educational posters on the wall and a circular fluorescent light fixture hanging from the ceiling. The overall scene is bright and positive.

Clean
Lighting
Coalition

Fluorescent Lamps Country Profiles and Country Market Potential

Global Mercury Partnership – Technical Session – June 19

Introduction

- Introduction to the Clean Lighting Coalition
 - **Rachel Kamande, Campaign Lead**
- Country Profiles and Market Potentials
 - **Katherine Hasan, Asia Pacific Regional Coordinator**
- India Lighting Market
 - **Kishore Kumar, Manager, CLASP India**
- All Questions, Answers and Discussion





**Clean
Lighting
Coalition**

The Clean Lighting Coalition (CLiC) is a global partnership working to capture the health and environmental benefits of eliminating mercury-based lighting.

Clean Lighting Coalition Activities



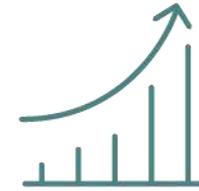
Engage governments

- Engage government agencies with locally relevant evidence of the benefits of a lighting transition
- Support a network of “champions” and promote consensus building



Activate advocates & public

- Coordinate public health and environmental advocates and consumer groups to advance national campaigns
- Build public awareness and pressure for accelerated action



Involve the private sector

- Work with progressive lighting companies, component makers, distributors, etc., to make an LED-only pledge
- Highlight the private-sector benefits of the transition

Four Key Benefits to Clean Lighting through Advanced Transition by 2025



Health

- Remove Hg to protect public health and the environment
- Pregnant women, infants and children



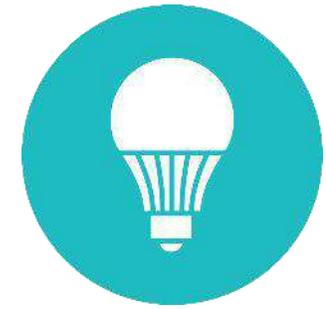
Economics

- Payback often less than 1 year, and T8 can be as low as 4 months¹
- Lower utility bills and fewer lamp changes (2-3x longer life LED)
- US \$1.34 Trillion in energy cost savings (2025-2050)



Environment

- 198 tonnes of mercury savings (2025-2050)
- 3.3 GT of CO₂ savings (2025-2050)
- Equity: No dumping of old technology



Technology

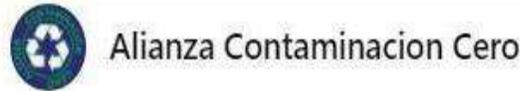
- Mercury-free LED lamps can retrofit into existing fixtures
- Over 90% of stock, no need to rewire or replace
- 50% energy savings (9,602 TWh 2025-2050)
- High quality lighting

¹[OSRAM website](#): “Replacement costs can be recouped in just four months”

Coalition Partners



CLIC



ASSOCIACAO DE SAUDE AMBIENTAL TOXISPHERA



Agenda

- **Country Profiles and Market Potentials**
- **China**
- **India**
- **Indonesia**
- **Iran**



Introduction

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Are Mercury-Free LEDs Widely Available? Are They Affordable Today?



- CLiC sought to understand whether the economics supported a phase-out globally
- Engaged partner organizations in **76 countries across Africa, Latin America and Asia Pacific**
- Gathered **1300 models of both mercury-containing fluorescent and LED in 2022**, and “**matching pairs**” of commonly used fluorescents and the available LED equivalents in **2023**
 - General Service Lamps
 - Linear Tube Lamps



Snap-Shot of Global Market Data

Africa Region:

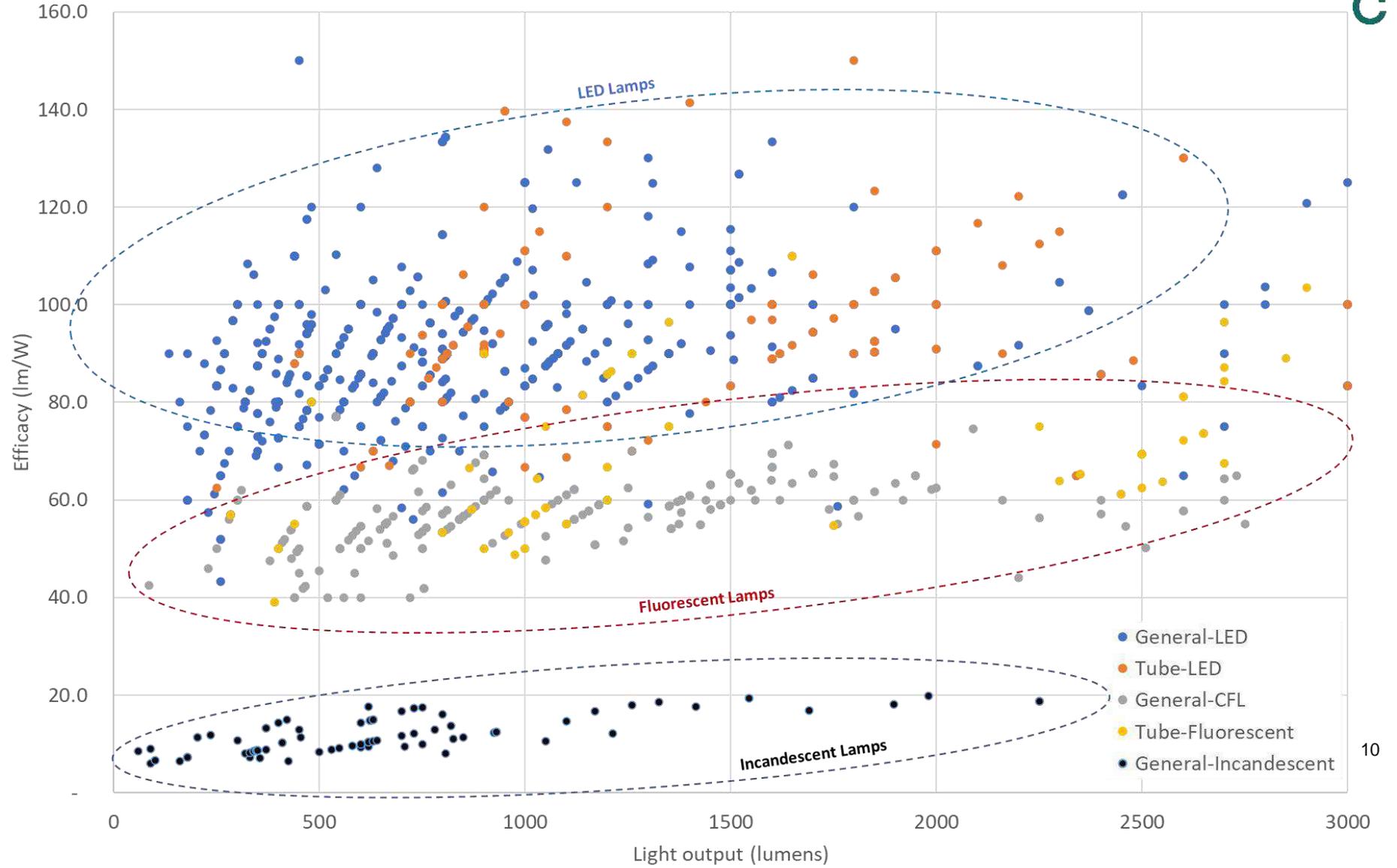
Burkina Faso, Cameroon, Ivory Coast, Gabon, Zambia, Uganda, Nigeria, Kenya, Ghana, South Africa, Togo and Ethiopia

Asia Pacific Region:

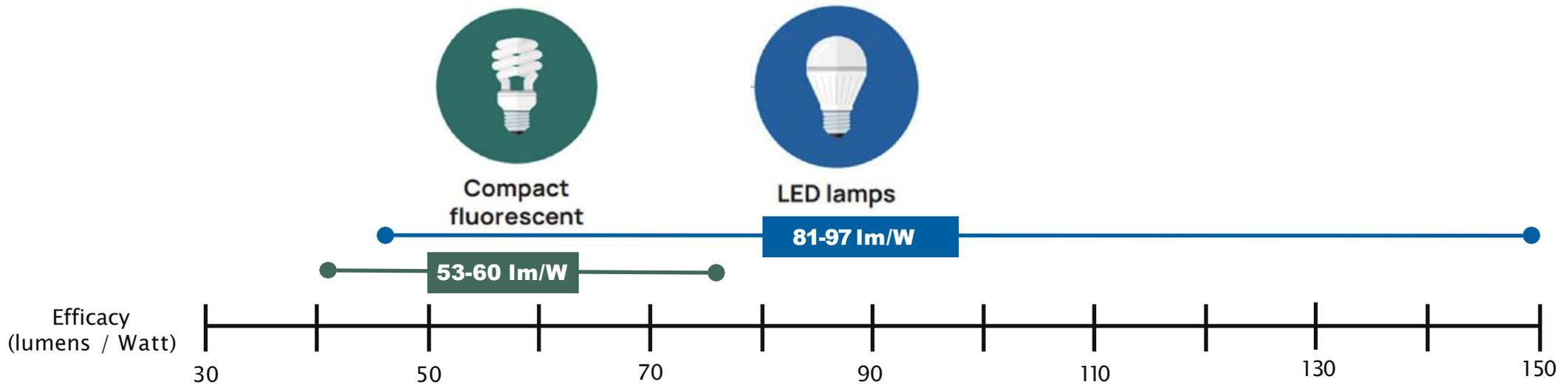
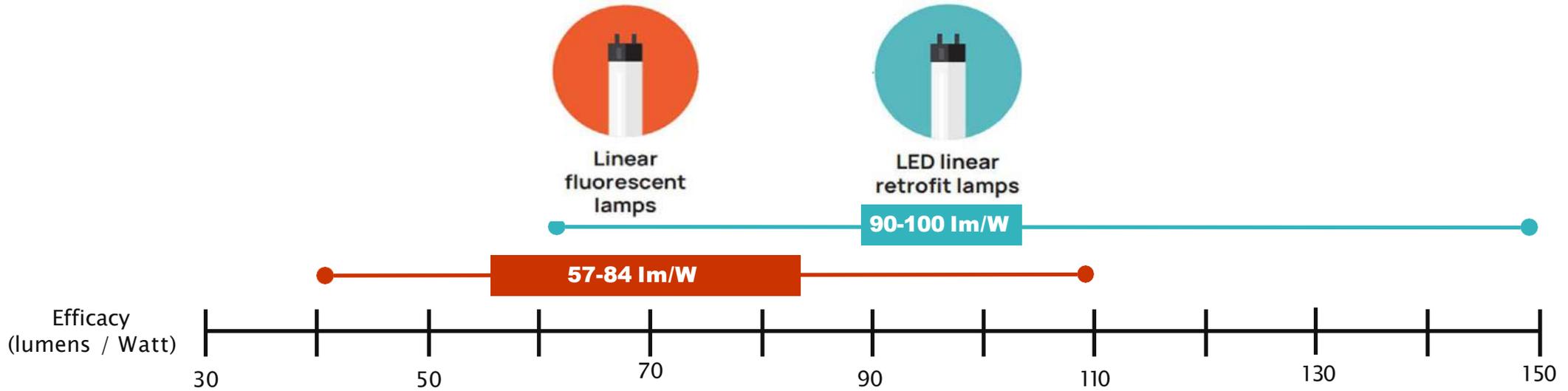
India, Bangladesh, Philippines, Pakistan, Sri Lanka, Vietnam, Indonesia, Japan and Malaysia*

GRULAC Region:

Antigua & Barbuda, Argentina, Belize, Jamaica, Brazil, Chile, Colombia, Guyana, Mexico, Panama, Peru, St. Kitts & Nevis, Trinidad & Tobago and Uruguay



LED, the Most Energy Efficient Lighting Technology





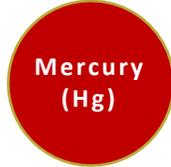
China

Payback Time for LFL-T8 Switch in China: 6.8 Months

- The largest manufacturer of LED lamps and components – driving the global lighting revolution
- LED transition commitment has been widely implemented at the national level, through efficiency policies and strong support in manufacturing sector
- Today, consumers can **spend an extra 16 Yuan** and **save 558 Yuan on the lighting cost (35x return)**
- LED option is **57% less expensive** than mercury-based LFL



FSL 佛山照明



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	3,000 hours	30,000 hours
Lamp Price*	CNY 10	CNY 26
Power	36 W	16 W
Elec Use*	118 kWh/yr	53 kWh/yr
Elec Cost*	CNY 95/yr	CNY 42/yr
9-year cost	CNY 983	CNY 425
Payback period		6.8 months

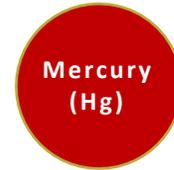
*Lamp prices collected in April 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: CNY 0.80/kWh. Life cycle cost adjusted to 2023 Net Present Value.



CLiC

Payback Time for LFL-T5 Switch in China: 10 Months

- The largest manufacturer of LED lamps and components – driving the global lighting revolution
- LED transition commitment has been widely implemented at the national level, through efficiency policies and strong support in manufacturing sector
- Today, consumers can **spend an extra 17 Yuan** and **save 337 Yuan on the lighting cost (20x return)**
- LED option is **47% less expensive** than mercury-based LFL



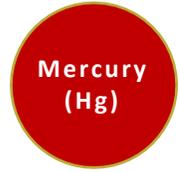
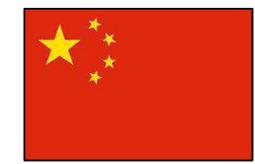
Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	12,000 hours	30,000 hours
Lamp Price*	CNY 15	CNY 32
Power	28 W	14 W
Elec Use*	92 kWh/yr	36 kWh/yr
Elec Cost*	CNY 74/yr	CNY 37/yr
9-year cost	CNY 720	CNY 383
Payback period		10 months

*Lamp prices collected in April 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: CNY 0.80/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Payback Time for LFL-T12 Switch in China: 15 Months

- The largest manufacturer of LED lamps and components – driving the global lighting revolution
- LED transition commitment has been widely implemented at the national level, through efficiency policies and strong support in manufacturing sector
- Today, consumers can **spend an extra 53 Yuan** and **save 553 Yuan on the lighting cost (10x return)**
- LED option is **47% less expensive** than mercury-based LFL

	Diminishing Market	
	Mercury (Hg)	Mercury Free
Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	5,000 hours	50,000 hours
Lamp Price*	CNY 12	CNY 65
Power	40 W	20 W
Elec Use*	131 kWh/yr	66 kWh/yr
Elec Cost*	CNY 105/yr	CNY 53/yr
10-year cost	CNY 1,164	CNY 611
Payback period		15 months

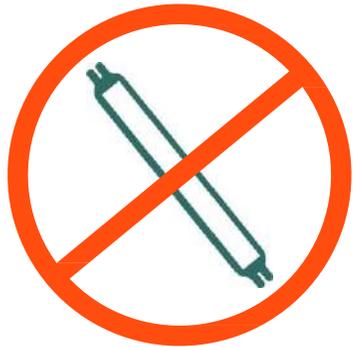


*Lamp prices collected in April 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: CNY 0.80/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Cumulative Savings from Clean Lighting Transition (to 2050) China, LFL Phase Out in 2025



CLiC



Avoided Lamp Sales
5.4 billion lamps

Avoided Mercury Use in
Lamp Manufacturing
33 ton of mercury



Net National Electricity Savings
3,484 TWh of electricity use



National Financial Savings from
Avoided Electricity Use
279 Billion USD

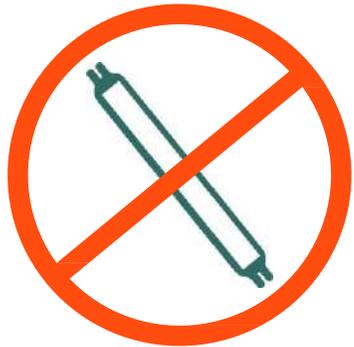


CO₂ Mitigation from
Avoided Electricity Use
1.5 GTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050) China, LFL Phase Out in 2025



CLIC



Avoided Lamp Sales
5.4 billion lamps

Avoided Mercury Use in
Lamp Manufacturing
33 ton of mercury



Equivalent to taking **334 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings
3,484 TWh of electricity use



National Financial Savings from
Avoided Electricity Use
279 Billion USD



CO₂ Mitigation from
Avoided Electricity Use
1.5 GTCO₂

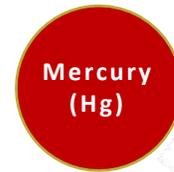


India



Payback Time for LFL-T8 Switch in India: 9.4 Months

- The second largest manufacturer of LED lamps and components in the world
- Pioneer in LED large scale deployment through 2015 UJALA program
- Today, consumers can **spend an extra 377 Rupees** and **save 3,284 Rupees on the lighting cost (nearly 9x return)**
- LED option is **45% less expensive** than mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	5,000 hours	25,000 hours
Lamp Price*	INR 38	INR 415
Power	36 W	18 W
Elec Use*	118 kWh/yr	59 kWh/yr
Elec Cost*	INR 1,005/yr	INR 503/yr
7-year cost	INR 7,241	INR 3,957
Payback period		9.4 months

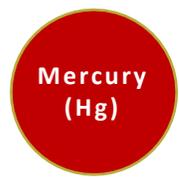
*Lamp prices collected in June 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: INR 8.50/kWh. Life cycle cost adjusted to 2023 Net Present Value.



T5
0.6" diameter

Payback Time for LFL-T5 Switch in India: 28 Months

- The second largest manufacturer of LED lamps and components in the world
- Pioneer in LED large scale deployment through 2015 UJALA program
- Today, consumers can **spend an extra 630 Rupees** and **save 1,414 Rupees on the lighting cost (over 2x return)**
- LED option is **25% less expensive** than mercury-based LFL



CLiC

Inclusive of PC housing, non-integral LED driver

Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	18,000 hours	25,000 hours
Lamp Price*	INR 120	INR 750
Power	28 W	18 W
Elec Use*	92 kWh/yr	59 kWh/yr
Elec Cost*	INR 782/yr	INR 503/yr
7-year cost	INR 5,706	INR 4,292
Payback period		28 months

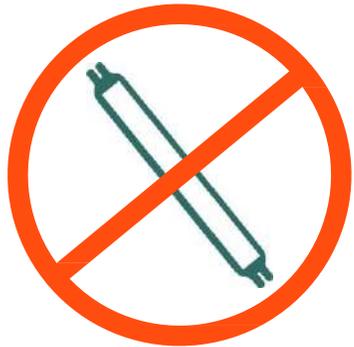
*Lamp prices collected in June 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: INR 8.50/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Lower payback, considering housing and ballast costs in LFL

Cumulative Savings from Clean Lighting Transition (to 2050) India, LFL Phase Out in 2025



CLIC



Avoided Lamp Sales

326 million lamps

Avoided Mercury Use in
Lamp Manufacturing

1,958 kg of mercury



Net National Electricity Savings

201 TWh of electricity use

National Financial Savings from
Avoided Electricity Use

20 Billion USD



CO₂ Mitigation from
Avoided Electricity Use

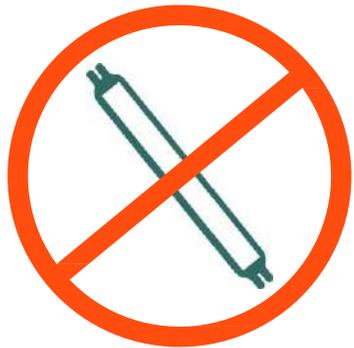
144 MTCO₂



Cumulative Savings from Clean Lighting Transition (to 2050) India, LFL Phase Out in 2025



CLIC



Avoided Lamp Sales

326 million lamps

Avoided Mercury Use in
Lamp Manufacturing

1,958 kg of mercury

Equivalent to taking **32 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings

201 TWh of electricity use

National Financial Savings from
Avoided Electricity Use

20 Billion USD



CO₂ Mitigation from
Avoided Electricity Use

144 MTCO₂



Introduction

- Introduction to the Clean Lighting Coalition
 - **Rachel Kamande, Campaign Lead**
- Country Profiles and Market Potentials
 - **Katherine Hasan, Asia Pacific Regional Coordinator**
- India Lighting Market
 - **Kishore Kumar, Manager, CLASP India**
- All Questions, Answers and Discussion





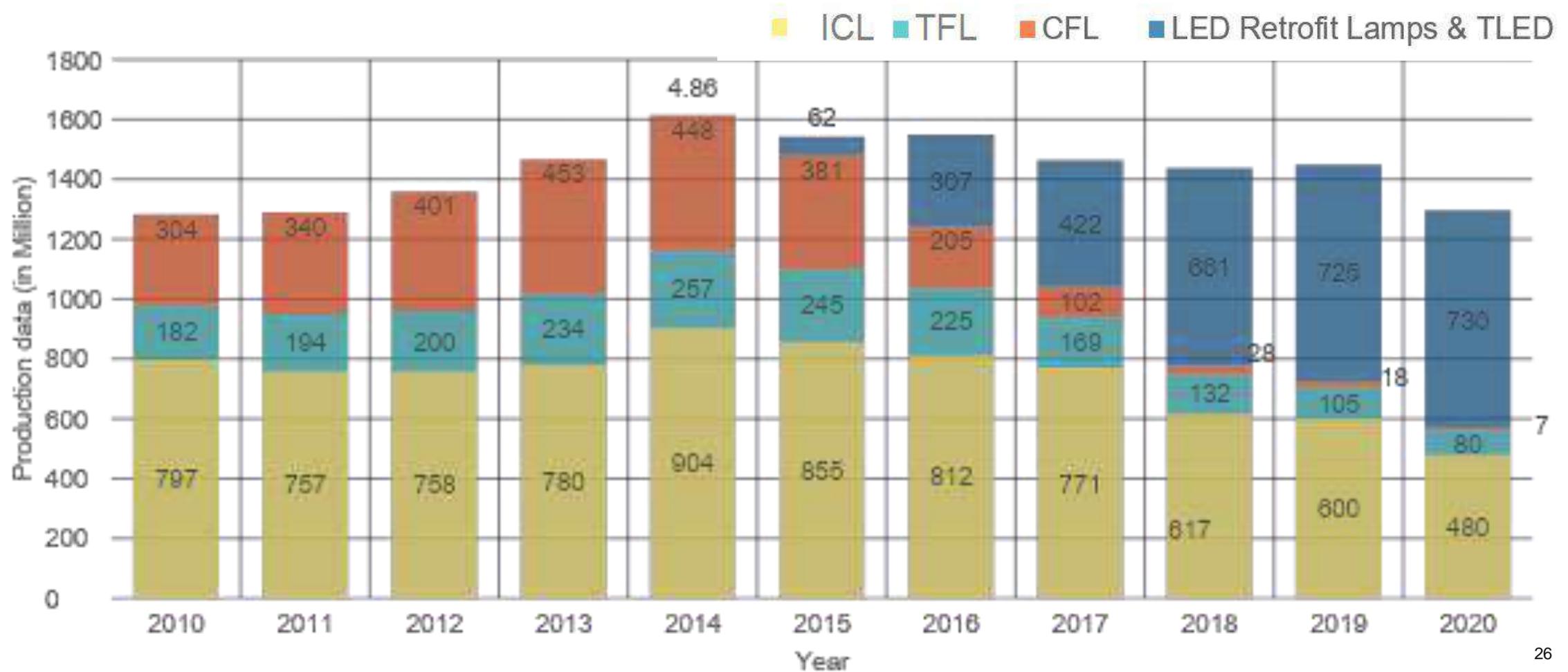
India Lighting Market and Energy Efficiency Policies

19 June 2023

India Lighting market shifted towards LED technologies and moving away from fluorescent lamps and tube lights.

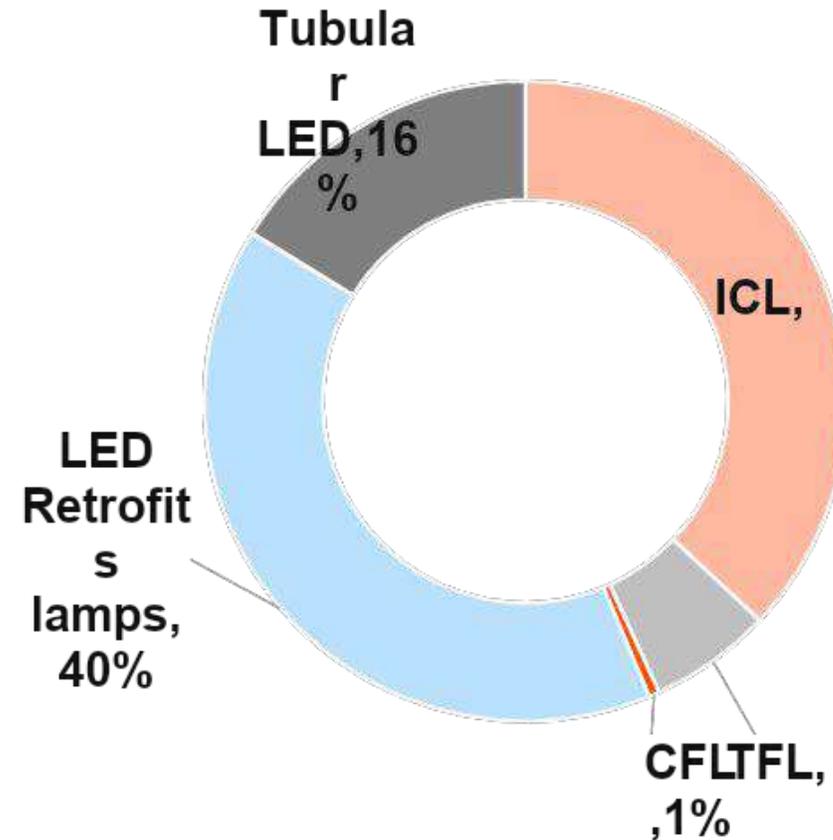
Based on lighting industry inputs, this shift in India has reduced the annual energy consumption in lighting to 13%, earlier it was 18%.

Lighting Market



Lighting Market Share by Technologies

- In 2020-21, India produced 1.3 billion lamps and tube lights.
- Majority of lighting market share is dominated by LED technology-
 - LED lamps and tube lights contributes to 56% share.
 - Followed by conventional lighting –incandescent lamp (37%), **FTL (6%) and CFL (1%)**



Source: ELCOMA

Energy Efficiency Policies- Lighting (TFL)

Tubular Fluorescent Lamps

- Bureau of Energy Efficiency (BEE) launched the Standards and Labelling program for Tubular florescent lamps (TFL) in **2006** as a **voluntary initiative**, and the program became mandatory in the year **2009**.

Scope

The tubular fluorescent lamp for general lighting services covers all wattages with nominal dimension starting from **1100 mm** and upto **1500 mm** as covered in **IS 2418 (Part I and II)**.

Energy Efficiency levels

Star Levels	Luminous Efficacy (Lumen/Watt)
	0100 hrs of operation
1	≥65 and <75
2	≥75 and <85
3	≥85 and <95
4	≥95 and <110
5	≥110

Sample Star label



Sample TFL with Star label



Energy Efficiency Policies – LED Lighting

LED Lamps

- To promote and support lighting transition, BEE launched labelling program of self-ballasted LED lamp in **2015** and became mandatory in the year **2018**.

Scope

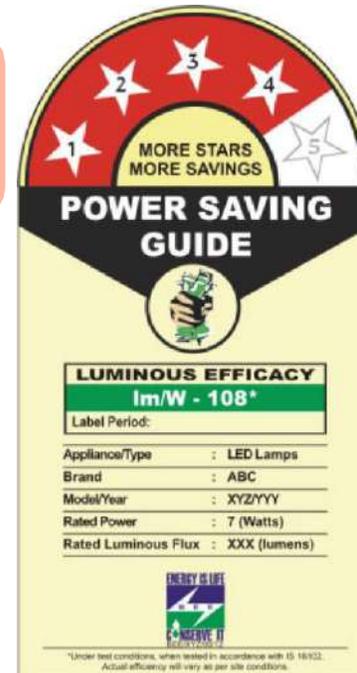
The self-ballasted LED lamps for general lighting services having rated power from **3 to 35 watts**.

Indian Standard **16102 (part 2):2020**.

Energy Efficiency Levels

Star Rating	1st July 2023 - 30th June 2026
	Luminous Efficacy (Lumen/Watt)
1	≥90 and <105
2	≥105 and <120
3	≥120 and <135
4	≥135 and <150
5	≥150

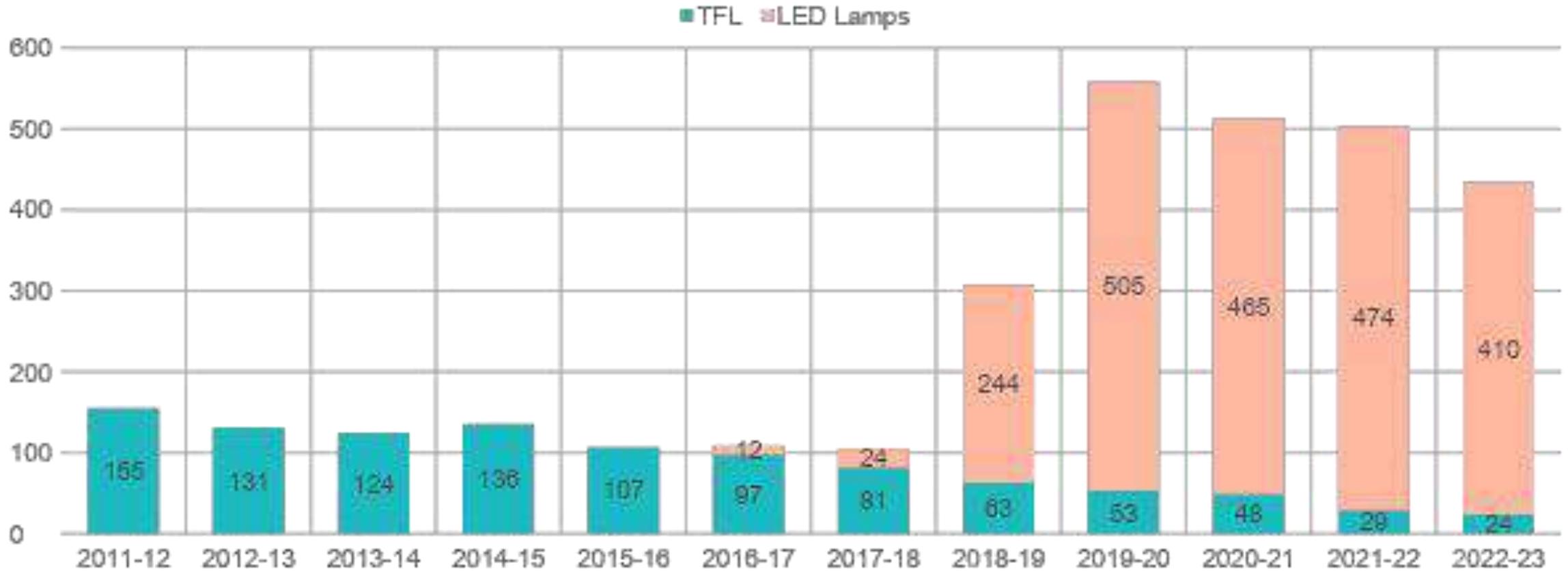
Sample Star Labeled LED Lamps



Sample Star label

TFLs and LED Lamps Productions

Source: BEE Registration



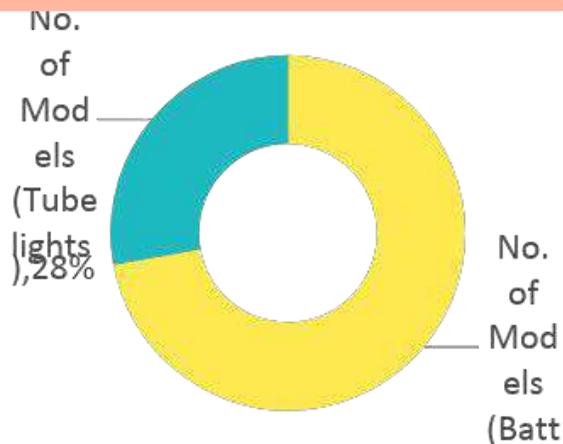
Energy Efficiency Policies - LED Tubes

LED Tube Lights

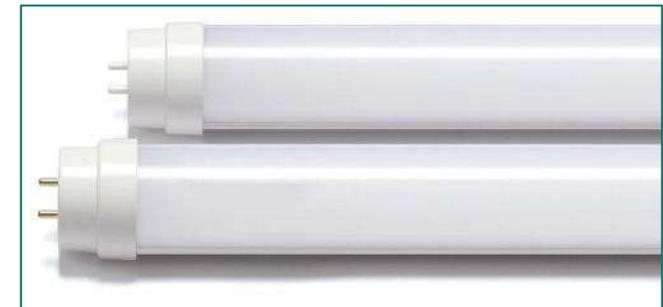
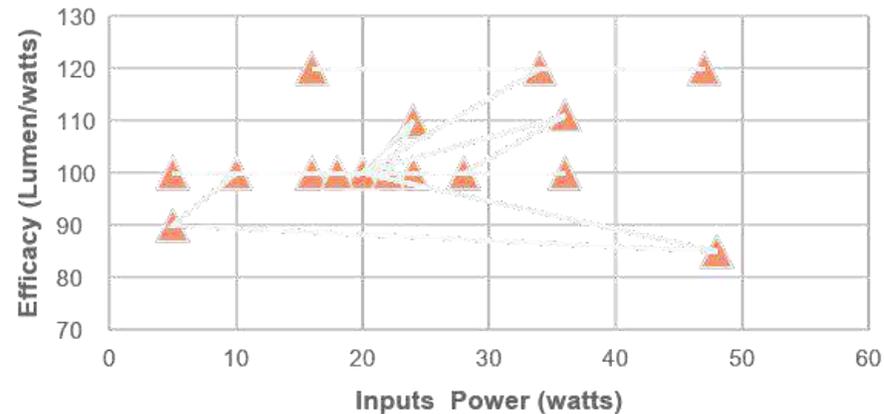
- BEE is planning to launch the energy efficiency policies for LED tube lights or batten in 2024 and move away from Tubular Fluorescent lamps. As part of this, the market assessment study is underway

Highlights of Market Assessment, India produced **210 million** LED tube lights and battens in 2020.

Models Available in LED Tube Lights (%)



LED Tube Light - Efficacy



Sample LED tubelights

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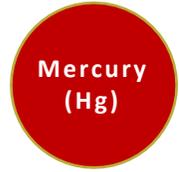
Indonesia



C.Li.C

Payback Time for LFL-T8 Switch in Indonesia: 5.5 Months

- The largest lighting market in Southeast Asia, with growing presence of high efficiency local LED manufacturing
- Strong national commitment in advancing LED transition through the ADLIGHT program
- Today, consumers can **spend an extra 21,350 Rupiah** and **save 603,763 Rupiah on the lighting cost (28x return)**
- LED option is **45% less expensive** than mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	13,000 hours	15,000 hours
Lamp Price*	IDR 20,150	IDR 41,500
Power	36 W	16 W
Elec Use*	118 kWh/yr	53 kWh/yr
Elec Cost*	IDR 170,850/yr	IDR 75,933/yr
7-year cost	IDR 1,254,909	IDR 651,146
Payback period		5.5 months

*Lamp prices collected in April 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: IDR 1,444.70/kWh. Life cycle cost adjusted to 2023 Net Present Value.

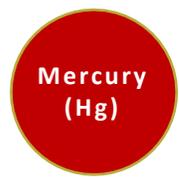


T5
0.6" diameter

CLiC

Payback Time for LFL-T5 Switch in Indonesia: 6.5 Months

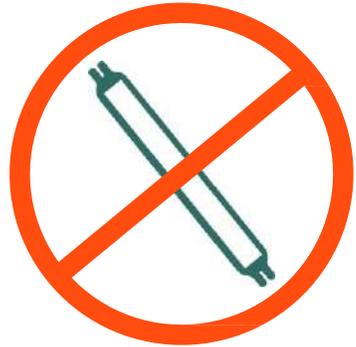
- The largest lighting market in Southeast Asia, with growing presence of high efficiency local LED manufacturing
- Strong national commitment in advancing LED transition through the ADLIGHT program
- Today, consumers can **spend an extra 16,620 Rupiah** and **save 326,359 Rupiah on the lighting cost (nearly 20x return)**
- LED option is **38% less expensive** than mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	20,000 hours	15,000 hours
Lamp Price*	IDR 44,880	IDR 61,500
Power	28 W	13 W
Elec Use*	92 kWh/yr	43 kWh/yr
Elec Cost*	IDR 132,884/yr	IDR 61,696/yr
6-year cost	IDR 853,242	IDR 526,883
Payback period		6.5 months

*Lamp prices collected in April 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: IDR 1,444.70/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Cumulative Savings from Clean Lighting Transition (to 2050) Indonesia, LFL Phase Out in 2025



Avoided Lamp Sales
229 million lamps

Avoided Mercury Use in
Lamp Manufacturing
1,380 kg of mercury



Net National Electricity Savings
149 TWh of electricity use

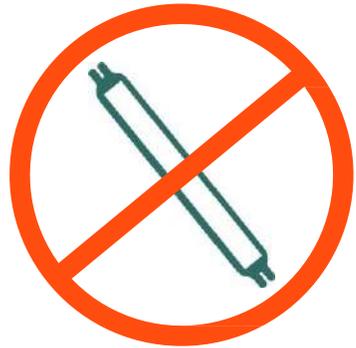


National Financial Savings from
Avoided Electricity Use
15 Billion USD



CO₂ Mitigation from
Avoided Electricity Use
90 MTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050) Indonesia, LFL Phase Out in 2025



Avoided Lamp Sales
229 million lamps

Avoided Mercury Use in
Lamp Manufacturing
1,380 kg of mercury



Equivalent to taking **20 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings
149 TWh of electricity use



National Financial Savings from
Avoided Electricity Use
15 Billion USD



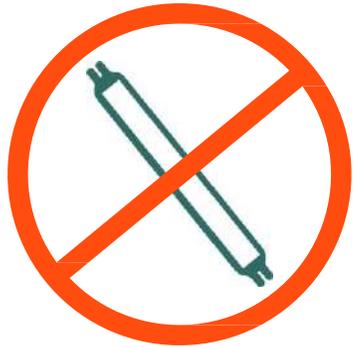
CO₂ Mitigation from
Avoided Electricity Use
90 MTCO₂



Iran

Cumulative Savings from Clean Lighting Transition (to 2050)

Iran, LFL Phase Out in 2025



Avoided Lamp Sales

143 million lamps

Avoided Mercury Use in
Lamp Manufacturing

816 kg of mercury



Net National Electricity Savings

95 TWh of electricity use



National Financial Savings from
Avoided Electricity Use

10.4 Billion USD

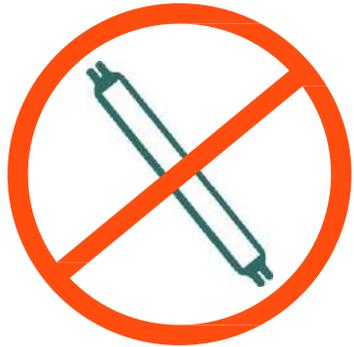


CO₂ Mitigation from
Avoided Electricity Use

44 MTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050)

Iran, LFL Phase Out in 2025



Avoided Lamp Sales

143 million lamps

Avoided Mercury Use in
Lamp Manufacturing

816 kg of mercury



Equivalent to taking **nearly 10 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings

95 TWh of electricity use



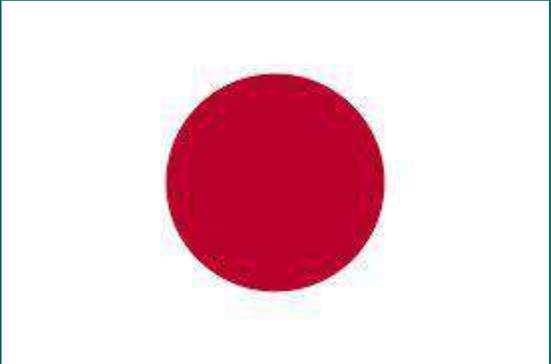
National Financial Savings from
Avoided Electricity Use

10.4 Billion USD



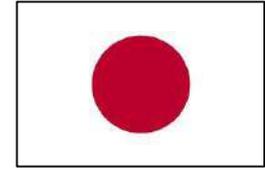
CO₂ Mitigation from
Avoided Electricity Use

44 MTCO₂



Japan

Japan and LED Lighting



21st Century Lighting Project in 1998

- Japan has begun promotion of Solid-State Lighting (SSL) and started developing market demand back in 1998
- One of the pioneers in initiating industry policies and incentives
 - 2014 Nobel Prize of Physics for blue-light LED invention, Isamu Akasaki, Hiroshi Amano, Shuji Nakamura
- Key players play important role in LED standards development
- To date, one of the largest LED lighting market in the world, with sharp growth, tripling from 26 billion JPY in 2010 to 81 billion JPY in 2018

Japan Lighting Manufacturers Association (JLMA) Vision 2030

- Domestic association's ambitious targets for LED lighting for the next decade
- 2030 goals to reduce 46% GHG emissions and 60% power use – and, to reach 100% SSL ratio and expand Lighting 5.0 adoption to 40%
- Per April 2023, SSL ratio at 56% and Lighting 5.0 adoption at 23%

“Galapagosization” of LED Lighting in Japan

National Efforts

- Significant contribution from Japan and key industry players in IEC standard development – **to promote LED advancements**
- Promote and secure demand for local industry through Japan-specific safety and performance standards – **to anticipate influx of imports and protect local industry**

Downsides

- Japan-centric policies and standards **limits market availability and results in market lag** compared to other economies
- Due to pending release of mandatory safety standard, end users have **limited access to safe and affordable LED drop-in retrofit replacements** – this leads to **safety risk concerns** as expressed in the submission to the Secretariat

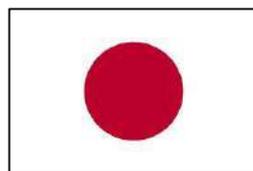


T8
1" diameter

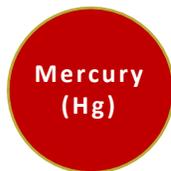
CiC

Payback Time for LFL-T8 Switch in Japan: 10.4 Months

- Minamata Convention named after Japan harbor city – Japan, as a Party that sets ambitious targets in addressing mercury emissions
- Pioneer in solid state lighting inventions, with major brands leading global lighting innovation
- Today, consumers can **spend an extra 404 Yen** and **save 11,911 Yen on the lighting cost (29x return)**
- LED option is **54% less expensive** than mercury-based LFL



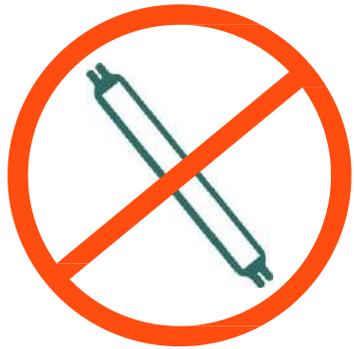
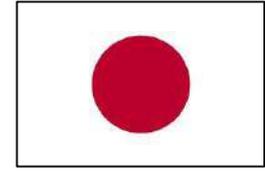
Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	12,000 hours	40,000 hours
Lamp Price*	JPY 1,466	JPY 1,870
Power	40 W	18 W
Elec Use*	131 kWh/yr	57 kWh/yr
Elec Cost*	JPY 1,774/yr	JPY 776/yr
10-year cost	JPY 22,230	JPY 10,320
Payback period		10.4 months



*Lamp prices collected in June 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: JPY 13.5/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Cumulative Savings from Clean Lighting Transition (to 2050)

Japan, LFL Phase Out in 2025



Avoided Lamp Sales

523 million lamps

Avoided Mercury Use in
Lamp Manufacturing

3,401 kg of mercury



Net National Electricity Savings

328 TWh of electricity use



National Financial Savings from
Avoided Electricity Use

75.6 Billion USD

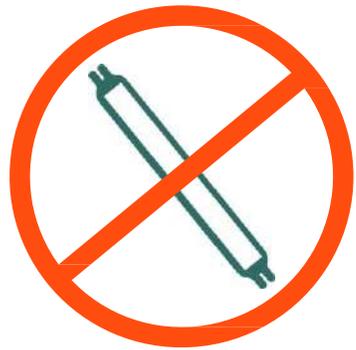
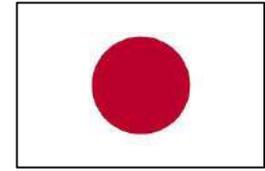


CO₂ Mitigation from
Avoided Electricity Use

112 MTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050)

Japan, LFL Phase Out in 2025



Avoided Lamp Sales
523 million lamps

Avoided Mercury Use in
Lamp Manufacturing
3,401 kg of mercury



Equivalent to taking **25 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings
328 TWh of electricity use



National Financial Savings from
Avoided Electricity Use
75.6 Billion USD



CO₂ Mitigation from
Avoided Electricity Use
112 MTCO₂



Pakistan

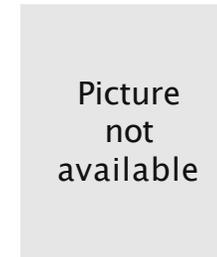
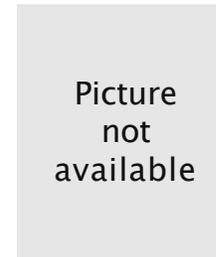
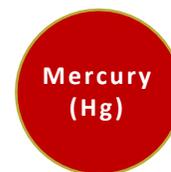


T8
1" diameter

C
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Payback Time for LFL-T8 Switch in Pakistan: 2.8 Months

- Cost-effectiveness has driven the market transition to LED
- Government has aligned effort to phase-out less efficient lighting technologies
- Today, consumers can **spend an extra 250 Rupees** and **save 6,338 Rupees on the lighting cost (25x return)**
- LED option is **52% less** mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	8,000 hours	16,000 hours
Lamp Price*	PKR 650	PKR 900
Power	36 W	16 W
Elec Use*	118 kWh/yr	53 kWh/yr
Elec Cost*	PKR 2,720/yr	PKR 1,209/yr
4-year cost	PKR 12,234	PKR 5,896
Payback period		2.8 months

*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: PKR 23/kWh. Life cycle cost adjusted to 2023 Net Present Value.

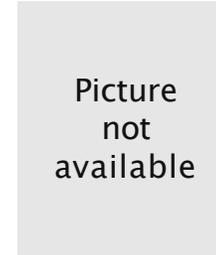
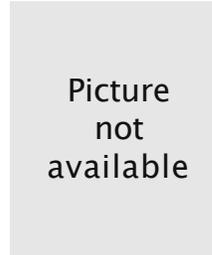
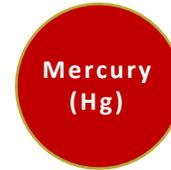
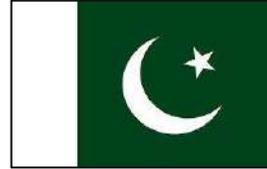


T5
0.6" diameter

**C
Li
C**

Payback Time for LFL-T5 Switch in Pakistan: Instant

- Cost-effectiveness has driven the market transition to LED
- Government has aligned effort to phase-out less efficient lighting technologies
- Today, consumers can **purchase 150 Rupees cheaper options** and **save 4,855 Rupees on the lighting cost (immediate return)**
- LED option is **50% less expensive** than mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	10,000 hours	15,000 hours
Lamp Price*	PKR 600	PKR 450
Power	28 W	14 W
Elec Use*	92 kWh/yr	46 kWh/yr
Elec Cost*	PKR 2,074/yr	PKR 1,037/yr
4-year cost	PKR 9,697	PKR 4,842
Payback period		instant

*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: PKR 23/kWh. Life cycle cost adjusted to 2023 Net Present Value.



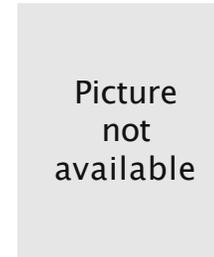
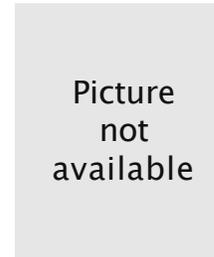
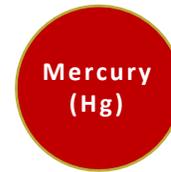
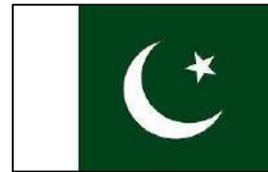
T12
1.5" diameter

C
Li
C

Payback Time for LFL-T12 Switch in Pakistan: 5.2 Months

Diminishing Market

- Cost-effectiveness has driven the market transition to LED
- Government has aligned effort to phase-out less efficient lighting technologies
- Today, consumers can **spend an extra 550 Rupees** and **save 15,089 Rupees on the lighting cost (27x return)**
- LED option is **48% less expensive** than mercury-based LFL

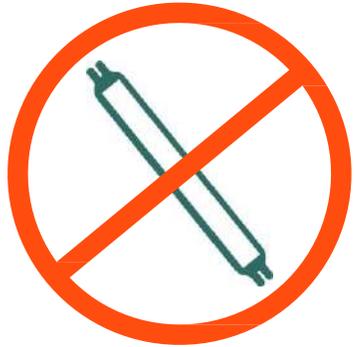
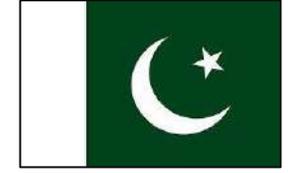


Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	20,000 hours	36,000 hours
Lamp Price*	PKR 750	PKR 1,300
Power	40 W	20 W
Elec Use*	131 kWh/yr	66 kWh/yr
Elec Cost*	PKR 2,074/yr	PKR 1,037/yr
10-year cost	PKR 31,661	PKR 16,572
Payback period		5.2 months

*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: PKR 23/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Cumulative Savings from Clean Lighting Transition (to 2050)

Pakistan, LFL Phase Out in 2025



Avoided Lamp Sales

78 million lamps

Avoided Mercury Use in
Lamp Manufacturing

467 kg of mercury



Net National Electricity Savings

52 TWh of electricity use



National Financial Savings from
Avoided Electricity Use

5.17 Billion USD

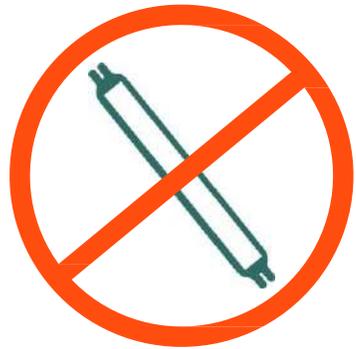
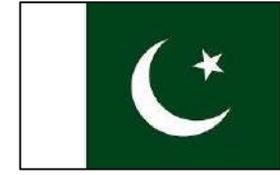


CO₂ Mitigation from
Avoided Electricity Use

24 MTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050)

Pakistan, LFL Phase Out in 2025



Avoided Lamp Sales

78 million lamps

Avoided Mercury Use in
Lamp Manufacturing

467 kg of mercury

Equivalent to taking **nearly 5.5 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings

52 TWh of electricity use



National Financial Savings from
Avoided Electricity Use

5.17 Billion USD



CO₂ Mitigation from
Avoided Electricity Use

24 MTCO₂



Philippines



T8
1" diameter

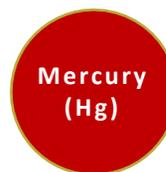
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Payback Time for LFL-T8 Switch in Philippines: 2.2 Months

- [House Bill No. 262](#) (draft) aims to require all government office to use LEDs instead of incandescent bulbs and fluorescent lamps (CFLs & LFLs)
- Today, consumers can **spend an extra 70 Peso** and **save 2,416 Peso on the lighting cost (35x return)**
- LED option is **55% less expensive** than mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	13,000 hours	15,000 hours
Lamp Price*	PHP 120	PHP 190
Power	36 W	15 W
Elec Use*	118 kWh/yr	49 kWh/yr
Elec Cost*	PHP 1,029/yr	PHP 429/yr
4-year cost	PHP 4,380	PHP 1,964
Payback period		2.2 months



*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: PHP 8.70/kWh. Life cycle cost adjusted to 2023 Net Present Value.

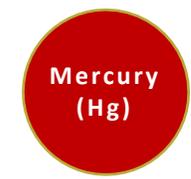


T5
0.6" diameter



Payback Time for LFL-T5 Switch in Philippines: 6.3 Months

- [House Bill No. 262](#) (draft) aims to require all government office to use LEDs instead of incandescent bulbs and fluorescent lamps (CFLs & LFLs)
- Today, consumers can **spend an extra 142 Peso** and **save 1,324 Peso on the lighting cost (9x return)**
- LED option is **38% less expensive** than mercury-based LFL



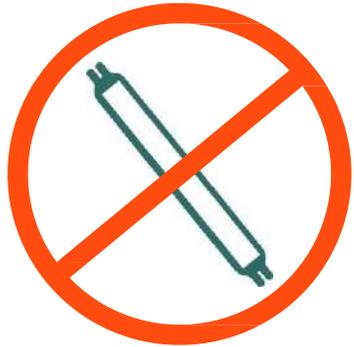
Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	10,000 hours	15,000 hours
Lamp Price*	PKR 130	PKR 272
Power	28 W	16 W
Elec Use*	92 kWh/yr	53 kWh/yr
Elec Cost*	PKR 800/yr	PKR 457/yr
4-year cost	PKR 3,484	PKR 2,160
Payback period		6.3 months

*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: PHP 8.70/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Cumulative Savings from Clean Lighting Transition (to 2050) Philippines, LFL Phase Out in 2025



CLIC



Avoided Lamp Sales

85 million lamps

Avoided Mercury Use in
Lamp Manufacturing

518 kg of mercury



Net National Electricity Savings

56 TWh of electricity use



National Financial Savings from
Avoided Electricity Use

10 Billion USD



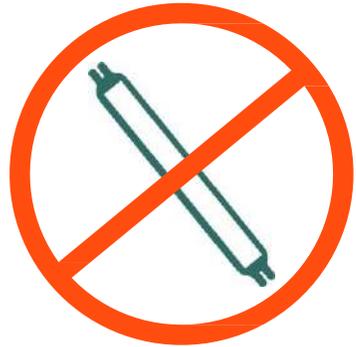
CO₂ Mitigation from
Avoided Electricity Use

26 MTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050) Philippines, LFL Phase Out in 2025



CLIC



Avoided Lamp Sales
85 million lamps

Avoided Mercury Use in
Lamp Manufacturing
518 kg of mercury



Equivalent to taking **nearly 6 million gasoline-powered passenger vehicle** off the road for a year



Net National Electricity Savings
56 TWh of electricity use



National Financial Savings from
Avoided Electricity Use
10 Billion USD



CO₂ Mitigation from
Avoided Electricity Use
26 MTCO₂



Thailand

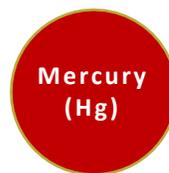


T8
1" diameter

CLiC

Payback Time for LFL-T8 Switch in Thailand: 8.3 Months

- 2021 [Long-term Low Greenhouse Gas Development Strategy](#) includes LEDs as part of the technologies for a successful transition. Voluntary MEPS for LEDs in place since 2013.
- Today, consumers can **spend an extra 80 Baht** and **save 695 Baht on the lighting cost (nearly 9x return)**
- LED option is **42% less expensive** than mercury-based LFL



Item	Linear Fluorescent Lamp	Equivalent LED Retrofit
Life	13,000 hours	15,000 hours
Lamp Price*	THB 65	THB 145
Power	36 W	18 W
Elec Use*	118 kWh/yr	59 kWh/yr
Elec Cost*	THB 372/yr	THB 186/yr
4-year cost	THB 1,658	THB 963
Payback period		8.3 months

*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: THB 3.1471/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Payback Time for LFL-T5 Switch in Thailand: 11 months

- 2021 [Long-term Low Greenhouse Gas Development Strategy](#) includes LEDs as part of the technologies for a successful transition. Voluntary MEPS for LEDs in place since 2013.
- Today, consumers can **spend an extra 251 Baht** and **save 856 Baht over time on the lighting cost (3.4x return)**
- LED option is **38% less expensive** than mercury-based LFL



Item
Life

Lamp Price*

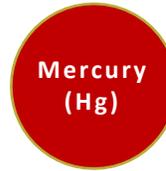
Power

Elec Use*

Elec Cost*

7-year cost

Payback period



Linear Fluorescent Lamp
20,000 hours

THB 105

28 W

92 kWh/yr

THB 289/yr

THB 2,258



Equivalent LED Retrofit
25,000 hours

THB 171

16 W

53 kWh/yr

THB 165/yr

THB 1,402

11 months



**T5
0.6" diameter**

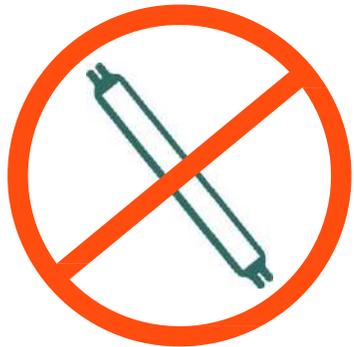
CLiC



**GLASS TUBE
T5 16W**

*Lamp prices collected in May 2023. All regular prices, no special offers or discounts. Usage assumption: 9 hours/day, 365 days/year. Electricity tariff rate: THB 3.1471/kWh. Life cycle cost adjusted to 2023 Net Present Value.

Cumulative Savings from Clean Lighting Transition (to 2050) Thailand, LFL Phase Out in 2025



Avoided Lamp Sales
168 million lamps

Avoided Mercury Use in
Lamp Manufacturing
1,012 kg of mercury



Net National Electricity Savings
111 TWh of electricity use



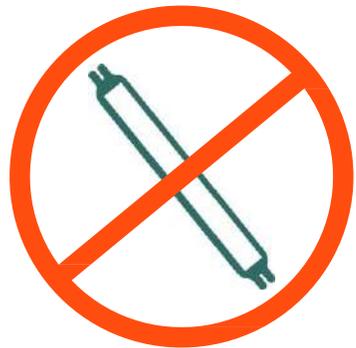
National Financial Savings from
Avoided Electricity Use
13.3 Billion USD



CO₂ Mitigation from
Avoided Electricity Use
39 MTCO₂

Cumulative Savings from Clean Lighting Transition (to 2050)

Thailand, LFL Phase Out in 2025



Avoided Lamp Sales
168 million lamps



Net National Electricity Savings
111 TWh of electricity use



National Financial Savings from
Avoided Electricity Use
13.3 Billion USD



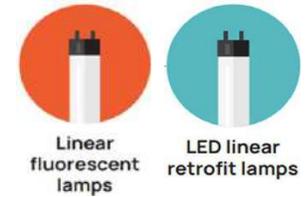
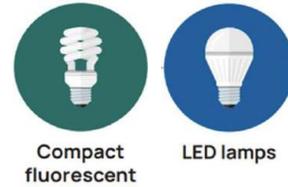
CO₂ Mitigation from
Avoided Electricity Use
39 MTCO₂



Equivalent to taking **around 8.5 million gasoline-powered passenger vehicle** off the road for a year

Cost Benefit Summary

LEDs Pay for Themselves Quickly...

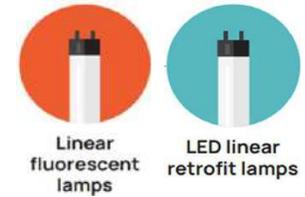
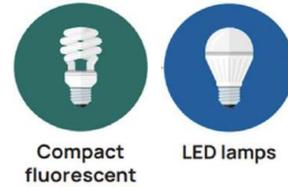


Country	LED payback vs. Inc/Hal	LED savings compared to CFL	LED payback vs. LFL	LED savings compared to LFL
Bangladesh	7 months	41%	12 months	40%
China	--	--	7 months	57%
India	7 months	50%	9 months	45%
Indonesia	6 weeks	47%	6 months	45%
Japan	--	--	10 months	54%
Pakistan	4 weeks	49%	3 months	52%
Philippines	12 weeks	53%	2 months	55%
Sri Lanka	8 weeks	48%	--	--
Vietnam	12 weeks	48%	4 months	49%
Thailand	--	--	8 months	42%



**T8
1" diameter**

LEDs Pay for Themselves Quickly...



Country	LED payback vs. Inc/Hal	LED savings compared to CFL	LED payback vs. LFL	LED savings compared to LFL
Bangladesh	7 months	41%	12 months	40%
China	--	--	7 months	57%
India	7 months	50%	9 months	45%
Indonesia	6 weeks	47%	6 months	45%
Japan	--	--	10 months	54%
Pakistan	4 weeks	49%	3 months	52%
Philippines	12 weeks	53%	2 months	55%
Sri Lanka	8 weeks	48%	--	--
Vietnam	12 weeks	48%	4 months	49%
Thailand	--	--	8 months	42%

Short payback period
Lowest lifecycle cost



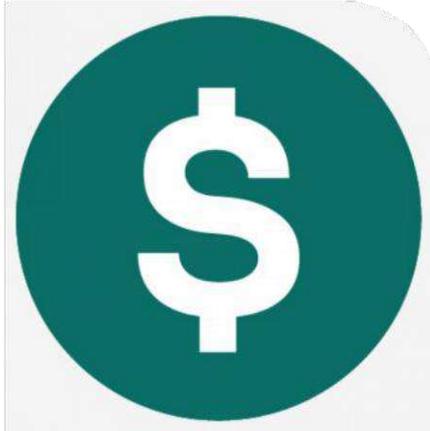
T8
1" diameter

National & Regional Benefits (cumulative, to 2050)



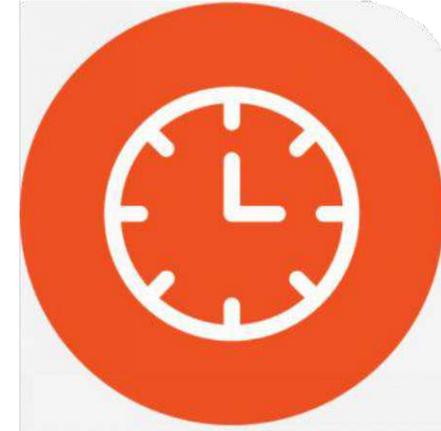
Country / Region	Mercury avoided in lamps only (metric tonnes)	CO2 avoided (million metric tonnes)	Electricity bill savings (billion USD)
Asia-Pacific	75.9	3,279	\$ 691.8
Latin America	11.3	239	\$ 90.9
Africa	4.9	221	\$ 31.4

Regional Snapshot: Asia Pacific



Price

Across all the focus countries, some LED brands are considerably **at price parity** with tube fluorescents, ranging between **2-3 times higher cost**



Payback Period

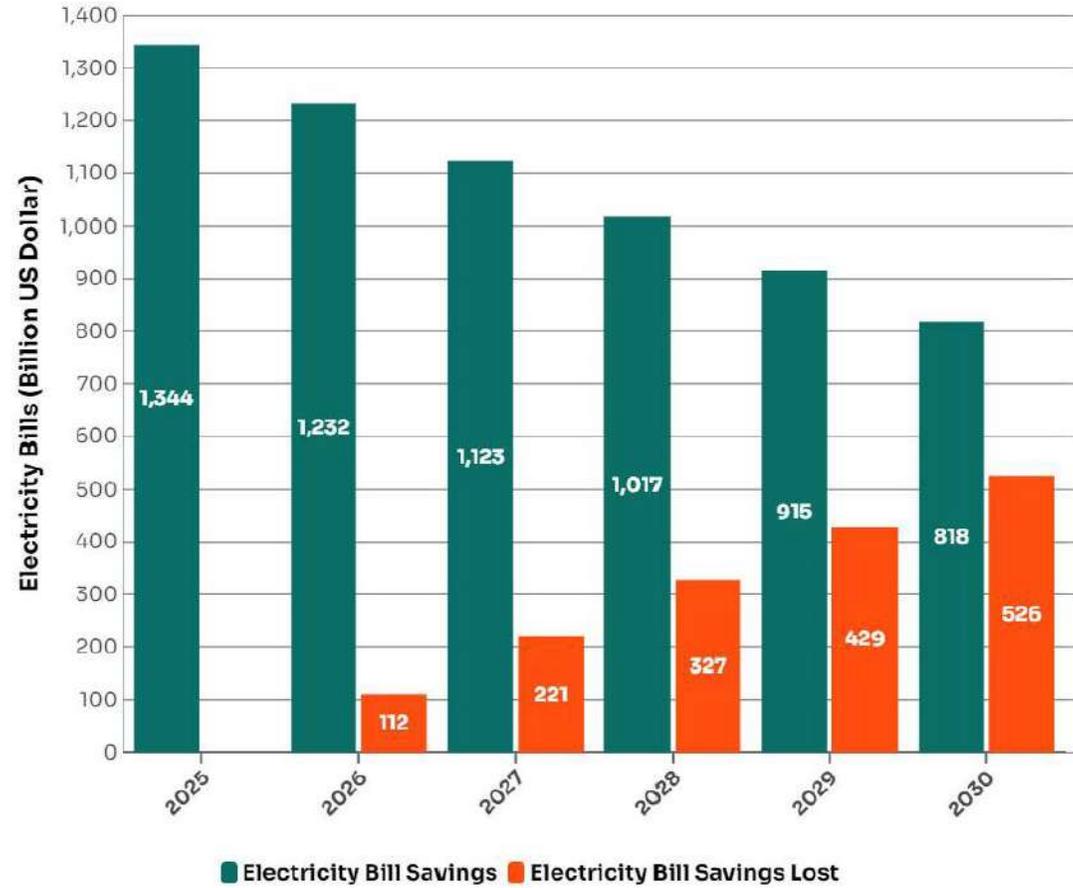
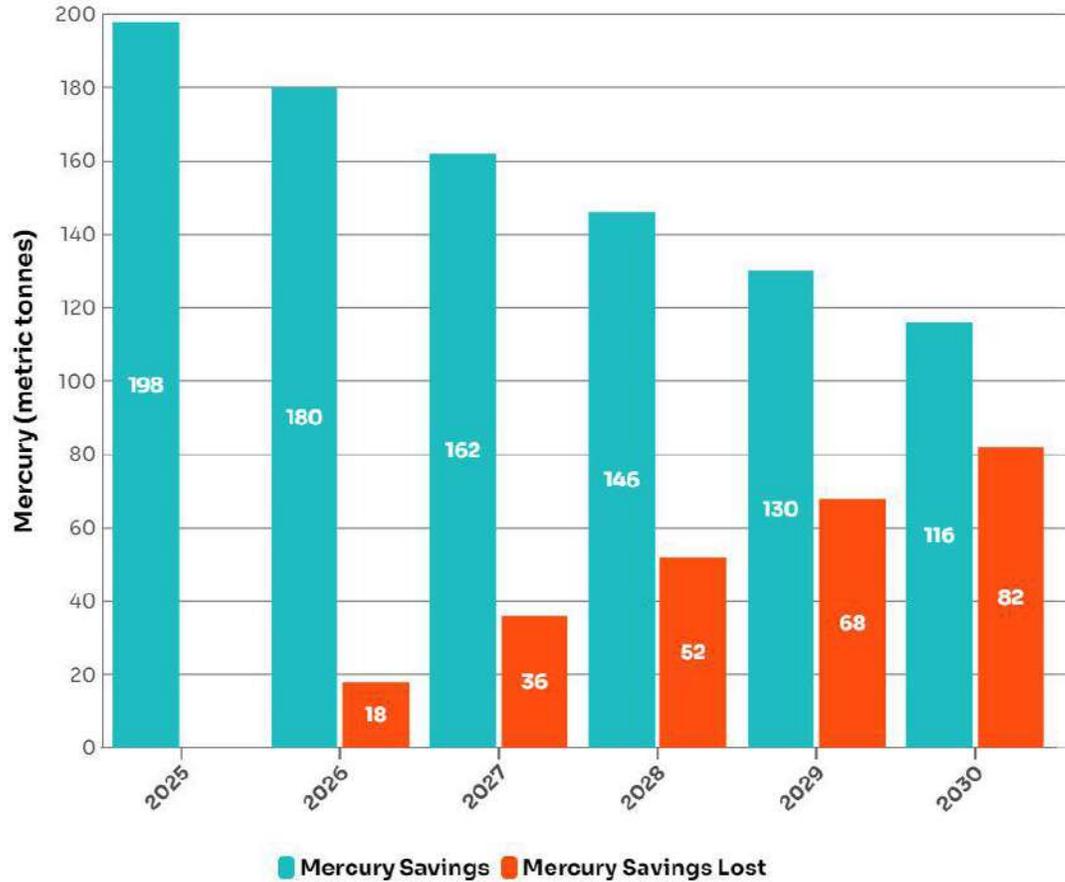
Payback period on tube lighting **range between 2 to 10 months** in many of the surveyed countries, **6 months being the average** – with life cycle cost being **40-50% lower than mercury-based LFL options**

Global Benefits of LFL Phase Out

Cumulative Benefits of a Global Phase-out of Linear Fluorescent Lamps (2025—2050):

Savings	2025	2027	2030
Mercury	198 tonnes	162 tonnes	116 tonnes
Financial	US\$1.34 trillion	US\$1.12 trillion	\$818 billion
CO2	3.3 GT	2.7 GT	1.9 GT
Energy	9,602 TWh	8,022 TWh	5,845 TWh

Global Benefits of LFL Phase Out



The Clean Lighting Coalition (CLiC) prepared this information document to provide Parties with information about LFLs in order to support the negotiations at COP5.

Thank you!

Rachel Kamande

Campaign Lead

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Health Risks of Mercury Exposure

Michael Bender

Co-founder, Mercury Policy Project, Co-lead GMP Products Partnership Area

Health Risks of Mercury Exposure and Waste Management Challenges of End-of-Life Fluorescent Lamps



**Technical Session:
“Transitioning
to Mercury-Free Lighting
in Asia-Pacific Countries”
19 June 2023**

**Michael T. Bender, Director
Mercury Policy Project
International Co-coordinator
Zero Mercury Working Group
www.zeromercury.org**

Zero Mercury Working Group



The **Zero Mercury Working Group** was formed to achieve 'Zero' emissions, demand, supply of mercury, with the aim of reducing exposure globally, with over 110 NGOs from more than 55 countries.



Overview:

- Many release pathways for mercury vapor from lamp breakage
- Exposure risk for sensitive populations, workers, waste pickers, etc.
- Compared to the value of the product, high cost for environmentally sound management and disposal
- Low or negative value of recovered material from lamp waste
- Often hazardous, wastes are more costly to manage

Groups of most concern from exposure risks:

- Sensitive populations, including pregnant and breast-feeding women, developing fetuses, infants and young children
- Vulnerable people, especially those with underlying health conditions
- Disadvantaged community members who are chronically exposed to a range of pollutants
- Workers who are regularly exposed



Exposure risks from drum top crushers



- Drum-top crushers(DTC) fit on the top of a 55-gallon drum
- Used to reduce the volume
- Filters should be changed regularly; managed as hazardous waste
- Mercury releases occur especially when emptying drums
- To protect workers protective gear should be worn; mercury levels tested regularly
- Better to operate DTCs outside to reduce exposure to personnel

OSHA[®] QUICK CARD[™]

Avoiding Mercury Exposure from Fluorescent Bulbs

Metallic mercury poses health risks from inhalation and skin exposure. Tubular or compact fluorescent bulbs contain small amounts of the metal mercury sealed inside. If fluorescent bulbs are broken, small amounts of mercury will be released into the environment. Proper cleanup will reduce workers' exposure to the low levels of mercury anticipated when a fluorescent bulb is accidentally broken.

How Workers Can Be Exposed

- Breathing mercury vapor in the air,
- Skin contact with mercury.

Health Effects and Symptoms

- Signs of mercury poisoning include tremors; mood, memory or coordination changes; and skin irritation or allergy.
- Exposure to mercury can harm unborn children.

Preventing Accidental Breakage

- Handle bulbs carefully and store away from workers.
- Package bulbs in a sturdy container to prevent breakage.
- Label containers of fluorescent bulbs.

Safe Cleanup of Broken Fluorescent Bulbs

- Notify workers and tell them to stay away from the area.
- Open any windows and doors to air out the room.
- **Do not** use a broom or vacuum cleaner unless the vacuum cleaner is specifically designed to collect mercury.
- Wear appropriate disposable chemical-resistant gloves.
- Use a commercial mercury spill kit if available, or scoop up pieces of glass and powder with stiff paper or cardboard to avoid contact with the broken glass.
- Use sticky tape to pick up any remaining pieces of glass.
- Wipe down hard floors with a damp paper towel.
- Place all pieces of glass and cleanup materials in a sealable plastic bag or a glass jar with a lid.
- Wash your hands thoroughly after cleanup.

Disposing of Fluorescent Bulbs

- Follow EPA and state government regulations for disposal of fluorescent bulbs and mercury-contaminated waste.

For more information:

OSHA[®] Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov 1(800)321-OSHA (6742)

OSHA 3092-01-0001

Mercury exposure risks for workers involved in mercury lamp processing

- ‘Recycling’ workers have exceptionally high mercury exposures globally
- During recycling, bulbs broken into small shards, mercury vapors released at high rate; lingers for weeks
- Routes of exposure include inhalation of mercury vapors and skin contact with broken materials
- Elemental, inorganic mercury absorbed into the human body through inhalation, digestion, or dermal exposure
- <https://www.mdpi.com/1660-4601/18/17/9295>



US State of Maine Lamp Breakage Study

- Mercury levels often exceeded the Maine Ambient Air Guideline (of 300 ng/m³)
- Short episodes over 25,000 ng/m³, sometimes exceeding 50,000 ng/m³
- High levels can linger for hours
- When breakage occurs on carpeting, mercury levels can spike when agitated
- Pregnant women, toddlers most at risk



What NEVER to do when cleaning up a mercury spill:



- Never use a vacuum cleaner or broom.



- Never pour mercury down a drain.



- Never allow people who are wearing mercury-contaminated shoes or clothing to walk around the house.



- Never use a washing machine to launder clothing or other items that may have come in contact with mercury.

Global Fluorescent Recycling Rates Lag



- 20% of lamps are recycled in Organization for Economic Co-operation & Development (OECD) countries
- 5% in developing countries and
- 0% in the least-developed countries
- Where there is no Extended Producer Responsibility, rates of recycling are low because disposal costs not built into product purchase

Global lamp recycling rates

- Only a small proportion of lamps are recycled:
 - 4% China
 - 9% Japan
 - 28% South Korea
 - 23% in the USA (USEPA 2021e)
 - 11% in Brazil ([Viana et al., 2022](#))
 - 10% Japan([JFS, 2004](#); [Lee et al., 2014](#))
 - 7% Canada ([Zhang et al., 2016](#))
- In Europe, with the WEEE directive for Extended Producer Responsibility (EPR):
 - 40% EU wide



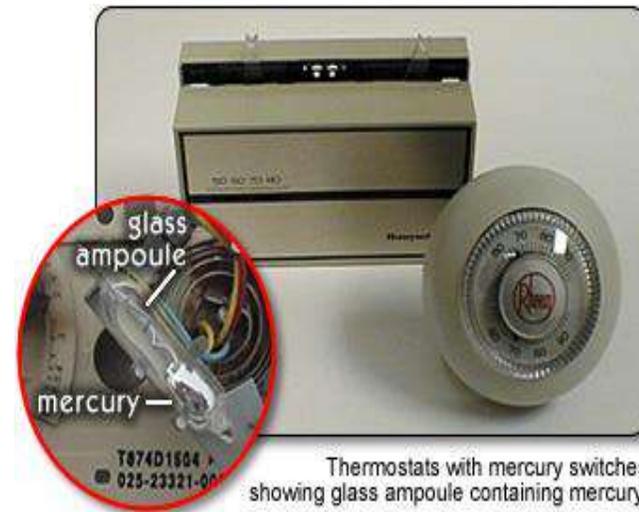
Continent	Est. price per CFL recycled	Est. price per tube recycled	Recycling/disposal method
Central America	1.00 USD	1.25 USD	In country ES disposal
Australia	1.76 USD per kilo	Charge by kilo	Recycled into new product
North America	0.90 USD; usually priced by pound or kilo	0.52 USD; different price for crushed lamps	Recycled into new product; In country ES disposal; Stored
Africa	1.5 USD	2.00 USD	Exported for ES disposal
Europe	2.00/3.00 USD (2007 data)	1.90/2.60 USD (2007 data)	Recycled into new product

Mercury content in lamps versus other MAPs

Compact fluorescent lamp	5 milligrams or less
Linear fluorescent lamp	5-10 milligrams
thermometer	500 milligrams
thermostat	4 grams
Sphygmomanometers	50-140 grams
Flow meters	5,000 grams
Barometers	400-620 grams
Manometers	30-75 grams
Pyrometers	5-10 grams
Hydrometers	<1 gram
Psychrometers	<1 gram
Relays	.005->1 gram
Tilt switches	0.5-5 grams
Float switches	0.1-70 grams
Flame sensors	>1 gram

Cost comparison of recycling CFL versus mercury-added thermostat (US example)

- Mercury amount in one thermostat (4 grams) about same as in 400-500 compact fluorescent lamps (5 milligrams)
- US EPA estimates recycling cost for a CFL at 0.50 USD
- US Thermostat Recycling Corporation charges 25 USD recycling fee per container of 100 thermostats, or cost per thermostat at 0.25 USD
- Bottom line: 1600 times more expensive to recycle mercury in a CFL than a thermostat



Thermostats with mercury switches showing glass ampoule containing mercury.

<https://www.lamprecycle.org/wp-content/uploads/2014/02/Recycling-Household-CFLs.-10-08.pdf>;
<https://files.dep.state.pa.us/waste/bureau%20of%20waste%20management/wastemgtportalfiles/SolidWaste/HazardousWaste/Universal/trc.pdf>

Lack of hazardous waste infrastructure in many developing countries make ESM & disposal of mercury lamps more challenging

- Many developing countries lack the hazardous waste infrastructure (collection, storage, transportation, processing, management and disposal capabilities) for cost effective ESM and disposal of mercury
- This makes waste mgt of lamps and other mercury product discards much more challenging—and expensive
- Where funding/options for environmentally sound permanent disposal of mercury is not available, many are “storing” tubes
- Longer mercury storage occurs, more likely to contaminate sites
- Drum top lamp crushers efficient at consolidating waste provided that workers are protected from exposure to mercury
- Cost prohibitive for developing countries to dispose of lamp waste in an environmentally sound manner without sustainable financing (ie extended producer responsibility or EPR)

Summary

- Lamp breakage presents an exposure risk especially to pregnant women, children, workers and waste pickers
- Recommendations to reduce exposure risks from lamp breakage cleanup are not known and/or are challenging to follow
- Environmentally sound management and disposal of fluorescent lamps is often cost prohibitive, esp. in developing countries
- Managing elemental mercury, other higher mercury products much more cost effective
- Many, many source reduction benefits from “turning off the mercury tap”





For more information, email:
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Thank you!



Sharing of experiences: Concerns and Challenges

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