

A nighttime photograph of a city skyline with several tall, illuminated skyscrapers. In the foreground, a wide street is lit by a prominent streetlight, creating a bright glow and lens flare. The sky is dark, and the overall scene is a mix of warm yellow light from the streetlights and cooler blue and white lights from the buildings.

Clean
Lighting
Coalition

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

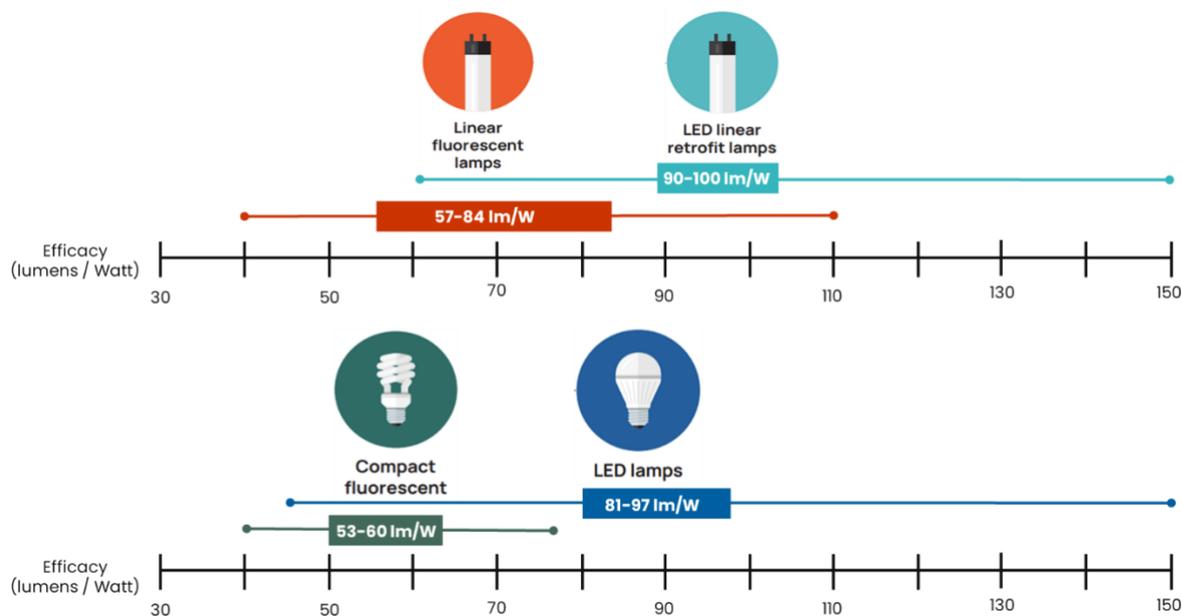
Global Overview

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

Over the last year, the Clean Lighting Coalition engaged partner organisations in 35 countries across [Africa](#), [Latin America](#) and [Asia-Pacific](#) to gather price and performance information on over 1200 lightbulbs, including both mercury-containing fluorescent and LED retrofits from those markets. The evidence outlined in this report demonstrates the widespread availability of cost-effective, energy-efficient and retrofittable LED alternatives to fluorescent lamps.

Energy Efficiency Comparison

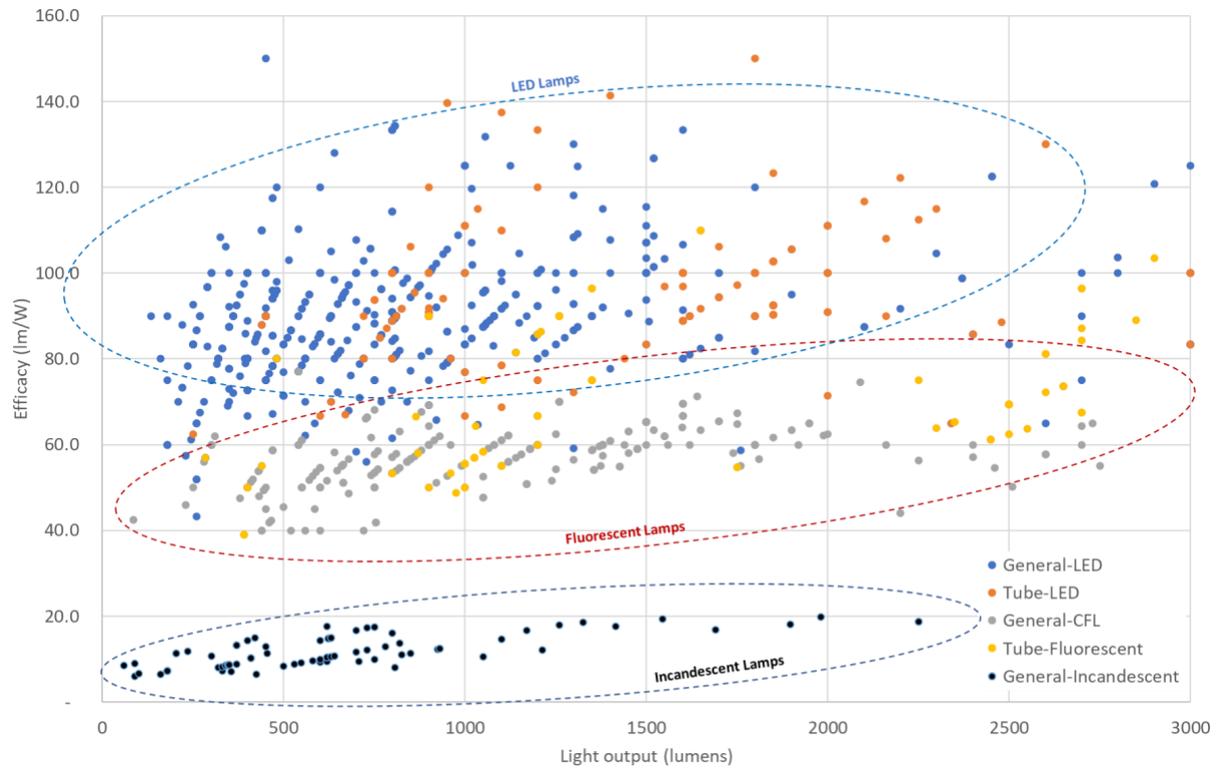
The energy efficiency of a light bulb is measured in lumens/watt. That is, the service provided which is measured in lumens of light, divided by the power consumption measured in watts. When you look at the range of values in the market, LED alternatives to mercury-containing fluorescent lamps are more energy-efficient. The lumens per watt of LED products are higher than fluorescent – generally approximately double the efficacy (or energy efficiency). The scale and range of efficiency values found across these 35 lighting markets and more than 1200 lamps is presented in the figure below.



Another way to look at the performance of the lamps found in these 35 national markets is presented in the scatter plot below. This graph below shows the efficacy (i.e., energy efficiency) of individual lamps collected across all regions. In general, LEDs are approximately twice as efficient as fluorescent lamps, which enables them to produce the same light with less energy and to reduce electricity bills.

The clusters of lighting technologies have been indicated on the graph – with LED lamps (both general service lamps and tubular lamps) being the most efficient, followed by fluorescent lamps (including compact fluorescent and linear fluorescent) and for reference purposes only,

incandescent and halogen lamps that were also part of the market research sample at the bottom of the scale.



Comparing Costs: LEDs vs CFL/LFL

The table below presents a sample of some of the economic findings from the various country markets that were analysed. In all cases, mercury-free LED lamps were found to be highly cost-effective, paying back within very short timescales and contributing net savings to the end-users over time. The full list of tables can be found in the Annexes to this report, however this provides an overview of the typical results of these economic comparisons.

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%
Belize	6 weeks	42%	11 months	48%
Brazil	4 weeks	43%	5 months	43%
Burkina Faso	Instant	53%	8 months	46%
Cameroun	8 weeks	55%	6 months	55%
Chile	Instant	38%	2 months	44%
Ethiopia	7 weeks	54%	11 months	47%
Gabon	18 weeks	54%	8 months	43%
Ghana	Instant	49%	1 month	50%
India	7 months	50%	6 months	41%
Indonesia	6 weeks	47%	7 months	47%
Kenya	3 weeks	50%	9 months	48%

Country	LED payback vs. Inc/Hal	LED savings compared to CFL	LED payback vs. LFL	LED savings compared to LFL
Nigeria	16 weeks	41%	9 months	45%
Pakistan	4 weeks	49%	5 months	47%
Perú	2 weeks	50%	4 months	55%
Philippines	12 weeks	53%	2 months	49%
South Africa	Instant	48%	Instant	50%
Vietnam	12 weeks	48%	4 months	49%

Overall, this market research exercise has shown that around the world – in more than 35 countries and thousands of lamps analysed – the time to switch to mercury-free LED lighting is now. There are health, economic, energy and climate reasons to make the switch. Eliminating toxic fluorescent lighting will bring about positive outcomes for public and environmental health, and help to realise a more sustainable, healthier and more climate-friendly lighting market moving forward.

The body of this report is divided up into three Annexes for each of the three regions studied. Within each of those three Annexes, the data is desegregated into the seven key areas of consideration as countries determine if a fluorescent phase-out, as outlined in the African lighting amendment, is feasible at the national and regional level. Below the key sections are summarized:

1. **CO₂ and Mercury Avoided:** If the proposed African lighting amendment is adopted, this section uses lamp shipment projections from CLASP's [Mepsy](#) model to provide regional and country-level projections of avoided CO₂ emissions and mercury releases cumulatively from 2025-2050. The data demonstrates that regions – and many individual countries – will experience significant reductions in CO₂ and mercury emissions.
2. **Lighting Market Overview:** Lighting markets are already transitioning to LEDs around the world, yet the legacy mercury-laden fluorescent lamps still linger, causing widespread mercury pollution and wasting energy. Adopting the proposed African lighting amendment will help to ensure the gradual transition to an all-LED market globally by 2025, in line with the [IEA's roadmap to achieve carbon neutrality by 2050](#). Furthermore, research demonstrates that adopting the proposed African lighting amendment will create new opportunities for local LED manufacturers to supply domestic and regional demand.
3. **Comparing Costs: LEDs vs. CFL/LFL:** Transitioning to efficient LED lighting will result in significant cost savings for people, businesses and governments. By analyzing current price and performance data collected in these 35 countries, we found strong and compelling economics in all markets. On the general service lamps, LED lamps are in most cases less expensive than the compact fluorescent lamps (CFLs) they were designed to replace. For those countries, the payback is instantaneous – switching to mercury-free LED saves at the time of purchase and cuts the energy bill for lighting in half. For linear fluorescent lamps, LED retrofit tubes are also highly cost effective, with all countries reporting payback periods – meaning, the energy savings pays for the incremental higher price of the LED tube – in one year or less. Most countries had payback periods between 4 and 8 months – on LED tubes that then go on to last for years. Given that LED technology is continuing to improve and get cheaper over time, the positive economic case we are observing in 2021/22 will be even more compelling in 2024/25 – the effective years in the proposed African lighting amendment.
4. **Energy Efficiency Comparison:** Each of the regions presents a comparison of the efficacy of light produced between linear fluorescent lamps and LED linear retrofit lamps, and between compact fluorescent lamps and LED lamps. In all cases, the average efficacy and

the range of efficacies is higher for LED than for fluorescent. In the market comparisons, researchers found that LED lamps typically had approximately half the wattage of fluorescent lamps, yet produced an equivalent amount of light when installed in a fixture.

5. **Lighting Policy & Legislative Landscape:** In this section, a brief summary of relevant policies and programmes that relate to lighting issues in the region are presented and discussed. Hyperlinks are provided which give access to more information.
6. **Compatibility / Retrofits for LED tubes:** LED lamps have been designed to have the same form, fit and function as the fluorescent lamps that they are replacing. In each of the markets researched, direct, drop-in replacement lamps were found that could be used in both compact fluorescent and linear fluorescent lighting applications. LED retrofits are widely available, have high rates of compatibility – particularly in developing and emerging markets which have a higher share of magnetic (choke) ballasts, on which LED lamps have 100% compatibility. Overall, using manufacturer literature published in both Europe and North America, LED retrofits have been found to be available for more than 90% of the applications in the field.
7. **End of Life Management for Lighting:** Collecting fluorescent lamps at the end of life is a global problem that has existed since the introduction of fluorescent lamps. Mercury released during the lifecycle of fluorescent lamps contaminate the atmosphere, land and water. This contamination may occur from lamp breakage when old lamps are mixed with general household waste, and during installation, collection or transport of discarded lamps, processing or recycling of spent lamps, or when lamps are landfilled, incinerated or otherwise disposed of. Each of the regional reports discusses the very low rates of recovery at end of life – for example only 4% recovery in Southern Africa, 1.3% in Eastern Africa and close to 0% in other parts. This means that virtually all the mercury from fluorescent lamps is going to landfills and is polluting the soil and water, and may poison vulnerable people for years to come. The best, lowest cost solution to this problem is simply to stop importing, buying, and/or selling the fluorescent lamps – turn the mercury tap off – and transition to cost-effective LED lamps.
8. **Annexes of Country Level Data:** For each of the countries where data was gathered, there is one or two pages of more detailed national-level information of interest. First, a table is provided which gives the mercury, electricity, CO₂ and financial savings associated with the proposed African Lighting Amendment. Next, a few bullet points are presented which provide relevant information on fluorescent and LED lamps in that country. Finally, there are one or two economic tables which compare fluorescent lamps with mercury-free LED retrofit lamps. In these tables, detail is given on the price in both local currency and USD, the running costs, the payback period and the total lifetime cost of light. These comparisons demonstrate that LED lighting is highly cost effective, in all of the markets analysed. And again, the cost-effectiveness is established based on 2021 / 22 LED prices and performance, in 3-4 years time when the proposed African Lighting Amendment would take effect, the LED lamps will be even cheaper and more efficient, meaning the economics will be even more attractive.

Our Partners

The Clean Lighting Coalition would like to thank and acknowledge the 35 partner organisations around the world which supported us in data collection efforts. Without their efforts, this analysis would not have been possible.

A full list of partners is provided below:

Partner	Country
AFRICA REGION	
Gouvernance Environnementale et le Développement Durable	Burkina Faso
CREPD	Cameroon
ok	Ethiopia
Centre d'Etudes et de Recherches Intercontinentales en Santé-Environnement	Gabon
Ecological Restorations	Ghana
African Center for Environmental Health	Ivory Coast
CEJAD	Kenya
SRADeV	Nigeria
Groundwork	South Africa
Les Amis de la Terre-Togo	Togo
Bio Vision Africa (BIVA)	Uganda
Children's Environmental Health Foundation	Zambia
ASIA PACIFIC REGION	
Environment and Social Development Organization	Bangladesh
Nexus3 Foundation	Indonesia
350.org	Japan
Environmental Protection Society Malaysia	Malaysia
SDPI	Pakistan
Centre for Renewable Energy and Sustainable Technology	Philippines
Janathakshan GTE	Sri Lanka
Centre for Supporting Green Development (GreenHub)	Vietnam
LATIN AMERICA & CARIBBEAN GROUP	
Integrated Health Outreach	Antigua and Barbuda
Asociacion Argentina de Medicos por el Medio Ambiente	Argentina
International Energy Initiative - Brazil	Brazil
Toxisphera	Brazil
Juana Lorena Salas Salgado	Colombia
IDEAMBIENTE	Chile
Casa Cem / Vias Verdes A.C.	Mexico
Alianza Contaminacion Zero	Panama
Red Social	Peru
Amalia Laborde	Uruguay