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PHASING IN QUALITY

Harmonization of CFLs to Help Asia Address Climate Change

March 2009

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ACRONYMS

ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
APP	Asia-Pacific Partnership on Clean Development and Climate
ASEAN	Association of Southeast Asian Nations
BIS	Bureau of Indian Standards
BSN	Badan Standardisasi Nasional (National Standardization Agency of Indonesia)
BEE	Bureau of Energy Efficiency (India)
CALI	China Association of Lighting Industry
CFL	compact fluorescent lamp
CFLI	International CFL Harmonisation Initiative
CLASP	Collaborative Labeling and Appliance Standards Program
CO_2	carbon dioxide
CQC	China Quality Certification Center
DEDE	Department of Alternative Energy Development and Efficiency (Thailand)
ECO-Asia	Environmental Cooperation-Asia
EGAT	Electricity Generating Authority of Thailand
ELI	Efficient Lighting Initiative
EC	European Commission
ESIS	Energy Standards Information System (APEC)
EST	Energy Saving Trust (UK)
EU	European Union
EVN	Vietnam Electricity
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GLS	general lighting service
GWh	gigawatt-hour
HEPS	high efficiency performance standards
IEA	International Energy Agency
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardization
ITFSP	International Task Force for Sustainable Products
KAN	Komite Akreditasi Nasional (National Accreditation Committee of Indonesia)
kWh	kilowatt-hour

kg	kilogram
lm	lumen
MEPS	minimum energy performance standards
MW	megawatt
NA	not applicable
NABL	National Accreditation Board for Testing and Calibration Laboratories (India)
NAVLAP	National Voluntary Laboratory Accreditation Program (US)
NGO	non-governmental organization
OECS	Organization of Eastern Caribbean States
PAO	Philippine Accreditation Office
PLN	Perusahaan Listrik Negara (State Electric Company of Indonesia)
PNS	Philippine National Standard
RDMA	USAID Regional Development Mission for Asia
SNI	Standar Nasional Indonesia (Indonesian National Standard)
TLAS	Thai Laboratory Accreditation Scheme
TUV	Technischer Überwachungs-Verein (Technical Monitoring Association)
UK	United Kingdom
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
US	United States
USAID	United States Agency for International Development
W	watt

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EXECUTIVE SUMMARY

National and local efforts to promote energy-efficient lighting have been gathering momentum in Asia and other parts of the world. These efforts include plans by more than forty countries worldwide to phase out the use of incandescent lamps. The most prevalent option being promoted by countries as a replacement for inefficient incandescent lamps is the compact fluorescent lamp (CFL).

In June 2008, the world's largest lighting companies signed an agreement to rid the Asian market of substandard energy-saving lights. Under this agreement, entitled the *Manila Compact*, lighting suppliers have committed to develop common performance levels to rate the quality of CFLs sold in Asia, introduce a product marking system, and establish an on-line regional database that identifies those CFLs that meet quality standards (Appendix A).

The Manila Compact was signed six months after the publication of *Confidence in Quality*, a landmark report which revealed that half of the CFLs sold in Asia during 2006 were substandard – producing less light or burning out faster than advertised or required by national regulations (USAID, 2007). The Manila Compact was the first public response by CFL manufacturers and lighting associations to address a situation with the potential to damage the spectacular growth of CFL sales in Asia ("Shoddy products cast poor light on $7 billion market," 2008).

This report, *Phasing in Quality*, identifies opportunities to fully implement the Manila Compact. The report begins with an overview of CFL markets and programs in China, India, Indonesia, Philippines, Thailand, and Vietnam. Next, the report presents a series of comparative analyses covering the current standards, regulations, testing, labeling, and other performance and quality requirements in effect for CFLs sold in these six nations. Finally, the report recommends initiating an immediate and intensive effort to coordinate existing regional CFL initiatives and to develop a broad-based quality assurance process for CFLs in Asia.

The findings presented in this report will be of considerable interest to policy makers and CFL manufacturers. For policy makers, the study presents a detailed comparison of existing CFL standards throughout Asia, as well as the first published estimates of the carbon dioxide (CO_2) emission reductions that could be achieved by replacing shoddy CFLs sold in Asia with quality CFLs. CFL suppliers will find information about the Asia CFL Quality Charter, an industry grouping that is developing a CFL quality ranking system with a set of performance levels or "tiers", a product marking system, and a database of registered CFL products that meet the performance standards.

CFLs have grown more complex over recent years, with the incorporation of electronic ballasts and efforts to shrink their overall shape and size while maximizing the number of locations where CFLs can be suitably installed. As a consequence, manufacturers must balance several physical and performance factors in order to produce affordable CFLs that satisfy consumer expectations while complying with the energy performance requirements of regulators and utilities. In this balancing act, a small adjustment to one performance factor carries the potential to significantly affect other aspects of lamp performance.

METHODOLOGY

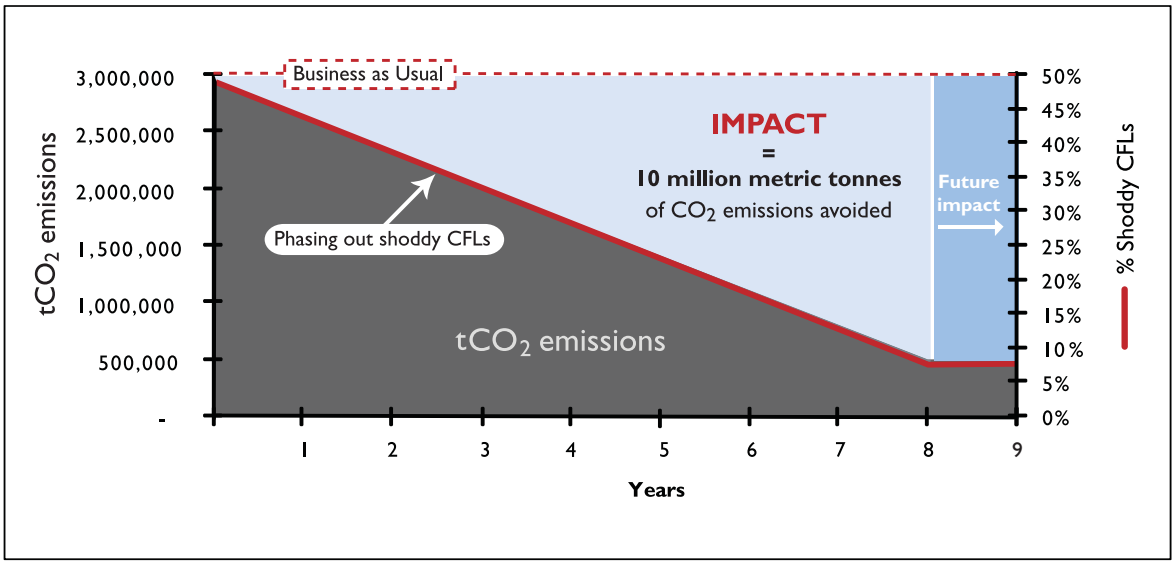
ECO-Asia completed a literature review and a survey of regional and national CFL standards and related criteria, including data about CFL standards, regulations, testing, labeling, and other performance and quality requirements in China, India, Indonesia, Philippines, Thailand, and Vietnam. These data were then synthesized to produce comparative analyses of CFL performance levels and quality criteria in the six countries. Finally, a comprehensive draft of this report was reviewed by clean energy experts in Asia and the United States, and the report was refined further to reflect their inputs and comments.

KEY FINDINGS

Many Asian countries are actively promoting CFLs through a range of programs including financial incentives, give-aways, and performance standards. There is now a wealth of experience with the promotion of CFLs in Asia, and there is much that can be learned through the increased sharing of experience and best practices. Unfortunately, each country has its own set of CFL standards and specifications, and this requires CFL suppliers to re-test and re-certify their products leading to inefficiencies and increased product costs in some cases. Appendix D of this report includes a summary of CFL programs and initiatives in the six focus countries.

Phasing in quality CFLs could reduce CO_2 emissions by 10 million tons. The analysis completed for this study indicates that 85 percent of the poor-quality CFLs currently sold in Asia could be replaced with high-quality CFLs within 4 years, and this would result in reductions of at least 10 million metric tons of carbon dioxide emissions within 8 years (**Figure 1**).[1]

FIGURE 1. AMOUNT OF CARBON DIOXIDE EMISSIONS AVOIDED BY PHASING-OUT LOW QUALITY (SHODDY) CFLS



Note: Assumptions and calculations for the CO_2 reductions in **Figure 1** are detailed in **Appendix B**.

While the CFL testing procedures used in several countries share similarities, there are no common criteria to define a "quality" CFL in Asia. This study found that while most Asian countries base their CFL test procedure on a common international standard, there is no recognized set of common quality criteria for CFLs in place across Asian markets. The survey found very close similarities among standards for rating the quality of CFLs, and this presents an opportunity for harmonization of quality standards.

Suppliers have the capacity to make enough high-quality CFLs for Asia, but the absence of a common regional quality standard is benefitting suppliers of low-quality, low-cost CFLs. There are sufficient numbers of CFL manufacturers with the capacity to produce quality CFLs for the Asian market. However, the Asian market continues to be flooded with sub-standard products due to the absence of common quality criteria for CFLs. In part, this is because poor-quality products can be manufactured at a lower cost, which puts suppliers of higher-quality, higher-cost CFLs at a disadvantage in the marketplace.

1 This estimate is based on (1) recent CFL sales data from five of the six Asian countries surveyed for this study; (2) widely accepted estimates of the carbon dioxide reducing potential of CFLs; (3) published data estimating the percentage of substandard CFLs sold in regulated markets; and (4) empirical research charting the uptake of new products into existing markets (See **Appendix B**).

RECOMMENDATIONS

The increased adoption of high-quality, energy-saving CFLs provides the opportunity to mitigate CO_2 emissions while enhancing international collaboration on common clean energy challenges. Since many individual countries are currently designing their own testing and quality programs for CFLs, now is the time to scale up the discussion of CFL programs to the international level, and to forge an agreement on common solutions, before a patchwork of programs limits the potential expansion of the regional and global CFL market.

The findings of this study suggest that the measures described below should be broadly considered. It should be noted that a number of international efforts have been working separately or cooperatively to implement one or more of these measures. In particular, the Asia CFL Quality Charter (AQC) – a public-private partnership, was established in 2008 to specifically address the issue of CFL quality. The AQC has developed and obtained agreement on a comprehensive set of CFL performance criteria and quality levels that could be recognized across nations. Other recommended measures remain, and the AQC, along with other actors across the region can, and need to work together, in order to achieve successful outcomes for each.

- **Develop a coordinated regional effort to address low-quality CFLs, which are undermining energy-efficiency policies and efforts to mitigate greenhouse gas emissions.** High-level policymakers must recognize that the prevalence of low-quality CFLs in the market is a significant barrier to the full realization of energy-efficiency policies. Currently, many countries focus their standards on energy efficiency and energy performance and do not explicitly incorporate other quality criteria into their standards.
- **Gain agreement on a comprehensive set of common performance standards to assess CFL quality.** There is a need for agreement on CFL performance and quality levels that could be recognized across nations, specifically focusing on a common set of performance criteria that covers all important aspects of CFL performance, not just one or two attributes.
- **Develop a regional agreement on a common test procedure, a data-sharing plan, and ways to mutually recognize test results across nations.** There is a pressing need for a uniform regional, if not international, process to test and assure the quality of CFLs sold in the region.
- **Establish a framework for minimum CFL standards as well as mandatory testing and labeling.** Research shows that over the long-term it is important to have mandatory testing and labeling of all products in the market and to develop minimum energy performance standards.
- **Increase public awareness about CFL quality.** Government agencies, the private sector (including manufacturers and retailers of CFLs) and non-governmental organizations (NGOs) in the region should take concrete actions to increase awareness of high-quality CFL products.

The increased adoption of high-quality, energy-saving CFLs can provide the Asia region with an important opportunity for mitigating greenhouse gas emissions. At the same time, if efforts to phase out incandescent lamps are accelerated without explicitly addressing the issue of CFL quality, the potential exists to significantly undermine the very policies that aim to increase energy efficiency and reduce CO_2 emissions. Consequently, it is urgent that governments and private sector lighting suppliers in the region come together to develop and implement a viable, regional quality control scheme within the next 12 to 18 months – or risk losing consumer confidence due to the proliferation of shoddy CFL products. Existing international standards are available. The challenge is for governments and suppliers to work together to develop a common, harmonized approach.

1. INTRODUCTION

National and local efforts to promote energy-efficient lighting have been gathering momentum in Asia and other parts of the world. These efforts include plans by more than forty countries worldwide to phase out the use of incandescent lamps **(Appendix C).** Many of these efforts rely on compact fluorescent lamps (CFLs), which use up to 75 percent less energy and last up to ten times longer than the incandescent lamps that they replace (USDOE, 2008). The most prevalent option being promoted by countries to replace inefficient incandescent lamps is the CFL.

The increasing reliance on this once unfamiliar product has resulted in some significant changes in how CFLs are made and sold around the world. These changes include:

- accelerated global CFL demand and production;
- concentration of CFL manufacturing in regions with low labor and material costs; and
- proliferation of national standards and other local or specific programmatic CFL requirements.

The above factors can combine to create a desirable situation, with increasing global adoption of CFLs and the resulting energy and cost savings, as well as reductions in greenhouse gas emissions. This occurs when there is an agreed upon definition of a "quality" CFL, common test methodologies, and consumer awareness of labeling and certification. These conditions allow responsible manufacturers to produce good quality products at their most efficient production facilities, and sell products in locations that recognize their test results.

Unfortunately, without a harmonized set of quality standards for CFL products, the above factors can also combine to work against the widespread, consistent adoption of quality CFLs. This occurs when there is not an agreed upon international definition of a "quality" CFL, creating a multitude of location-specific standards and requirements. This results in increased costs for quality products, as manufacturers have to submit their products for testing in multiple markets, reducing their ability to compete against lower-cost, lower-quality products.

1.2 OBJECTIVE OF THE REVIEW

This report presents an assessment of the technical standards, national regulations, testing and labeling requirements, and other performance and quality requirements that affect CFLs available for sale in Asia. While this report broadly applies to the Asia region, the data presented focus primarily on China, India, and four countries holding membership in the Association of Southeast Asian Nations (ASEAN) - Indonesia, Philippines, Thailand, and Vietnam. Together, these six nations account for 96 percent of the gross domestic product (GDP) of Asia's developing economies as well as a significant share of the global CFL market (USAID, 2007a).

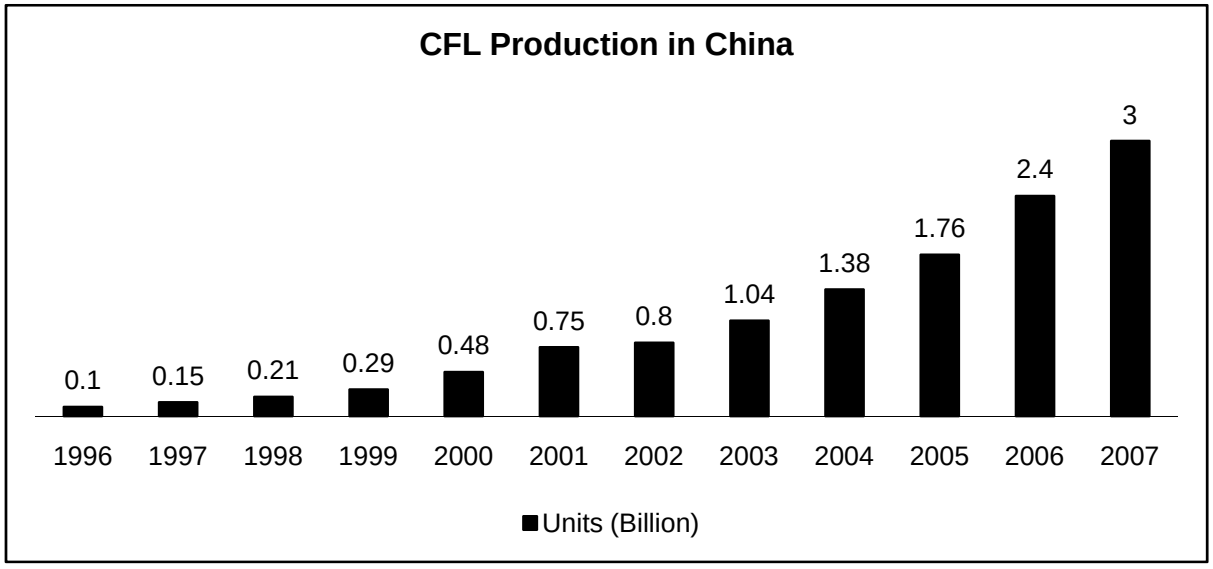
This report also examines the issue of testing, availability and compatibility of results, and the potential benefits of a regionally and globally harmonized approach to testing and regulating CFLs.

2. OVERVIEW OF THE CFL MARKET

2.1. CFL GROWTH TRENDS

The worldwide market for CFLs is growing rapidly, especially in Asia. The most dramatic increase happened within the past decade: annual global CFL production reached one billion units per year just over five years ago, and now exceeds three billion units annually, with China accounting for nearly 90 percent of worldwide CFL production **(Figure 2)**.

FIGURE 2. ESTIMATED CHINESE CFL PRODUCTION



Source: Chen, Yansheng. China Association of Lighting Industry, 2008.

Where survey data are available, it is clear that the CFL markets in many countries worldwide are experiencing extremely rapid growth. If current growth trends continue, global CFL production could exceed four billion units annually by 2010.

2.2. CFL MANUFACTURING TRENDS

During the early stages of CFL production, manufacturing was dominated by a few well-known international brands and production was based in Europe, the US, Japan, and China. Presently, the production of CFLs is being carried out by a large group of less well-known manufacturers throughout Asia **(Table 1)**. China currently leads the region (and the world) in the number of CFL manufacturers. Currently, there are at least 200 CFL manufacturers and 400 suppliers of specialized CFL materials and components in China, where more than 90 percent of the CFLs sold worldwide are manufactured (Chen, 2008).

TABLE 1. SUMMARY OF REGIONAL CFL PRODUCTION AND SALES [2]

	Annual Volume (in million units)					
COUNTRY	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
China	750	800	1,040	1,380	1,760	2,400
India	NA	34	40	46	70	100
Indonesia	10	40	50	60	70	90
Philippines	4.5	NA	NA	18	25	NA
Thailand	NA	NA	NA	NA	10	15
Vietnam	NA	NA	5.4	7	8.4	11

Source: USAID, 2007a.

3. REGULATIONS, LABELING, AND OTHER REQUIREMENTS GOVERNING SALES OF CFLS IN ASIA

3.1. PREVIOUS ANALYSIS OF REGIONAL CFL ISSUES

In 2007, ECO-Asia published a report analyzing CFL markets and programs in China, India, and the four largest ASEAN countries: Indonesia, the Philippines, Thailand, and Vietnam. The report assessed the quality of CFLs available in regional markets and found that as many as 50 percent of the CFLs produced and sold in Asia were shoddy or sub-standard (e.g., burning out faster or producing less light than advertised or required by national regulations). The report proposed an immediate and intensive coordination of existing regional CFL initiatives in order to support development of a broad-based quality assurance process in Asia. This report builds on the previous analysis by reviewing in detail the technical and quality standards for CFLs that are in place or planned for countries in the region.

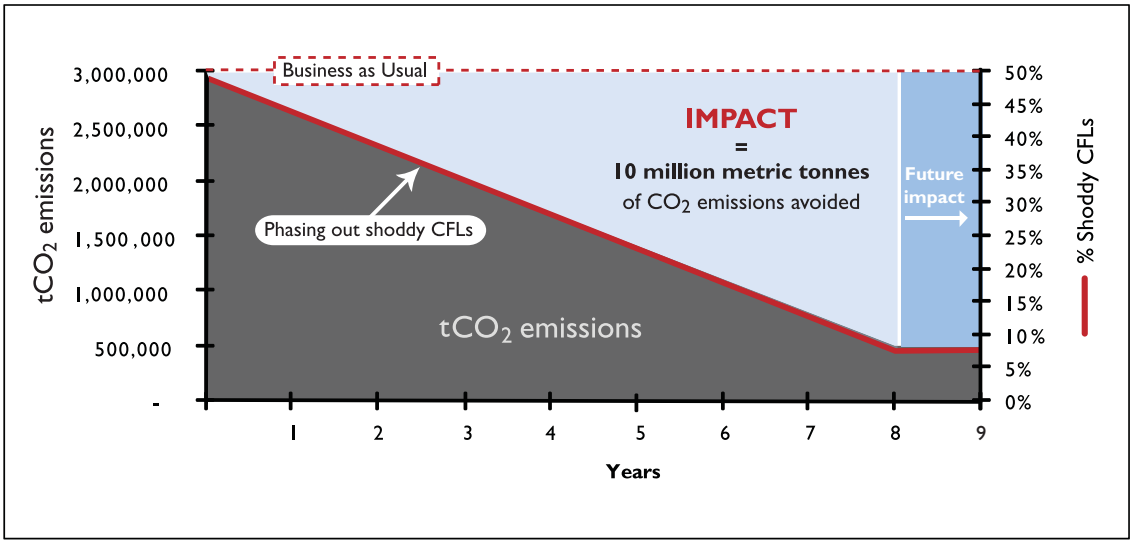
3.2. IMPACTS OF "SHODDY" CFLS

The negative impacts of poorly-performing CFLs are significant. First, if CFLs do not meet performance claims, they will not meet energy savings or greenhouse gas reduction targets.[3] Second, poor-quality CFLs create dissatisfied consumers as well, endangering the continued and increased adoption of this energy-saving technology. Other energy-saving technologies may also suffer the same perception as a consequence. Third, compared to high-quality CFLs, sub-standard CFLs will burn out sooner and create more waste for landfills – including mercury, which is contained in small amounts in CFLs.

2 Data for China represent total CFL production. It is estimated that domestic CFL sales in China are in the range of 500 million up to 1 billion annually. Data for other countries represent estimates of total in-country sales (production minus exports, plus imports).

3 In addition, CFL with poor power factors may affect utility sponsorships.

FIGURE 3. CO_2 EMISSIONS AVOIDED BY PHASING-OUT SHODDY CFLS



Note: Assumptions and calculations for the CO_2 reductions illustrated in **Figure 3** are detailed in **Appendix B**.

Based on data that were available in November 2008, it can be projected that 85 percent of poor-quality CFLs currently sold in Asia could be replaced with high-quality CFLs within 4 years, and this would result in reductions of at least 10 million tons of carbon dioxide emissions within 8 years **(Figure 3)**. This estimate is based on (1) recent CFL sales data from five of the six Asian countries surveyed for this study; (2) widely accepted estimates of the carbon dioxide reducing potential of CFLs; (3) published data estimating the percentage of substandard CFLs sold in regulated markets; and (4) empirical research charting the uptake of new products into an existing market. Detailed calculations and sources are provided in **Appendix B**.

3.3. ANALYSIS OF CFL STANDARDS

Countries and national agencies have responded to the spectacular growth of the CFL markets by implementing a number of measures designed to control CFLs sold in their countries, and provide some indication that they can be safe and efficient. Programs to promote CFLs also have taken measures towards the same purpose. These measures include safety standards or requirements, efficiency standards or labeling requirements, and minimum energy performance standards (MEPS).

Without any existing international agreement on CFL performance and quality, countries are left to set their own standards, and individual agencies often implement measures to ensure CFL performance or quality based on their area of responsibility. For example, the voluntary labeling of efficient products in India is the purview of the Indian Bureau of Energy Efficiency (BEE), while in Indonesia, the registration of CFLs for sale in the country falls under the purview of the National Standardization Agency (Badan Standardisasi Nasional – BSN).

For this report, the ECO-Asia project team conducted a survey of national CFL standards, product labeling requirements for consumer, safety, electrical, or other purposes, as well as minimum energy performance standards, as applicable and available.

The survey and catalogue of country efforts to regulate the CFLs is a complex task, affected by two major factors:

- **Lack of common CFL performance criteria.** Because there is no international agreement on basic CFL performance or quality characteristics, the number and type of criteria used in CFL regulations vary among countries.
- **Influence of agency mission.** Since national agencies design measures to ensure CFL performance or quality based on their purview and mission, the scope of the resulting national standard can often be limited to only a subset of CFL criteria (i.e. energy efficiency, but not other performance or environmental criteria).

These two factors combine to create a range of CFL standards, labeling criteria, and minimum energy performance standards that tend to be unique to each country and implementing agency. In addition, because the CFL is both an energy-saving device and an electrical appliance, it is regulated differently, not only in different countries, but sometimes in the same country by two different agencies. Nevertheless, regardless of differing approaches among countries, a number of international test standards exist, and these can be referenced to provide basic and common elements used in the regulation of CFL quality.

4. OVERVIEW OF CFL STANDARDS WORLDWIDE

The ECO-Asia review found a proliferation of CFL standards and testing requirements across the region, and this creates an undesirable situation. Currently, there are 48 different national standards and labeling schemes for CFLs in place, of which 9 are under consideration **(Table 2).**[4] Four types of standards are summarized in **Table 2**: (1) minimum energy performance standards (MEPS), which are usually but not always mandatory; (2) labeling requirements; (3) national standards for CFL testing; and (4) international reference standards, upon which the national standards are based.

TABLE 2. SUMMARY OF CFL PROGRAMS AROUND THE WORLD

COUNTRY	Minimum Standard	Labeling	National Test Standard	Reference Standard
Argentina	N	Yv(1)		
Australia	U(1)	Yv(1)		IEC 60969
Brazil	Ym(1)	Ym(2)	PROCEL 01 RESP/010-LUZ	
Canada	Ym(1)	Yv(1)	CAN/CSA-C 861-95	
Chile	N	Ym(1)	NCh 2695: 2002 NCh 3020: 2006	
People's Republic of	Ym(1)	Yv(1)	GB/T 17263-2002	IEC 60969

4 These data are based on information in the Asia-Pacific Economic Cooperation-Energy Standards Information System (APEC-ESIS, located at www.apec-esis.org), with data for several countries updated by the ECO-Asia Clean Development and Climate Program.

TABLE 2. SUMMARY OF CFL PROGRAMS AROUND THE WORLD

COUNTRY	Minimum Standard	Labeling	National Test Standard	Reference Standard
China			GB 19044-2003	
People's Republic of China (Taipei, Taiwan)	Ym(1)	N		
Colombia	Ym(1)	N	NTC 5101 NTC 5103 NTC 5102 NTC 5109	
Czech Republic	N	Yv(1)		
Ghana	Ym(1)	Ym(1)	GS 323:2003	
Hong Kong, China	N	Ym(1)	CIE 84-1989 IEC 60901 IEC 60969	IEC 60969
Hungary	N	Yv(1)		IEC 60969
India	Ym(1)	Uv(1)	IS 15111	IEC 60969
Indonesia	N	Yv(1)		
Latvia	N	Yv(1)		
Mexico	Ym(1)	Yv(1)	NOM-017-ENER-1997	IEC 60969
New Zealand	U(1)	Yv		IEC 60969
Nicaragua	U(1)	U(1)		
Pakistan	Ym	N/A	IEC 60969	IEC 60969
Peru	N	Yv(1)		
Philippines	Ym(1)	Ym(1) Yv(1)	PNS 603-2-Amd.1:2001	IEC 60969
Poland	N	Yv(1)		IEC 60969
Republic of Korea	Ym(1)	Ym(1) Yv(1)	KS C 7621-99	IEC 60969
Singapore	N	Yv(1)	CIE 84-1989	IEC 60969
South Africa	N	Yv(1)		
Sri Lanka	N	Yv(1)	SLS 1225:2002	
Thailand	Ym(1)	Yv(2)	TIS 236-2533, TIS 2310-2549	IEC 60969

TABLE 2. SUMMARY OF CFL PROGRAMS AROUND THE WORLD

COUNTRY	Minimum Standard	Labeling	National Test Standard	Reference Standard
UK	N	Yv(1)		IEC 60969
USA	Ym(1)	Yv(1)	10 CFR Part 430 Subpart B App R US Energy Star	
Viet Nam	U(1)	U(1)		

KEY: **Yv** = Yes, voluntary; **Ym** = Yes, mandatory; **U** = under consideration

Most countries have standards for at least one or more of the following categories:

- safety (electrical and/or mechanical);
- energy performance (lumens of light output per input Watt);
- lighting performance (color rendering and/or color correlated temperature);
- other performance and operational characteristics (start-up, lumen maintenance, lifetime etc.);
- labeling criteria (registration, etc.);
- performance testing standards (methodologies and references); and
- testing requirements (sample selection and/or size).

4.1. THE IEC STANDARDS

There is at least one set of international standards for testing CFLs: the International Electrotechnical Commission (IEC) standards 60968 and 60969. Most national and programmatic CFL standards for safety and performance specify a variation of these test standards. IEC 60968 covers product safety, and IEC 60969 covers testing of product performance.

It is important to recognize that IEC 60969 is not currently a performance standard, *per se*. It specifies how laboratories can determine a number of CFL performance parameters such as light output, color rendering, start-up time, etc. IEC 60969 itself does not specify CFL performance levels, so its adoption does not automatically mean that CFL quality will improve, especially in countries with voluntary CFL programs.

There can also be differences in how the IEC 60969 test methodology is adopted by countries or national standard agencies. The variation can range from slight to significant, so that the use or reference of IEC 60969 by governments and agencies may or may not result in quality CFLs.

Four of the six ECO-Asia countries surveyed employ a performance requirement standard, and all of these countries use IEC 69069 as the reference test standard. In each of these four countries, the program is voluntary. Additionally, Indonesia requires a Standar Nasional Indonesia (SNI) Marking Certificate for both domestic and imported CFLs, which can require further testing. Only the Philippines utilizes IEC 60969 as a mandatory standard.

4.2. SAFETY STANDARDS

Most of the ECO-Asia surveyed countries have some minimum safety requirements for CFLs, often treating it as an electrical device. In this case, standards were designed to reduce risks from electric shocks. These standards and requirements range from registration of products, such as required by Indonesia, to full electrical inspection, as is the case for both India (by the Bureau of Indian Standards, or BIS) and China (by the Administration of

Quality Supervision, Inspection and Quarantine, or AQSIQ). Typically, the electrical safety standards cover only electrical performance, but a number of countries' standards also cover mechanical issues and the integrity and fit of CFLs.[5]

Five countries surveyed for this study use a national testing protocol for CFLs. Only Vietnam has not issued a national testing protocol; however, Vietnam does maintain a generally applied standard for electrical lamps, and the Government of Vietnam plans to issue a national test standard by the end of 2008.[6] Each country with a national testing protocol bases its national standard on the same reference standards: IEC 60968 for safety and IEC 60969 for performance measurement. Five countries use the IEC 60968 as a mandatory safety standard; use of this standard in Vietnam is voluntary **(Table 3)**.

TABLE 3. OVERVIEW OF CFL SAFETY REQUIREMENTS

COUNTRY	CFL Safety Requirements	Voluntary or Mandatory	Electrical Inspection	Mechanical Inspection
China	Y	M	Y	Y
India	Y	M	Y	Y
Indonesia	Y	M	Y	Y
Philippines	Y	M	Y	Y
Thailand	Y	M	Y	Y
Vietnam	Y	V	Y	Y

In addition to minimum electrical safety requirements for CFLs, countries also have electrical requirements, which may include standards for transient and voltage fluctuation to protect CFLs from line surges and voltage variations. These requirements often fall under CFL performance requirements rather than electrical safety. Note that this survey does not cover enforcement of standards, which also varies by country, and can add another complex layer to the challenge of ensuring CFL quality.

4.3. ENERGY PERFORMANCE

The category of energy performance is an area common to most countries that have implemented CFL standards, labeling requirements, or MEPS[7]—as it is the core of CFL functionality. Unfortunately, there is very little commonality in the way different countries classify and rate CFL energy performance.

TABLE 4. NUMBER OF WATTAGE BINS USED BY NATIONAL STANDARDS

COUNTRY	Number of Wattage Bins
China	4
India	5
Indonesia	4
Philippines	5
Thailand	4
Vietnam	2*

*Note: Vietnam's standard remains under consideration.

5 For example in Vietnam, CFL mechanical inspection would require 3 Nm of twisting moment for the E27 pins.

6 The standard will be promulgated under Vietnam Standards (*Tieu Chuan Viet Nam*) by the Ministry of Science, Technology and Environment.

7 Indonesia does not have a MEPS. However under a draft Government Regulation (*Peraturan Pemerintah*) on Energy Conservation that is to be signed by the President, efficiency labeling itself will become mandatory; only star rated CFLs will be allowed to carry a label. Hence indirectly the lowest star rating become a sort of MEPS.

With respect to CFL classification, they are normally grouped by types (for example, bare lamps or covered lamps). Within each type, the lamps are segregated by wattage range or "bins", which can then be further subdivided by lamp color temperature. Most standards cover bare lamps. **Table 4** summarizes the number of wattage "bins" used in each of the surveyed country.

Although countries may have identical number of wattage "bins" in their classification, these bins may not have the same wattage ranges (**Table 5**).

TABLE 5. A SAMPLING OF CFL WATTAGE BINS AND EFFICACY REQUIREMENTS

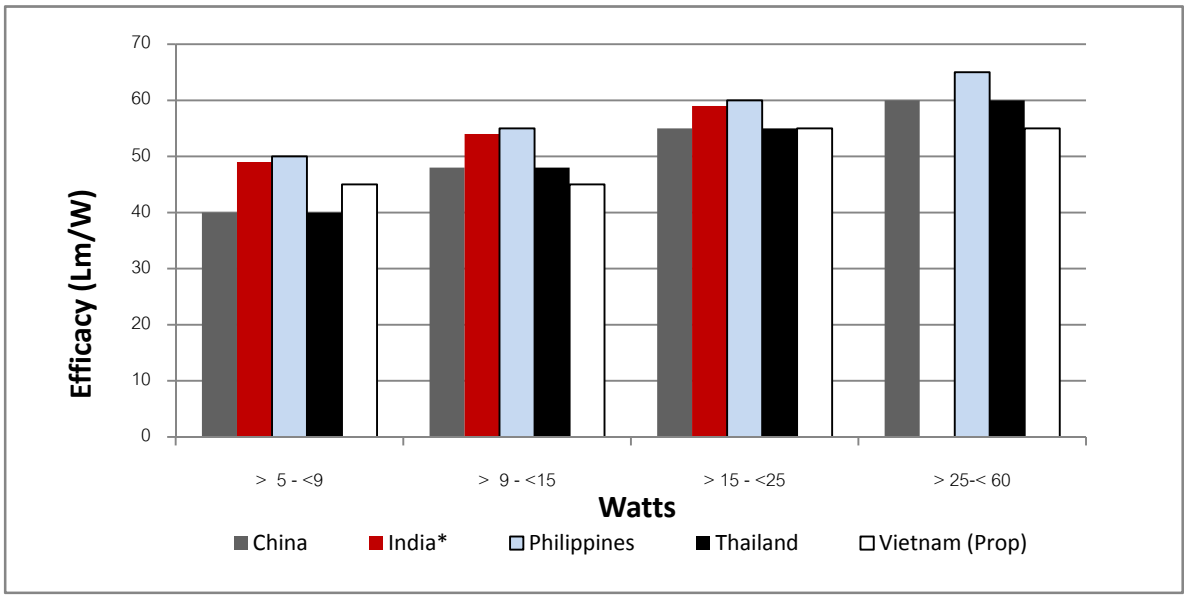
Bins (Watts)	Efficacy (Lm/W)	Country
≥ 2 - <5	45	Philippines
≤7	44	India
5 - 8	40	China
	40	Thailand
≥ 5 -<9	50	Philippines
	50	Aus/NZ(ELI)
	45	Vietnam
<10	40	Taiwan
	45	Korea
8 - 10	49	India
9 - 14	48	China
	48	Thailand
≥ 9 -<15	55	Philippines
	55	Aus/NZ(ELI)
	45	Vietnam
≥10-≤15	50	Korea
10-<15	50	Taiwan
11 - 15	54	India
≥15 -<25	60	Philippines
	60	Aus/NZ(ELI)
	55	Vietnam
15 -<25	60	Taiwan
15 - 24	55	China
	55	Thailand

TABLE 5. A SAMPLING OF CFL WATTAGE BINS AND EFFICACY REQUIREMENTS

Bins (Watts)	Efficacy (Lm/W)	Country
>15 -<20	58	Korea
16 - 23	59	India
>20	60	Korea
24 - 26	59	India
≥ 25	65	Philippines
	65	Taiwan
≥ 25-<60	65	Aus/NZ(ELI)
	55	Vietnam
25 - 60	60	China
	60	Thailand

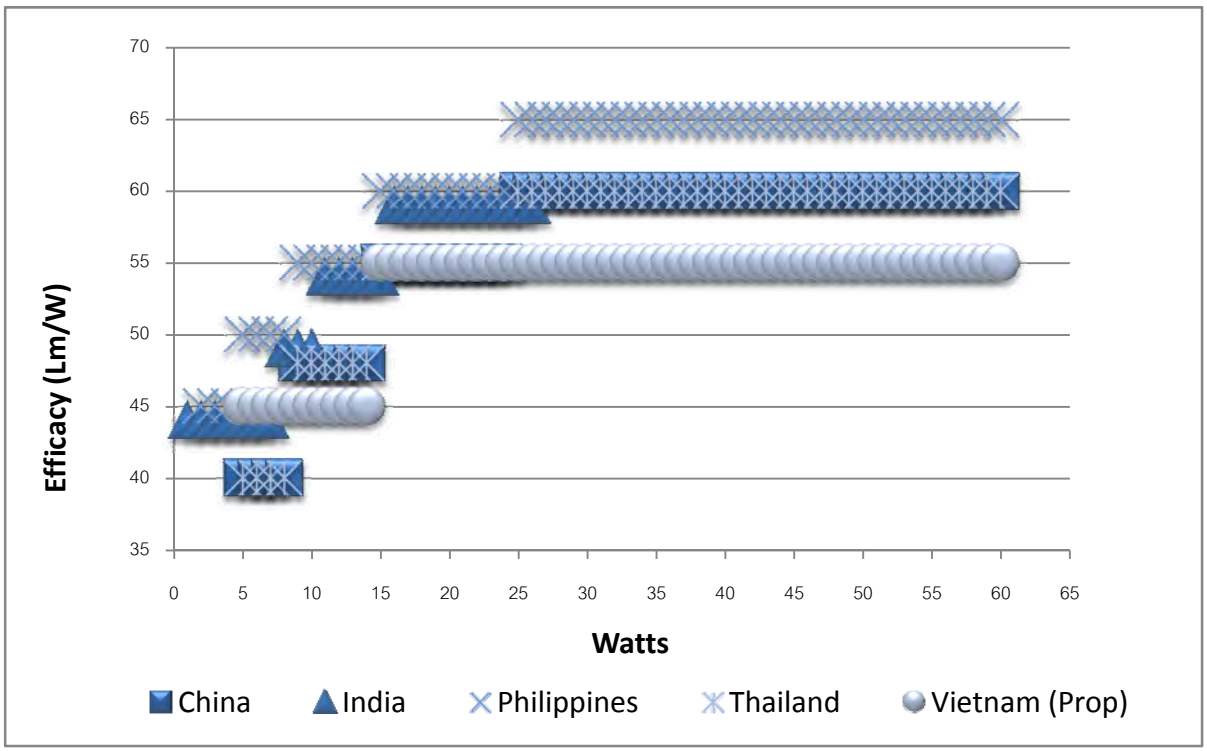
As **Table 5** shows, in addition to the differences among how CFLs are categorized by type and wattage, the energy efficiency (or efficacy) requirements for each wattage class or "bins" also differ from country to country. There are two types of efficacy requirements: (1) minimum energy performance standards (MEPS), which set a floor for CFL efficacy; and (2) target high-efficiency levels, which are used in utility and government labeling and endorsement programs to promote sales of CFLs. Even within these two groupings, MEPS and target high-efficiency levels, the requirements vary by country. **Figures 4 and 5** show variations of MEPS between countries for each wattage bin, first as a bar chart, and then as a line graph. Within each wattage bin, there are very small differences between the levels set by each country.

FIGURE 4. CFL EFFICACY REQUIREMENTS: MEPS LEVELS



*Note: India has different wattage bins than the other countries but is plotted above in the closest common wattage bins for ease of comparison.

FIGURE 5. CFL EFFICACY REQUIREMENTS: MEPS



Figures 6 and 7 show variations of the target high-efficiency levels between countries, for each wattage bin, first as a bar chart, and then as a line graph. These figures also include additional international standards in the comparison—from the Efficient Lighting Initiative (ELI) and the US ENERGY STAR program.

FIGURE 6. CFL EFFICACY REQUIREMENTS: HIGH EFFICIENCY

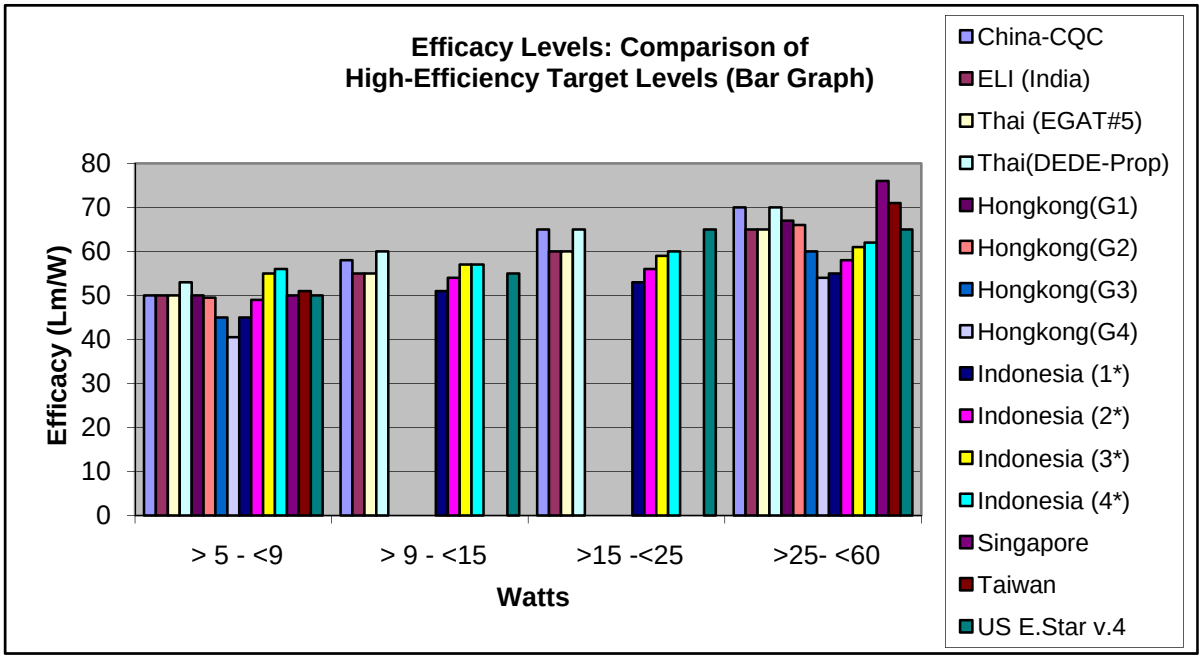
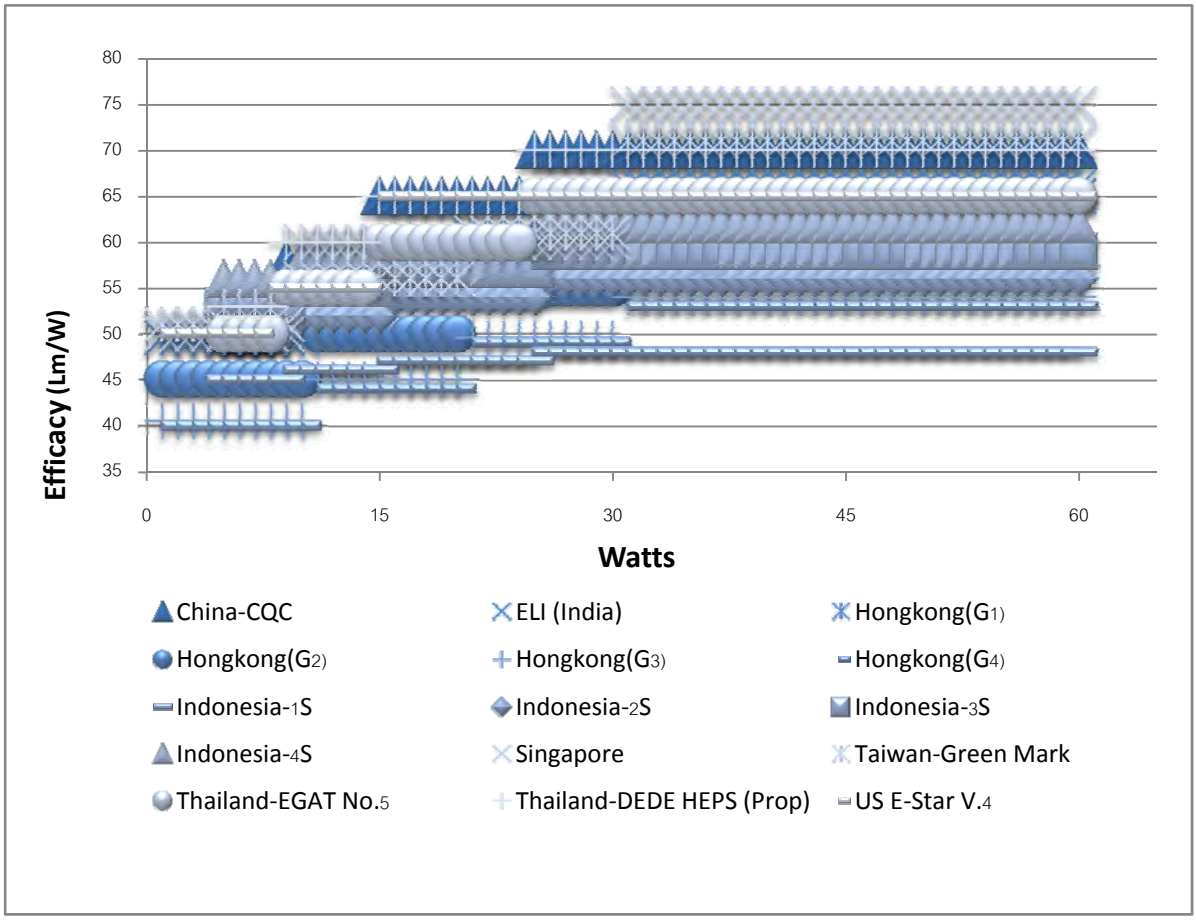


FIGURE 7. CFL EFFICACY REQUIREMENTS: HIGH EFFICIENCY



The main point of these graphical comparisons is that the differences in the levels set between countries are minimal and are not based on any strong technical rationale. In fact, they result from a haphazard process of national regulation, with little or no regional and international coordination in establishment of the targets. This approach is clearly inadequate for a globalized product such as CFLs.

4.4. LIGHTING, OTHER PERFORMANCE PARAMETERS AND PRODUCT LABELING

There is no international agreement that defines what constitutes a "quality" CFL. In the absence of such an agreement, this reports uses previously developed metrics to characterize CFL quality as a basis in analyzing these standards. The metrics include: lighting characteristics (color rendering and color correlated temperature), and other performance parameters (start-up time, lifetime, and lumen maintenance). Finally, we also looked for any provisions for consumer assurance and satisfaction. Note that one inherent limitation of the MEPS approach for CFLs is that it may not be possible to address these other "quality" parameters such as start-up time, color rendition, lumen maintenance, etc.

Table 6 (next page) summarizes requirements with respect to these parameters across the six Asian countries surveyed for this report. The Philippines currently has the most comprehensive CFL standards in Asia, covering not only product safety and performance, but also product warranty. China's and Thailand's standards also cover a significant number of these "quality" criteria.

4.5. LABELING CRITERIA

A number of countries surveyed have labeling programs in place to help consumers identify CFLs as an energy-efficient product. Of the six ECO-Asia countries, only the Philippines and China have exclusively mandatory labeling programs for CFLs. Thailand has both a mandatory MEPS and a voluntary endorsement labeling program. India and Indonesia have voluntary comparative-labeling programs, which cover CFLs as well as the energy efficiency of home electrical appliances and equipment.

TABLE 6. CFL PERFORMANCE AND QUALITY CRITERIA COVERAGE

COUNTRY	Safety	Efficacy	Color Rendering	Start-up Time	Lamp Lifetime	Lumen Maintenance	Warranty
China	✓	✓	✓	✓	✓	✓	×
India	✓	✓	×	×	✓	✓	✓
Indonesia	✓	✓	×	×	×	×	×
Philippines	✓	✓	×	✓	✓	✓	✓
Thailand	✓	✓	×	×	✓	✓	✓
Vietnam	✓	U	×	×	✓	✓	×

U = under consideration

4.6. LABORATORY ACCREDITATION AND AVAILABILITY AND COMPATIBILITY OF RESULTS

As part of the analysis for this report, ECO-Asia examined laboratory accreditation schemes used in each of the six countries. Laboratory accreditation is the final "leg" of the "testing stool" – the others being standards and performance parameters. These factors can combine to define the level of test results produced by any laboratory. This information is useful in the near term as a way to assess laboratory testing capacity in each country. In the longer term, when the issue of mutual recognition of test results arises, these factors will also be needed in order to compare results across laboratories and determine their compatibility and integrity. **Table 7** summarizes current national laboratory capacities and their accreditation.

TABLE 7. NATIONAL CFL LABORATORY CAPACITY AND ACCREDITATION

COUNTRY	Available Laboratories	Laboratory Accreditation
China	More than 4	1 NAVLAP
India	More than 3	NABL
Indonesia	More than 3	KAN
Philippines	2	1 PAO[8]/APLAC
Thailand	2	ISO/TLAS
Vietnam	5	TUV/QualTest 1

8 PAO (Philippine Accreditation Office) is a signatory to APLAC (Asia Pacific Laboratory Accreditation Cooperation).

Several Asian nations are conducting CFL testing to support their national promotion efforts. Under its Vietnam Energy Efficient Public Lighting Project, the government of Vietnam has issued a request for proposals to develop a comprehensive investment plan to support the establishment of a National Lighting Product Quality Certification and Testing Laboratory.

Public release and access to CFL test data are handled differently in each country. Most of the data collected is provided to agencies and utilities for statistical and tracking purposes. These data sets are generally unavailable to non-governmental organizations (to promote and monitor energy-efficiency efforts) or to consumers, to inform their product selection. This study found no evidence that these data sets have been shared across national agencies or internationally, and no framework was in place for such data to be shared. Furthermore, many countries still do not yet have in place the technical standards nor the methods and means of testing CFL quality.

4.7. QUALITY: THE WHOLE CFL VIEW

CFLs are complex electrical devices, and they have grown more so with the incorporation of electronic ballasts, along with the market drive to reduce the size of the CFL while maximizing the number of locations and fixtures in which it can be suitably installed. As a consequence, manufacturers must balance a number of physical and production factors in order to deliver a CFL that will simultaneously meet consumer expectations in terms of product functions and price, while satisfying regulators and utilities on energy performance. In this balancing act, a small adjustment of one performance factor has the potential to affect other factors in significant ways.

BOX 1. SOME KEY INTERNATIONAL INITIATIVES ON CFLs

International CFL Harmonisation Initiative (CFLI). The International CFL Harmonisation Initiative is a network of government, NGO and private sector groups active in the efficient lighting sector with the goal of making CFLs more widely available to the public. It has worked on four focus areas: 1) performance specifications, 2) test protocol, 3) verification testing, and 4) compliance. (www.apec-esis.org/cfl/)

Global Environment Facility (GEF). In partnership with the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP), the GEF has launched a global lighting initiative aimed at transforming the global market for efficient lighting through accelerated phase-out of inefficient lighting technologies. (www.gefonline.org/projectDetailsSQL.cfm?projID=3457) In Asia, UNDP is initiating a project called Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling Project (BRESL), which will be aimed at promoting the widespread utilization and increased market share of energy efficient appliances and equipment (including CFLs) in the region. (www.gefonline.org/projectDetails.cfm?projID=2777)

The Efficient Lighting Initiative (ELI). ELI began as a GEF and IFC-funded initiative operated by the International Finance Corporation, and it is now an international program for certifying the quality and efficiency of lighting products. It is operated by the ELI Quality Certification Institute with the mission of providing a simple and transparent mechanism for certifying the quality and efficiency of lighting products sold globally. (www.efficientlighting.net)

Continued on next page…

Therefore, in defining criteria that constitute a quality and efficient CFL, it is important to consider these linkages. Otherwise a desire to optimize one function may tilt too far in one direction, and may result in unintended, negative economic and technical consequences. For example, a CFL with high efficacy that is expensive to produce may not sell well. Similarly, a long-lasting CFL that takes too long to start up may disappoint consumers and lead to them to reject CFLs the next time they replace a light bulb in their home.[9]

BOX 1. SOME KEY INTERNATIONAL INITIATIVES ON CFLs

International Energy Agency (IEA). The IEA promotes energy-efficiency policy and technology in end-use applications and has undertaken international activities to support the replacement of incandescent lighting with higher efficiency alternatives. (www.iea.org/Textbase/work/workshopdetail.asp?WS_ID=287)

Asia-Pacific Partnership on Clean Development and Climate (APP). The Building and Appliances Task Force of the APP has endorsed a "Flagship Project" on the harmonization of CFL test procedures and quality assurance. The project is co-funded by the United States and Australian governments, and it includes benchmark testing of CFL quality; regional capacity-building workshops with industry and government officials; and support for an industry-led regional CFL quality scheme. The ECO-Asia program is a co-implementer of this flagship project. (www.app.gov/app/library/enews/108095.htm)

USAID ECO-Asia Clean Development and Climate Program. The USAID ECO-Asia Program is working with government and private sector partners in the region to promote benchmark testing of CFL quality; to support a regional, industry-led scheme for certifying and assuring CFL quality; to catalyze investments in large-scale CFL programs; and to provide training and capacity-building for government officials planning and implementing CFL promotion programs. (www.cleanenergyasia.net). ECO-Asia has worked with major international and Chinese lighting manufacturers to initiate the Asia CFL Quality Charter, a public-private partnership established in 2008 to develop regional quality standards and a product marking system for CFLs in Asia.

World Bank. The World Bank has been providing technical assistance in the design and implementation of large-scale CFL procurement and deployment programs worldwide. Some of its notable programs include those in China, India, Rwanda, South Africa, Sri Lanka, Uganda, and Vietnam (www.energyrating.gov.au/pubs/2008-phase-out-session4-sarkar.pdf).

Therefore, in defining what constitutes a "quality" CFL, it is important to consider and even group its various characteristics in order to identify the ones that are necessary for broad acceptance, first and foremost by consumers, but also by regulators, program managers, utilities, energy advocates, program administrators. In addition, each of these characteristics needs to be considered in the context of a mass-produced, international product that needs to be efficient, affordable, long lasting, and approximate the incandescent lamp in fit, function and light quality. Many organizations have developed standards and criteria for CFLs based on their area or areas of responsibilities, ranging from safety to energy efficiency, and their results reflect these multiple views of CFL performance that can take the CFL quite far in one direction. The International CFL Harmonization Initiative (CFLI) is a response to this phenomenon, and it has played an important role since 2005 in working toward harmonized standards for CFLs **(Box 1)**.

9 As these factors are indeed related, a high-efficacy lamp may be more expensive to produce, or may not be able to maintain its lumen output over its life, depending on how the manufacturer chooses to address the issue. Similarly, a long-life lamp needs a more reliable starting mechanism than a shorter-lived lamp, and requires a longer starting time.

Table 8 shows a recommended framework for rating CFL quality that was assembled by CFLI, based on input from manufacturers, government officials, and a range of lighting experts. This grouping was intended to result in a CFL that can satisfy a greater number of constituents.

The actual performance level for each of the categories below needs to be considered within the context of the other categories. The grouping is also designed to accept a tiered structure desired by many agencies to designate labeling and performance levels.

TABLE 8. RECOMMENDATIONS FOR A CFL QUALITY RATING FRAMEWORK PROPOSED BY THE INTERNATIONAL CFL HARMONIZATION INITIATIVE

PERFORMANCE CATEGORY	Tiered or Set Value	Target Constituent(s)
Initial efficacy (lm/W)	Tiered values	A, P, R, U
Lifetime (hrs)	Tiered values	A, C, P, U
Lumen maintenance (%)	Tiered values	A, P, C
Start-up time (s)	Set maximum value	A, C, P
Run-up time (s)	Set maximum value	A, C, P
Premature failure (%)	Set value for max %	A, C, P, U
Color rendering index (CRI)	Set maximum value	A, C, P
Standard Deviation of Color Measurement	Set maximum variation	A, C
Power factor	Set minimum value	U
Switching withstand	Set minimum value	A, C, P
Electromagnetic compatibility	Reference standard	A, R
Mercury	Set maximum value	A, C, R
Safety	Reference standard	All

KEY: **A** = Advocates; **C** = Consumers; **P** = Program Administrators; **R** = Regulators; **U** = Utilities

5. SUMMARIZING COMMON CFL ISSUES

The increasing world-wide reliance on the CFL as a key energy-saving product has resulted in some significant changes in how they are made and sold. These changes include accelerated global CFL production, concentration of CFL manufacture in regions with low labor and material costs (primarily China), and a proliferation of national standards and other local or specific programmatic CFL requirements.

The increased availability of low-cost CFLs should create a desirable situation, providing consumers around the world with CFLs of reasonable quality at affordable prices, while increasing energy savings. Unfortunately, markets in Asia are being flooded with low-cost, low-quality CFLs, primarily due to three factors: (1) the absence of a harmonized system for testing and rating CFL quality; (2) the absence of CFL quality standards in some countries; and (3) the absence of a system for testing lamps and enforcing compliance with existing national quality standards. This situation results in disillusioned consumers, who are not satisfied with the quality of CFLs they purchase.

The global CFL market is in flux, and the prevalence of shoddy CFLs is a looming problem throughout the region. The findings of this study highlight a number of common issues that should be of interest to stakeholders working on energy policy, energy efficiency, climate change, and promotion of CFLs in all countries:

1. **High share of poor-quality CFLs.** Based on the ECO-Asia Program's 2007 report, it is estimated that close to half of the CFLs produced in Asia in 2006 – about 1 to 1.3 billion units – are of questionable quality. The same can be said of the CFLs produced in 2007. If this issue is not addressed in the near term, programs and consumers depending on CFLs to reduce energy use and greenhouse gas emissions will not achieve desired results.

2. **Suppliers have the capacity to make enough high-quality CFLs.** There is currently neither a shortage of high-quality CFLs nor a lack of manufacturers willing to make them. The problem is that each nation maintains largely different standards of expected quality, and some countries have no CFL quality standard at all. There is a proliferation of varying CFL standards and testing requirements across the region, and this creates an undesirable situation not just for manufacturers but for all concerned parties.

3. **Lack of a common standard for testing the quality of CFLs in the region.** Currently there exists no systematically adopted and harmonized test procedure and recognized set of quality criteria for CFLs. CFLs are increasingly manufactured in a few countries for global distribution, but they are regulated locally, with location-specific requirements. Further, there are no provisions for sharing test data. Although more than 90 percent of CFLs are produced in China, each country surveyed maintains different test procedures, specification levels, and minimum energy performance standards, if any at all.

Countries that have adopted IEC standards should only be seen as taking the first step toward CFL quality efforts, and not yet having arrived at the solution.[10] Other steps are needed, such as adopting a common set of performance criteria, disseminating test results, and recognizing other test data. Without a common definition of product quality and an acceptable way to measure and share the results, it is impossible to distinguish between products, aside from brand recognition, and consumers cannot separate a good-quality from a poor-quality CFL. In this situation, consumers gravitate towards lower-priced products as their only universal criteria for CFL selection, and this leads to a further proliferation of lower-quality products.

4. No price signal for quality CFLs. Because there exists neither a regional agreement on CFL quality nor a harmonized set of CFL standards, the current price signal for CFLs around the region seems to put sellers of higher-quality CFLs at a disadvantage in two ways: their CFLs are not only more expensive to produce, but

10 This is because the IEC test standard for CFL performance (IEC 60969) defines how to measure performance but does not set performance thresholds or targets.

manufacturers are also burdened by the additional costs of proving that theirs are higher-quality products. Thus, CFL manufacturers have less incentive to produce high-quality products. Simply stated, the main obstacle to improving CFL quality in the region is the lack of a regionally recognized minimum threshold for CFL quality.

5. Urgent need for coordination on CFL program and quality issues. There is significant interest in CFLs and a proliferation of CFL programs that can benefit from closer coordination, especially on product quality. These efforts are being hampered by the other issues outlined above. Even if a country has minimum requirements in place, it may lack the technical standards or the method and means of testing and assuring CFL quality. Poor CFL quality can create dissatisfied consumers, thus effectively putting an end to the continued and increased adoption of CFLs, not only by individual consumers, but by others within their sphere of influence, and may negatively affect how other energy-efficient products are viewed.

6. RECOMMENDATIONS

The increased adoption of high-quality, energy-saving CFLs can provide an opportunity for mitigating global climate change, while also enhancing international collaboration on common clean energy challenges. Since a number of regional and international initiatives related to CFLs are under way or planned, there is no reason that a successful solution cannot be tailored, or at least initiated by a regional group for subsequent wider adoption. A move toward international cooperation fits well with the current state of awareness and the desire to take action by policymakers.

As individual countries are designing their own quality and testing programs for CFLs, now is the time to engage in serious regional and international discussions on CFL quality, recognizing existing, common solutions, before a patchwork of programs limits the potentials of the global CFL market. It should be noted that a number of international efforts have been working separately or cooperatively to implement one or more of the measures and common solutions recommended below. In particular, the Asia CFL Quality Charter (AQC) – a public and private initiative, was established in 2008 to specifically address the issue of CFL quality. The AQC has developed and obtained agreement on a comprehensive set of CFL performance criteria and quality levels that could be recognized across nations. Other needed actions (as enumerated in 6.1, below) remain, and the AQC, along with other actors across the region can, and need to work together, in order to achieve successful outcomes for each.

6.1. ACTIONS FOR CFL QUALITY AND HARMONIZATION

It is critical that governments and private sector lighting suppliers come together to develop and implement a viable, regional or global quality control scheme. Existing international standards are available. The challenge is for governments and suppliers to work together to develop a common, harmonized approach.

1. **Low-quality CFLs are a threat to energy-efficiency policies and must be addressed through a coordinated, regional effort.** High-level policymakers must recognize that while CFLs represent a viable and cost effective tool for climate change mitigation, the prevalence of low-quality (i.e. sub-standard, or shoddy) CFLs in the market represents a significant barrier to the full realization of this strategy for Asia, as well as globally.

2. **Develop common performance quality standards.** Quality standards should only be used to keep low-quality CFLs out of the market and not act as a barrier to good-quality products. There is a need for agreement on CFL performance and quality levels that are recognized across nations, specifically focusing on a common set of criteria that covers all important aspects of CFL performance, not just one or two attributes.

3. **Develop regional agreement on a common test procedure, data sharing plan, and ways to mutually recognize test results across nations.** There is a pressing need for a uniform regional, if not international, process to test and assure the quality of CFLs sold in developing Asia.

Nearly all Asian governments that have CFL programs in place use the IEC test procedures as their international reference standard. Asian governments should state their support for *complete adoption* of the IEC test procedures as the common test procedures for testing the quality and energy performance of CFLs. This simple step – which would not require adopting any new standards, but rather would codify the common use of an existing international standard – would facilitate the testing and foster the development of a system to compare CFLs manufactured and sold anywhere.

4. **Develop a framework for setting standards and labeling CFLs.** Voluntary approaches to product efficiency are limited, and research shows that over the long-term it is important to have mandatory testing and labeling of all products in the market and to develop minimum energy performance standards. CFLs should be addressed as other appliances, with a program in place to test products; to provide labeling of all products in the market so that consumers can easily identify high-efficiency models; and to eventually adopt minimum energy performance requirements.

5. **Increase public awareness about CFL quality.** Government agencies, the private sector (including manufacturers and retailers of CFLs) and NGOs in the region should take concrete actions to increase awareness of the importance of promoting high-quality CFL products.

The strategies recommended above will lead to harmonization of product requirements, increase the level of consumer awareness and education, and achieve CFL quality assurance. These recommendations are not new, and a number of them have been successfully implemented on a smaller scale. However, the market size, geographic and economic settings, as well as the number and levels of government agencies currently involved in the promotion of CFLs across Asia are unprecedented, and can present significant challenges to even a regional harmonization effort. Nevertheless, the magnitude of the looming threat posed by global climate change should serve as an impetus for governments and suppliers to take action on CFL quality.

REFERENCES

Ablaza, A. (2008, June 6). Scaling up CFL Programs in Asia-Pacific with Regional Quality (The Philippine Energy Efficiency Project). *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

APEC-ESIS. Retrieved September 10, 2008, from http://www.apec-esis.org/productsumworldwide.php?product=CFLs&ID=57

Asawutmangkul, A. (2008, June 6). Current Situation of CFLs in Thailand. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

Asia Pulse. (2006, February 23). Briefing: Asia Energy. Retrieved October 20, 2008 from http://goliath.ecnext.com/coms2/gi_0199-5256267/BRIEFING-ASIA-ENERGY-FEB-23.html

Shoddy Products Cast Poor Light on $7 Billion Market: CFL Industry Launches Quality Identification Plan for Asia. (2008, June 6). Press release issued by the Asian Development Bank (ADB) and United States Agency for International Development (USAID). Retrieved November 15, 2008 , from http://www.adb.org/Media/Articles/2008/12495-asian-energies-initiatives/nr-cfl.pdf

Hua, S. (2008, June 6). Current Situation of CFL Product in China. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

Huliganga, R. (2008b, June 6). CFL Quality - Updates on CFL Markets & Programs. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia*. Asian Development Bank Headquarters, Manila, Philippines.

Ibrahim, S. (2008b, June 6). *Indonesian CFL in Brief*. Presented at the Regional Workshop on Phasing-in Quality*: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

Sujan, S. (2008, June 6). CFLs in India. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

Thanh, H.D. (2008, June 6). Some Features of CFL in Vietnam. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

US Department of Energy - Energy Information Administration (USDOE-EIA). (2008). Voluntary Reporting of Greenhouse Gases Program. Retrieved October 20, 2008 from http://www.eia.doe.gov/oiaf/1605/techassist.html

United States Agency for International Development (USAID). (2007). *Confidence in Quality: Harmonization of CFLs to Help Asia Address Climate Change.* Prepared by International Resources Group under the ECO-Asia Clean Development and Climate Program. Contract No. EPP-1-100-03-00013-00 Task Order 9.

US Environmental Protection Agency (USEPA) and US Department of Energy (USDOE). (2008). ENERGY STAR ®. Retrieved October 20, 2008, from http://www.energystar.gov

APPENDIX A: THE MANILA COMPACT

Final: 6 June 2008

Memorandum of Understanding

(The "Manila Compact")
Supplier Cooperation to Develop a Quality Identification System for Integrated Compact Fluorescent Lamps in Asia

1. This Memorandum of Understanding (MOU) expresses an intention to develop a quality system for integrated compact fluorescent lamps (CFLi). While it is not a binding document, it forms a foundation and basis for future cooperation and coordination between the signatories.

2. Given that:

   2.1. compact fluorescent lamps are an important technology for saving energy and addressing climate change by mitigating emissions of greenhouse gases;

   2.2. at least 40 countries have announced plans to phase out the use of inefficient lamps during the coming five years worldwide;

   2.3. there are currently a range of unaligned standards and specifications for CFLi in different Asian countries, with no valid technical rationale for the minor differences; and

   2.4. manufacturers and suppliers of CFLi's have a strong interest in harmonizing CFLi quality standards in order to reduce barriers to trade, improve product quality, and mitigate greenhouse gas emissions.

3. We the undersigned agree to develop a quality identification system for CFLi's that can be implemented initially across Asia, with possible later expansion to developing countries in other regions of the world. It is envisioned that the quality identification system will include the following elements:

   3.1. a commonly agreed set of key performance and quality criteria of CFLi's (such as efficacy, lumen maintenance, lifetime, and mercury content);

   3.2. a voluntary system for marking the CFLi's, to indicate which performance threshold they meet;

   3.3. eventually, an Asia CFL Quality Registry, a web-based system that will be used to record and track information with accredited test results submitted by manufacturers; and

   3.4. eventually, a system for check-testing and monitoring the quality of CFLi's sold in the marketplace, to ensure the integrity of the CFLi quality identification system.

4. The parties will cooperate to develop a detailed roadmap for these activities, which will be completed within three (3) months.

5. This quality identification system will be open for participation by any interested supplier of quality CFLi's.

6. The parties to this agreement will encourage countries in the region implementing CFLi programs and bulk buyers of CFLi's to specify CFLi's that meet one of the performance tiers specified through this agreement.

7. The system will be consistent with existing standards of the International Electrotechnical Commission (IEC). It will also be consistent with existing international systems for certification and endorsement of CFLi quality.

8. This Memorandum has been developed by the signatories, with support from the United States Agency for International Development (USAID) and by the Government of Australia as part of their joint efforts to

promote energy-efficient lighting in Asia, implemented under the umbrella of the Asia-Pacific Partnership on Clean Development and Climate (APP).

9. The USAID ECO-Asia Clean Development and Climate Program envisions providing resources for initial coordination and support for the activities described in this MOU.

10. This agreement, the "Manila Compact," will be updated by the addition of manufacturers or suppliers or their representative associations, who may not be present in Manila, and who may want to demonstrate their commitment at a later date, by signing onto this agreement.

Signed on this 6th day of June 2008, Manila, Philippines,

Name:
Organization: SG CFLI Philips Lighting

Name:
Organization: Energy Mad Ltd.

Name:
Organization: GE Lighting and Industrial

Name:
Organization: Zhongshan Opple Lighting Company Limited

Name:
Organization: OSRAM Asia Pacific Limited

Name:
Organization: Lighting Council Australia

Name:
Organization: Philippine Lighting Industry Association, Inc.

Name:
Organization: APERLINDO (The Indonesian Electrical Lighting Industry Association)

Supporting Organizations:

Name:
Organization: USAID ECO-Asia Clean Development and Climate Program

Name:
Organization: Efficient Lighting Initiative Quality Certification Institute

Name: Melanie Slade
Organization: Australian Government Department of the Environment, Water, Heritage and the Arts

Name:
Organization:

29 July 08

ROAD MAP FOR THE ASIA CFL QUALITY CHARTER

1. Background

In June 2008, the world's four largest lighting companies, Philips, OSRAM, General Electric, and Havells Sylvania signed a pact to establish standards for compact fluorescent lamps (CFL) in an effort to rid the Asian market of shoddy energy-saving lights. Also signing the agreement were Zhongshan Opple Lighting of China, Energy Mad of New Zealand, and lighting councils and associations from India, Indonesia, the Philippines and Australia. Supporting organizations that signed the agreement include the USAID ECO-Asia Clean Development and Climate Program, Australia's Department of Environment, Water, Heritage and the Arts, the Efficient Lighting Initiative, and the International CFL Harmonisation Initiative

Under the new agreement, called the Asia CFL Quality Charter, lighting suppliers in Asia will develop performance levels to rate CFL quality, a system for product marking, and a regional database so consumers can identify which CFLs meet quality standards. The new quality system will be voluntary, will be consistent with IEC, and will be based on the IEC safety and performance test standards (60968 and 60969)

The suppliers are reacting to concerns about the proliferation of shoddy lamps in the Asian market. A recent report by the USAID ECO-Asia Clean Development and Climate Program found that as many as half the CFLs produced in Asia are substandard – producing less light or burning out more quickly than advertised. It is estimated that the potential market for CFLs in Asia is $7 billion annually, based on current usage and market projections. Suppliers are concerned that consumer dissatisfaction with shoddy CFLs will threaten the energy-saving lamps' spectacular growth in Asia.

The Asia CFL Quality Charter will be developed as a tool for identifying quality CFL products. It will be intended for use by the market at large, including bulk purchasers, utilities, national programs, and end users. Once developed, the tool will be marketed to national standards and energy agencies, managers of CFL programs, and large purchasers. The goal will be to develop a brand for quality, like Energy Star, that will become well known across the region.

This document lays out a Road Map for implementation of activities under the Asia CFL Quality Charter during its first year of operation, starting in July 2008.

2. Vision for the Asia CFL Quality Charter

The common vision of the Charter members is to develop an industry-driven system for qualifying and marking good quality CFLs for Asia. The system will be voluntary, will be consistent with IEC, and will be based on the IEC safety and performance test standards (60968 and 60969)

The Asia CFL Quality Charter will be a tool to be used by the market at large, including bulk purchasers, utilities, national programs, and end users. Once developed, the tool will be marketed to national standards and energy agencies, managers of CFL programs, and large purchasers. The goal will be to develop a brand for quality, like Energy Star, that will become well known across the region.

The participating suppliers recognize that countries have their own national standards for CFLs, and initially the supplier-driven regional quality rankings will be different from the national standards. Accordingly, it is important that regulators be consulted during the development of the new quality system and encouraged to promote and/or adopt the quality levels. It is envisioned that the regional quality rankings will eventually become *de facto* quality standards for the region, with 2 or 3 quality levels indicating "good", "better", and "best."

There is also a common vision that the system should be simple and easy to implement. Members agree that it should be easy to upgrade the performance tiers over time, and the U.S. Energy Star program is seen as a good example in this regard.

3. Implementation Timeline

The table below shows a timeline for implementation of the activities described in this Road Map. This road map describes activities to be carried out during the first year of implementation of the CFL Quality Charter, culminating with a business plan that will describe sources of income, describe ongoing and planned activities, and lay out the organizational structure and staffing for the Charter.

The activities described below will be led by Technical Working Groups made up of a subset of Core Group members, with a vote on proposals being made by all Core Group members (see section on Organization and Decision-Making Process).

Activity	2008						2009					
	7	8	9	10	11	12	1	2	3	4	5	6
Draft overall Road Map document												
Vision and objectives of the Manila Compact												
Organization and Decision-Making Process												
Establishment of performance tiers												
Establishment of product marking system												
Marketing of quality system to regulators and purchasers												
Establishment of product database (CFL Quality Registry)												
Business Plan for Asia CFL Quality Charter												
Development of a system for monitoring registered products and check testing												

4. Organization and Decision-Making Process

4.1. Signatories

The parties listed below have signed memorandum of understanding (The "Manila Compact") that led to formation of the Asia CFL Quality Charter. The date of signing is shown in parentheses.

Suppliers

- General Electric (6 June 2008)
- Philips (6 June 2008)
- OSRAM (6 June 2008)
- Havells Sylvania (20 June 2008)
- Opple (6 June 2008)
- Energy Mad (6 June 2008)

Associations

- Lighting Council Australia (6 June 2008)
- APERLINDO (Indonesian lighting association) (6 June 2008)
- ELCOMA (India) (20 June 2008)
- Philippines Lighting Industry Association (6 June 2008)

Supporting Organizations

- USAID ECO-Asia Clean Development and Climate Program (6 June 2008)
- Australian Department of Environment, Water, Heritage, and the Arts
- Efficient Lighting Initiative (6 June 2008)
- International CFL Harmonisation Initiative (6 June 2008)

4.2. Maintenance and Updating of the MOU

The USAID ECO-Asia Clean Development and Climate Program will maintain the MOU documents and will notify all signatories of any amendments or additions.

4.3 Membership

The Manila Compact will include three types of members:

- *The Core Group*, which will develop the quality marking system
- *Participating Members*, who will join and assist in the development and implementation of the quality marking system
- *Supporting Members*, who will assist in the promotion and implementation of the quality marking system.

The *Core Group* has voting rights and consists of the following organizations:

- Philips, GE, OSRAM, Havells Sylvania (multinational suppliers)
- The original signatory lighting associations, who will represent the interest of suppliers in their country or region. The China Association of Lighting Industry (CALI) will also be encouraged to join the core group, in order to provide representation to Chinese suppliers. Additional lighting associations will be encouraged to be Participating Members.
- The role and composition of the Core Group will be reviewed in one year, at the end of the period envisioned in the initial Road Map.

Participating Members are CFL suppliers and are invited to join the Manila Compact in order to help improve the quality of CFLs sold in the Asia region. Participating Members will be invited to provide input into deliberations of the Manila Compact. They will have access to all information and outputs related to the Compact, such as draft proposals, agreements, meeting minutes, etc.

Supporting Members will play an important role by helping to promote awareness of, and broad implementation of the quality marking system. Supporting Members will also be invited to provide input into deliberations of the Manila Compact. They will have access to all information and outputs related to the Compact, such as draft proposals, agreements, meeting minutes, etc. Such members will include government, and non-government organizations interested in lighting efficiency (e.g., USAID ECO-Asia, Australian Government, Efficient Lighting Initiative, NGOs, etc.)

4.4. Secretariat

A "Secretariat" will provide support and facilitation services for the Asia CFL Quality Charter. During the period covered in this Road Map (July 2008 through June 2009), the Secretariat will be managed by the USAID ECO-Asia Clean Development and Climate Program, from its regional program office in Bangkok, Thailand. It is envisioned that the business plan that will be developed as part of this Road Map will provide an ongoing model for managing the Asia CFL Quality Charter, which will include an income model and roles, responsibilities and recommend staffing for the management of the Asia CFL Quality Charter.

4.5. Decision-Making Process

Core Group. The Core Group must vote on all proposals for the Manila Compact. In order to be approved, a motion must have 2/3 of the votes of the Core Group members present. A minimum "quorum" must be established in order to proceed with a vote. The quorum is at least 2/3 of the Core Group.

Technical Working Groups. A Technical Working Groups will assemble to develop detailed proposals for consideration and voting by the Core Group. To be efficient, it is recommended that the Technical WG should consist of 6 members. The Technical Working Group will be appointed by members of the Core Group, with each Core Group member having the right to nominate one representative.

The Proposal Process

In order to be considered and approved, any proposal will be developed by following the sequence of steps below:

Step 1. The Technical Working Group develops a proposal and distributes to all members of the Asia CFL Quality Charter (including Core Group Members, Participating Members, and Supporting Members).

Step 2. The Secretariat organizes a meeting (via teleconference, or in person) to discuss the proposal. This meeting is open to all members of the Charter.

Step 3. The Technical Working Group modifies and finalizes the proposal based on input from Charter members.

Step 4. Core Group Members vote on the proposal. If the proposal does not pass, the Core Group can recommend that the Technical Working Group revise the proposal.

5. Establishment of Performance Tiers

This will be the first technical action of the Charter, and will involve reaching agreement on the quality and performance parameters to be used in the quality identification system; as well as on the values to be set of reach tier; and on the number of tiers.

The participating suppliers have agreed that in principle, there will be just a limited number of parameters, and these are likely to include efficacy, lifetime, lumen maintenance, and mercury content. There may also be some "minimum pass" values for certain parameters, such as start time, run-up time, and color rendering index.

The Technical Working Group for performance tiers will be responsible for completing two steps:

Step 1: Agree on which parameters to be included, and number of tiers (i.e. 1 or 2 tiers)

Step 2: Agree on target value for each performance tier level

This activity will begin during July 2008 and should be completed no later than 30 October 2008.

6. Establishment of Product Marking System

The suppliers will establish a simple and flexible Product Marking System, which will be used to provide a physical marking on all CFLs sold in the region by the Participating Members. It is envisioned that the marking system will allow a small, recognizable stamp or mark on the CFL lamp and packaging. For example, the mark could be based on a green leaf, or a star, or simply just the words "CFL 1", "CFL 2", etc."

The Product Marking System will also include a system for certification of the product, and registration in a database (see No. 8 below). For example, the system could be based on self certification by suppliers, with test results from accredited 3rd party laboratory. The details will be worked out by a Technical Working Group and approved by vote of the Core Group Members. *This activity will begin during October 2008 and should be completed by 31 December 2008.*

7. Marketing of Quality System to Regulators and Purchasers

In parallel with the design of the Product Marking System, the suppliers have agreed that it will be important to contact national regulators in the region, as well as some bulk CFL purchasers, prior to launching the product marking system. While the performance tiers developed by the Asia CFL Quality Charter will not be aligned with all current national MEPS and high performance levels, it will be important to build awareness of the product marking system at the national level, and to get some feedback and input before launching it in early 2009. This marketing activity will include meetings and roundtables in China, India, and other countries, including ASEAN countries covered by ECO-Asia (Indonesia, Philippines, Thailand, and Vietnam).*This activity will begin during October 2008 and should be completed by than 31 December 2008.*

8. Establishment of Product Database (Asia CFL Quality Registry)

The product database will be developed and initially managed by the Secretariat on behalf of the Asia CFL Quality Charter. It is envisioned that the Asia CFL Quality Registry will be a secure on-line system where suppliers can submit evidence of certification for CFL products for review by the Secretariat. The Asia CFL Quality Registry will have a public area that will provide an up-to-date listing of all approved CFL products.

The design of the Registry will be carried out by the Secretariat under the guidance and direction of a Technical Working Group. *This activity will begin during October 2008 and should be completed by 30 March 2009.*

9. Business Plan for Asia CFL Quality Charter

The Business Plan will outline tasks, staffing, and funding for a sustainable Project Management Unit for the Asia CFL Quality Charter, for the period starting July 2009. It is envisioned that the Charter will continue to be led by CFL suppliers and national lighting associations, and that the Core Group and Participating Members will provide fees to support the new Project Management Unit. There may also be some initial funding from Supporting Organizations to help ease the transition to a supplier-funded model.

The Business Plan will be developed by the Secretariat, under the guidance of a Technical Working Group and the Core Group. *This activity will begin during March 2009 and should be completed by 30 June 2009.*

10. Development of a System for Monitoring Registered Products and Check Testing

This activity will entail development of a system to protect the integrity of the regional quality marking system. The monitoring system will likely include third-party verification of products from a sample of registered products. It will also include some provisions for check-testing, although it is recognized that check-testing will have to be managed at the national level and will therefore fall under the responsibility of national agencies and associations.

The details will be worked out by a Technical Working Group and approved by vote of the Core Group Members. *This activity will begin during January 2009 and should be completed no later than 30 June 2009.*

APPENDIX B: ASSUMPTIONS AND DATA SOURCES TO ESTIMATE THE CO2 REDUCTIONS ACHIEVED THROUGH THE IMPLEMENTATION OF THE MANILA COMPACT

A 2007 report by USAID's ECO-Asia Clean Development and Climate Program estimated that up to half of the energy-saving CFLs sold in Asia were burning out faster and giving off less light than advertised or as required by national regulations (USAID, 2007).[11] Therefore, improving the quality of the shoddy lamps in Asia has the potential to not only prevent emissions from the use of incandescent lamps, but will also reduce emissions resulting from the use of less efficient, shoddy CFLs.

ECO-Asia's efforts to address the issue of CFL quality brought together the world's largest lighting companies for an agreement to establish standards for CFLs in Asia and denote whether lamps meet various quality criteria, ranking them as "good", "better" or "best." This agreement has been endorsed by manufacturers, lighting councils, associations and government agencies from China, India, Indonesia, the Philippines, and Australia. Implementation of the industry-led quality identification system for CFLs Asia – the Asia Quality CFL Charter - will begin in 2009.

Using available data on CFL performance and electricity generation in Asia, ECO-Asia estimates that the full implementation of the Asia CFL Quality Charter can result in the prevention of at least 2.8 million tons of CO_2 from entering the atmosphere annually. The estimate is based on the following set of data and calculations:

A. BASIC DATA AND ASSUMPTIONS

Parameter	Value	Notes or Source(s) of Data
Typical incandescent wattage	60 W	Based on program interviews with suppliers and program managers in ECO-Asia focus countries
Average daily use	4 hrs/day	Estimate based on program interviews with suppliers in ECO-Asia focus countries.
Number of days per year	365 days/yr	
Average CFL lifetime (hrs)	6000 hrs	Minimum lifetime requirement in the draft quality guidelines for the Asia CFL Quality Charter (Level 1)
Average CFL lifetime (yrs)	4.1 yr	Calculated lifetime based on average CFL lifetime of 6000 hrs and average daily use of 4 hrs/day
Average transmission and distribution losses (Asia average)	19%	(Asia Pulse, 2006)[12]
CO_2 emission from electricity	0.000681 tCO_2/kWh[13]	Calculated based on country specific data (US DOE

11 USAID. (2007, October). *Confidence in Quality: Harmonization of CFLs to Help Asia Address Climate Change*., Prepared by International Resources Group under the ECO-Asia Clean Development and Climate Program. Contract No. EPP-1-100-03-00013-00 Task Order 9.

12 Asia Pulse. (2006, February 23). *Briefing: Asia Energy*. Retrieved October 20, 2008 from http://goliath.ecnext.com/coms2/gi_0199-5256267/BRIEFING-ASIA-ENERGY-FEB-23.html

13 Electricity emission factors are based on average emissions intensity of total electric sector generation and include transmission and distribution (T&D) losses incurred in delivering electricity to the point of use.

Parameter	Value	Notes or Source(s) of Data
generation (average for Asia)		Energy Information Administration, 2008)[14]
Volume of CFLs sold in Asia per year	1.3 billion	(Hua, 2008; Sujan, 2008; USAID, 2007; & Thanh, 2008)
Percent of shoddy CFLs in Asia	50 percent	(USAID, 2007)

B. AVOIDED CO_2 EMISSION CALCULATION RESULTS

Parameter	Good Quality CFL	Shoddy CFL	Difference	Notes and source(s)
Replacement CFL wattage	15 W	18.75 W	3.75 W	For a good quality CFL – A 15 W CFL is a typical 1 for 1 replacement of a 60 W incandescent based on comparable light output. For a shoddy CFL - An 18.75 W CFL (or higher) is a calculated 1 for 1 replacement of a 60 W incandescent to achieve a comparable light output assuming a 25 percent higher power requirement compared to a good quality CFL.
Power savings from replacement of incandescent (60 W) with CFL	45 W	41.25 W	3.75 W	Calculated based on a 60 W incandescent bulb
POINT OF USE				
Annual electricity saving per CFL (point of use)	65.7 kWh/yr	60.2 kWh/yr	5.5 kWh/yr	Calculated based on 4 hrs/day, 365 days/year
Annual avoided CO_2 emissions per CFL (point of use)	0.0447417 tCO_2/yr	0.0410132 tCO_2/yr	0.0037285 tCO_2/yr	Calculated based on annual energy savings and average CO_2 emission from electricity generation in Asia
Potential annual avoided CO_2 emissions in Asia (point of use)	28,880,767 tCO_2/yr	26,474,037 tCO_2/yr	2,406,731 t CO_2/yr	Calculated based on 50 percent of the 1.3 billion CFLs sold in Asia
Lifetime avoided CO_2 emissions per CFL (point of use)	0.1838700 tCO_2	0.1685475 tCO_2	0.0153225 tCO_2	Calculated based on CFL lifetime of 4.1 years (6,000 CFL lifetime used 4 hrs/day)
Potential lifetime avoided CO_2 emissions for CFLs sold in Asia (point of use)	118,411,145 tCO_2	108,543,552 tCO_2	9,867,597 tCO_2	Calculated based on 50 percent of the 1.3 billion CFLs sold in Asia in the period of 4.1 years
POINT OF GENERATION				

14 US DOE Energy Information Administration. (2008). *Voluntary Reporting of Greenhouse Gases Program*. Retrieved October 20, 2008 from http://www.eia.doe.gov/oiaf/1605/techassist.html

Parameter	Good Quality CFL	Shoddy CFL	Difference	Notes and source(s)
Annual electricity saving per CFL (point of generation)	78.2 kWh/yr	71.7 kWh/yr	6.5 kWh/yr	Calculated based on 4 hrs/day, 365 days/year
Annual avoided CO_2 emissions per CFL (point of generation)	0.0532426 tCO_2/yr	0.0488057 tCO_2/yr	0.0044369 tCO_2/yr	Calculated based on annual energy savings and average CO_2 emission from electricity generation in Asia
Potential annual avoided CO_2 emissions in Asia (point of generation	34,368113 tCO_2/yr	31,504,104 tCO_2/yr	2,864,009 tCO_2/yr	Calculated based on 50 percent of the 1.3 billion CFLs sold in Asia
Lifetime avoided CO_2 emissions per CFL (point of generation)	0.2188053 tCO_2/yr	0.2005715 tCO_2/yr	0.0182338 tCO_2/yr	Calculated based on CFL lifetime of 4.1 years (6,000 CFL lifetime used 4 hrs/day)
Potential lifetime avoided CO_2 emissions for CFLs sold in Asia (point of generation)	140,909,264 tCO_2	129,166,825 tCO_2	11,742,439 tCO_2	Calculated based on 50 percent of the 1.3 billion CFLs sold in Asia in the period of 4.1 years

As can be seen in the table, a good-quality CFL has the potential to prevent the emissions of up to 219 kilograms of CO_2 over its lifetime. A poor quality CFL can cause about 18 additional kilograms of CO_2 or more to be emitted over its lifetime (at the point of generation) due to the fact that consumers will have to select a higher wattage CFL to compensate for the lower light output (18 W or higher instead of 15 W). Assuming 50 percent of the lamps sold in Asia (1.3 billion lamps) are shoddy, and use 18 W or more, then they have the potential to emit an additional 2.8 million metric tons of CO_2 annually. In reality, a truly dissatisfied consumer might also choose to revert to incandescent lamps.

In summary, the CFL performance guidelines being developed by the Asia CFL Quality Charter will help to improve consumer satisfaction and will also lead to significant energy savings and reductions in greenhouse gas emissions. When fully implemented, the guidelines are expected to reduce Asia's CO_2 emissions by 2.8 million metric tons in the first year, and by an estimated 11 million metric tons over the first four years.

APPENDIX C: INTERNATIONAL ACTIONS ON CFLs

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
Australia	Announced phase-out of inefficient incandescent lamps through MEPS for lighting products	In February 2007, the Australian Government announced that it would phase-out inefficient incandescent lamps and will implement it by introducing MEPS for lighting products. The importation and sale of non-compliant lighting products (light bulbs that have an efficiency level of less than 15 lumens per watt) will be restricted starting November 2008 and November 2009, respectively. Retailers will then have a further 12 months to sell existing supplies before any sort of retail ban comes into effect.	(DEWHA, 2007; Slade, 2008).
Argentina	Launched program to phase out incandescent bulbs by 2011	In December 2007, the Government launched the National Program for the Rational and Efficient Use of Energy (PRONUREE, Decree 140/2007). One of the first activities defined under national program is to phase out incandescent bulbs by 2011. Financed by the government, the program aims to replace incandescent bulbs with energy efficient CFLs in all the households connected to the electricity grid and selected public buildings. It foresees the distribution of 25 million lamps overall.	(Wikipedia, 2008)
Belgium	Announced policies and initiatives to phase out the sale of incandescent light bulbs	It is reported that during the period of March to May 2007, the government of Belgium also announced policies and initiatives similar to the UK.	(Waide, 2007)
Brazil	Plans to introduce regulations to phase out incandescent lamps	Brazil has been subsidizing the cost of CFL's for dissemination to households. A move to introduce regulations to phase out incandescent lamps is thought to be in the offing in Brazilian Congress.	(Greenpeace, 2008)
Canada	Announced phase out inefficient incandescent lamps by the year 2012	In April 2007, the Minister of Natural Resources Canada announced that the country would phase out inefficient incandescent lamps by the year 2012. The government is in the process of finalizing its light bulb standard where lamp performance requirements are set in terms of a minimum efficacy performance curve rather than by lumen bins and wattage caps.	(EcoAction, 2007)
China	Considering options to phase out incandescent bulbs	The Chinese government and the lighting industry is considering options to phase out incandescent bulbs and is in the process of implementing a GLS phase-out project with support from the GEF. Major CFL promotional programs have been implemented in the country including measures to encourage public authorities to only procure efficient lamp sources. Among its current initiatives (in April 2008), the National Development and Reform Commission and the Ministry of Finance announced a program to promote efficient lighting products nationwide - the government will subsidize 50 million efficient	(Chen, 2008)

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
		fluorescent lamps annually for three years for a total of 150 million lamps.	
Cuba	Banned the import and sale of incandescent lamps and implemented a country-wide program of in-situ replacement of GLS lamps with CFLs	Cuba has adopted a dual approach of banning the import and sale of incandescent lamps and implemented a country-wide program of in-situ replacement of GLS with CFLs. The program was implemented from 2006 and is thought to have been completed in 2007. Since the start of the program, it is reported to have changed 116 million of incandescent bulbs, saved 4.5 million tons/annum of fuel and reduced CO_2 emissions by more than eight million tons annually, reduced the maximum demand of electricity in peak hours of more than 3,980 MW. It is reported that it has implemented similar initiatives in 15 other countries. It also reported to have applied the same methodology in 15 other countries, some of which are members of the Organization of Eastern Caribbean States (OECS) where it has already installed 700,000 energy saving light bulbs in May 2007 and has offered to provide new bulbs to sustain the energy saving initiative at cost price.	(Gonzales, 2008); (OECS, 2007)
Czech Republic	Implemented GLS replacement program	As a result of the ELI program which started in 2001and ended in 2003, a TV and newspaper advertising campaign for households combined with public relations and cooperation with producers and sellers of ELI-certified CFLs was launched. The program evaluation showed that the ELI campaign had achieved significant changes on the Czech retail market – boosting sales of CFLs and raising public awareness – with an increase in annual sales of 15percent above the natural market development and a 50 percent increase in awareness of the most important advantages of CFLs – from the established 25 percent to 35–40 percent of the population.	(Hendel-Blackford et al. 2007).
Egypt	Undertakes programs to increase diffusion of efficient lamps	Egypt's initiatives on energy efficient lighting includes 1) a study for the reduction of custom duties for CFL from 30 percent to 5 percent, 2) undertake a program for the diffusion of CFL by the Distribution Companies (DCs) through replication of the leasing program, 3) encourage the private sector to manufacture CFL locally (four factories were established), and 4) public awareness program for the diffusion of efficient lamps which led to the increase of the market size of CFL from 434 million (2001) to 3.3 million (2006).	(Yassin, 2007)
European Union	Announced progressive bans on bulbs based on the number of watts of electricity used and energy efficiency class	On March 9th, 2007, the European Union (EU) Council of Ministers called on the European Commission (EC) to establish a regulation addressing incandescent lighting by 2009 within the framework of the already existing Eco-design for Energy Using Products Directive 2005/32/EC. This Directive is a regulatory framework which grants the EC authority to set mandatory (or voluntary) energy performance standards for tradable goods sold across the EU. The EU heads of state also asked the executive EC to come up with proposals for saving power in office and street lighting by 2008 and in homes by 2009. The new	(Waide, 2007); (CLASP, 2008)

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
		rules would place progressive bans on bulbs based on the number of watts of electricity they use and their energy efficiency class.	
Finland	Bill presented to ban the sale of incandescent light bulbs ending in 2011	In September 2007, a bill presented before the Finnish parliament envisages a ban on the sale of incandescent light bulbs. Under the terms of the bill, only energy-efficient lighting would be permitted after a three-year transition period ending in 2011.	(Helsingin Sanomat, 2007)
France	Announced plan to ban incandescent light bulbs by 2010	From months of discussions aimed at pushing France into the vanguard of the fight against global warming, the government announced in October 2007, a plan to ban incandescent light bulbs by 2010.	(Euractiv, 2007)
Ghana	Drafted policy to phase-out incandescent lamps	Ghana is also reported to have drafted a policy to phase-out incandescent lamps and other high energy consumption lamps with approval anticipated to be within this year (2008).	(CLASP, 2008)
India	GLS replacement activities are underway	While India has not officially made a decision to phase-out incandescent bulbs at present, it is moving away from inefficient lamps through large scale Clean Development Mechanism (CDM) projects. For instance, the Indo-German Energy Programme carried out by the German Agency for Technical Cooperation (*GTZ*) and the Indian Bureau of Energy Efficiency (BEE), and funded by the German Federal Ministry for Economic Cooperation and Development (*BMZ*), is disseminating up to 400 million energy-efficient light bulbs to private households all over the country over five years. Several promotional activities are underway in the country and it is estimated that sales of CFLs will grow to 300 million in 2008.	(CLASP, 2008); (ITFSP, 2008); (Sujan, 2008)
Indonesia	Countrywide promotion to replace GLS	Beginning in 2002, PLN began to promote expanded use of CFLs when it identified that lighting was a major component of PLN's peak load. They made it easy for customers to obtain CFLs by making them available through payment points in targeted areas. Since then, sales of CFLs have surged, and prices have come down. The number of CFLs increased from less than 10 million units in 2001 to more than 71 million in 2007. Since 2007, PLN introduce the program called CFL Donation where it planned to give away three units of 8-Watt CFL as replacement for 40 Watt incandescent lamps to 17 Million lower income household customers throughout the country. The plan is to purchase more than 51 million pieces and the move is expected to result to a cut back on peak load of 1,600 MW in the entire Indonesia; reduction of electricity production by 1,250 GWh in 2008 and 2,458 GWh in 2009; a reduction of fuel oil consumption and fuel oil cost in the amount of Rp4,8 Trillion (USD 4.8 Million) in 2009, and; a reduction of CO_2 emissions equivalent to 2.2 Million Tons in 2009 (with a baseline emission factor for oil generator of 0.9 Kg CO_2 for 1 kWh).	(USAID, 2007b); (Ibrahim, 2008a)

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
Ireland	Announced ban on incandescent light bulbs in favor of energy-saving alternatives from 2009	In December 2007, Ireland announced it will ban incandescent light bulbs in favor of energy-saving alternatives from 2009. It has introduced new energy efficient standards that were aimed at ending the use of incandescent light bulbs in the country which would reduce carbon dioxide emissions by 700,000 tons a year and reduce USD 269.3 million from households' electricity bills.	(Environmental Leader, 2007)
Italy	Run a promotional campaign to replace GLS with CFLs	A promotional campaign by the largest electricity suppliers in 2001to promote CFLs to all residential customers (more than 23 million) included posters and brochures, amongst other methods. The campaign evaluation report showed an increase in the number of individuals with an average of 1 CFL installed per household from 9,700,000 before the campaign in 2000 to 11,000, 000 in 2001.	(Hendel-Blackford et al. 2007)
Jamaica	Countrywide distribution of energy-saving bulbs undertaken	The Jamaica/Cuba Bulb Programme involved the distribution of four million energy saving bulbs. When the project is completed (project was started in February 2006), the annual energy savings to the country is expected to be about J$5.44 billion at current fuel cost. In terms of capital investment, this translates into savings of J$8 billion resulting from avoided additional power generating capacity. The project was scheduled to be completed last September 2007.	(Paulwell, 2007)
Japan	Set to ban incandescent bulbs by 2012	The Japanese government is set to ban incandescent bulbs by 2012 as part of its efforts to curb global warming. In April 2008, the Minister of the Ministry of Economy, Trade and Industry announced "the replacement policy for incandescent to CFLi by 2012". The Prime Minister likewise announced that the government "will work to replace all incandescent light bulbs with energy-efficient ones by 2012".	(Sun, 2008); (Prime Minister of Japan and His Cabinet, 2008)
Korea	Implemented MEPS and high efficiency label specifications to phase-out inefficient lamps	While there is no formal policy to phase-out incandescent lamps, Korea has implemented MEPS and high efficiency label specifications coupled with rebates and promotional schemes to phase-out inefficient lamps. This has resulted to increased sales for CFLs and a decreasing trend for incandescent bulbs in the country.	(Cha, 2007)
Mexico	Put forward strategies for the replacement of light bulbs in residential housing	On 28 November 2007, Mexico released its energy plan for 2007-2012 where it put forward different strategies to be adopted including increasing the financing for the replacement of light bulbs in residential housing. The report, however, did not identify timelines for these ideas.	(G8 Research Group-Oxford, 2008)
Netherlands	Implemented several programmes to promote use of CFLs	When the Parliament decided in 1997 to request utilities to promote efficient lighting, several CFL programs were established. These campaigns included coupons for rebates, or delayed payment for the CFL purchase through the bill together and were coupled with information dissemination. Significant increase in the number of CFLs in	(Hendel-Blackford et al. 2007)

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
		the country was reported due to these activities.	
New Zealand	Announced phase-out of traditional incandescent light bulbs	In June 2008, New Zealand has announced that it will also phase-out traditional incandescent light bulb as part of a strategy for more energy efficient lighting. Products that do not meet the set MEPS cannot be sold in New Zealand starting October 2009.	(Parker, 2008)
Philippines	Announced plan to phase out incandescent bulbs by January 2010	In February 2008, at the conclusion of the Energy Summit, the Philippine President announced the country's plans to phase out incandescent bulbs by January 2010. To further achieve its goal, the Philippine Department of Energy has called for the calibrated phase-out of incandescent bulbs within a period of two years. The Governments initiative to phase out incandescent bulbs qualified for partial grant financing from various programs under the Asian Development Bank's (ADB) Clean Energy and Environment Program, launched in 2007. Its nationwide CFL distribution program under the Philippine Energy Efficiency Project plans to purchase and distribute nine million CFLs through three procurement packages. A bill has likewise been filed in the senate proposing the nationwide phase out of incandescent bulbs by 2010.	(Huliganga, 2008a); (Ablaza, 2008); (Gatdula, 2008)
Poland	Implemented projects increasing penetration of CFLs	Market-based program approaches to reduce barriers and to increase consumer demand for CFLs in the country was successfully used by the Poland Efficient Lighting Project. A considerable increase in the level of CFL penetration and a much stronger CFL market exists today than when project started in 1995. Direct subsidies were competitively awarded to domestic manufacturers of qualified CFLs and manufacturers and wholesalers were required to pass on full savings to retailers, who applied a standard percentage-based mark-up, passing savings on to consumers. This has sparked increased demand for CFLs in the country.	(Hendel-Blackford et al. 2007)
Portugal	Imposed a tax on inefficient incandescent light bulbs	The government imposed a tax on inefficient incandescent light bulbs (standard incandescent lamps) of 0.5 Euro in April 2007.	(Leonardo Energy, 2007)
Russia	Begun a marketplace initiative on the use of energy saving light bulbs	Russia has begun a marketplace initiative by subsidizing a marketing campaign to encourage the use of energy saving light bulbs and is expected to be one of the first beneficiaries of the GEF's proposal for a global phase-out of incandescent light bulbs. Moscow is also reported to be urging residents to switch to CFLs.	(CLASP, 2008); (Earth Policy Institute, 2007); (Brown, 2007)
Spain	Passed a regulatory policy for immediate replacement of incandescent light bulbs	Under its "Energy efficient bulbs program" the government passed a regulatory policy for immediate replacement (fiscal year 2007) of incandescent light bulbs and other non-efficient lamps with highly-efficient lamps	(Hendel-Blackford et al. 2007).

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
South Africa	Implemented initiative for CFLs to replace incandescent bulbs	At the household level, a major initiative has disseminated compact fluorescent lamps to replace incandescent bulbs. The Global Environment Facility and Eskom targeted all households with the intention of installing around 18 million compact fluorescents over 20 years. Eskom estimates a total energy savings of four terawatt-hours per year, with carbon dioxide savings of almost one million ton of carbon per year.	(Chandler et al., 2002)
Switzerland	Announced stricter requirements on household light bulbs to force inefficient bulbs off the market	The Swiss Federal Office of Energy announced that the Federal Council has approved the revised Energy Ordinance which defines and imposes stricter requirements on household light bulbs: With a few exceptions, from 1 January 2009 only light bulbs that comply with at least energy efficiency class E may be sold. This move is expected to force the poorest-category F and G bulbs off the market.	(Swiss Federal Office of Energy, 2008)
Taiwan (Chinese Taipei)	Plans to phase out traditional incandescent light bulbs over the next five years.	The Ministry of Economic Affairs is planning to phase out traditional incandescent light bulbs over the next five years. The Chief of the Bureau of Energy said that the ministry will encourage the government and the private sectors to replace incandescent light bulbs with other energy-saving and high-efficiency lighting devices. The government has mapped out complementary measures for the new plan, and will work to accelerate the phasing out of incandescent light bulbs on both the production and consumption fronts.	(Taipei Times, 2008)
Thailand	Announced voluntarily phase out of the sale of incandescent light bulbs within three years	In March 2007, the Thai Minister of Energy announced plans for a national campaign to subsidize the sale of energy-saving compact fluorescent lamps (CFLs) and work with Thai suppliers to phase out the sale of incandescent lamps. The government provided THB 80 million (USD 2.3 million) fund to reduce the cost of CFLs, and is expected to voluntarily phase out the sale of incandescent lamps within three years. Since 2007, it planned to give away 800,000 CFLs to residential and public sectors and expects to phase out 30 million incandescent in three years (2007-2010).	(International CFL Harmonisation Initiative, 2007) ; (Phumaraphand, 2008)
United Kingdom	Announced plans to phase out the sale of incandescent light bulbs by 2011	In September 2007, the British government announced plans to phase out the sale of incandescent light bulbs by 2011 in favor of energy efficient lamps. The initiative to phase-out the basic "A" shaped, old fashioned GLS comes from a joint and voluntary agreement between the UK lighting industry, retailers and the Government, to phase out the GLS light bulbs by 2011. The aim of the agreement is to cut up to five million metric tons of carbon dioxide emissions a year by 2012 through cutting electricity demand. Under the plan, retailers will voluntarily decline to stock 150 watt bulbs from January 2008, 100 watt bulbs from January 2009, 40 watt bulbs in 2010, and all remaining bulbs by 2011.	(DEFRA, 2007)

INTERNATIONAL ACTONS ON CFLs

Country	Summary	Details	Source(s)
United States of America	Enacted into law the phasing-out of incandescent lamps starting 2012	The US enacted into law the Energy Independence and Security Act in December 2007 which came into effect on January 4, 2008. The US federal standards specifies the phasing-out of incandescent lamps in the following timeframe: by 2012 - the most common 100 W incandescent lamps cannot be manufactured or imported for sale, by 2013 - the most common 75 W lamps are phased out, while by 2014 - phase out will cover all common lamp wattages (60W and 40 W). However, the states of Nevada and California, which passed earlier laws on regulating the performance of GLS light bulbs, are permitted to advance the implementation dates of the federal standards (beginning 2011 instead of 2012).	(CLASP, 2008)
Venezuela	Implemented a program to save energy by giving away millions of CFLs	The government has implemented its program to save energy by giving away millions of compact fluorescent (CFL) bulbs for free to its neighborhoods nationwide.	(Greenpeace, 2008)
Vietnam	Plans to carry out a bulk purchase and distribute five million CFLs throughout the country	From 2007-2010, Vietnam Electricity (EVN) plans to bulk purchase and distribute five million CFLs through its distribution channels. The program is expected to reduce 95 MW peak load at maximum in 2011 and an energy saving of 600 million KWh (from 2007-2013).	(Thanh, 2008)

Notes:

1. GLS is a commonly used short-hand term for incandescent lamps. It stands for general lighting service lamps.
2. Most, but not all of these countries have announced plans to phase out incandescent lamps. Including the European Union (27 countries), there are a total of more than 40 countries that have announced steps to work toward the phase-out of incandescent lamps.

SOURCES

Ablaza, A. (2008, June 6). Scaling up CFL Programs in Asia-Pacific with Regional Quality (The Philippine Energy Efficiency Project). *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

Brown, L.R. (2007, May 9). Environment: Momentum Grows to 'Ban the Bulb'. Retrieved September 10, 2008, from http://www.ipsnews.net/news.asp?idnews=37666.

Cha, J. (2007, October 25-26). Korea's Energy Efficiency Programs Focused on CFLs. *Presented at the Workshop on Confidence in Quality - Eliminating Shoddy CFL Products within ASEAN Countries.* Bangkok, Thailand.

Chandler, W. Schaeffer, R., Dadi, Z., Shukla, P.R., Tudela, F., Davidson, O. & Alpan-Atamer, S., (2002, October). *Climate change mitigation in developing countries*. Prepared for the Pew Center on Global Climate Change Retrieved September 10, 2008, from http://www.pnl.gov/aisu/pubs/CCMitDevCo.pdf

Chen, Y. (2008, May 14-16). China Response to Phase-out of Inefficient Lighting. *Presented at the Phase-Out 2008 – Working Towards Global Phase-out of Inefficient Lighting*. Sofitel Hyland Hotel, Shanghai, China.

Collaborative Labeling and Appliance Standards Program (CLASP). (2008). A Global Movement toward Phasing out Energy Inefficient Light Bulbs is Emerging. Retrieved September 12, 2008, from http://www.clasponline.org/files/Phasing%20out%20of%20Ineff%20FINAL_23Jan08.pdf

Department for Environment, Food and Rural Affairs (DEFRA). 2007. *Energy Guzzling Lightbulbs Phase Out to Start Next Year.* Retrieved September 12, 2008, from http://www.defra.gov.uk/news/2007/070927a.htm

Department of Environment, Water, Heritage and the Arts (DEHWA). 2007. Phase-out of inefficient incandescent light bulbs. Frequently asked questions. Retrieved September 12, 2008, from http://www.environment.gov.au/settlements/energyefficiency/lighting.html

EcoAction. (2007, April 25). *Announcement of a Ban on Inefficient Lighting in Canada* -- Speech by the Honourable Gary Lunn, P.C., M.P. and Minister of Natural Resources. Retrieved September 12, 2008, from http://www.ecoaction.gc.ca/speeches-discours/20070425-eng.cfm

Earth Policy Institute. (2007). Data for BAN THE BULB: Worldwide Shift from Incandescents to Compact Fluorescents Could Close 270 Coal-Fired Power Plants. Retrieved September 11, 2008, from http://www.earthpolicy.org/Updates/2007/Update66_data.htm.

Environmental Leader. (2007, December 7). Ireland Moves Forward On Incandescent Bulb Ban. Retrieved September 12, 2008, from http://www.environmentalleader.com/2007/12/07/ireland-moves-forward-on-incandescent-bulb-ban

Euractiv. (2007, October 26). *Sarkozy pledges 'green revolution' for France*. Retrieved September 12, 2008, from http://www.euractiv.com/en/sustainability/sarkozy-pledges-green-revolution-france/article-167953

G8 Research Group-Oxford. (2008, March 31). *The G8 and Climate Change since Heiligendamm*. Interim Compliance Report for the G8 and Outreach Five Countries. Retrieved September 11, 2008, from http://www.g7.utoronto.ca/oxford/g8rg-ox-interim-2007.pdf

Gatdula, D. (2008, March 17). *Zubiri files bill phasing out incandescent bulbs by '10*. Article from the Philippine Star 17 February 2008. Retrieved September 11, 2008, from http://www.alternat1ve.com/biofuel/2008/02/17/mr-biofuels-files-bill-banning-incandescent-bulbs

Gonzales, R. (2008, May, 14-16). The Replacement of Incandescent Bulbs – The Cuban Experience. *Presented at the Phase-Out 2008 – Working Towards Global Phase-out of Inefficient Lighting*. Sofitel Hyland Hotel, Shanghai, China.

Greenpeace. (2008, March 14). *Argentina to 'Ban the Bulb'*. Retrieved September 11, 2008, from http://www.greenpeace.org/international/news/argentina-ban-the-bulb-140308

Helsingin Sanomat (International Edition). (2007, September 27). *Ban on incandescent lamps discussed by Finnish Parliament*. Retrieved September 12, 2008, from http://www.hs.fi/english/article/Ban+on+incandescent+lamps+discussed+by+Finnish+Parliament/113523061349 1

Hendel-Blackford, S., Angelini, T., and Ozawa, S. (2007). Energy Efficiency in Lifestyles: Europe and Japan. Final Report. EU-Japan Centre for Industrial Cooperation. Retrieved September 12, 2008, from http://www.eujapan.com/europe/Alten2007ReportEnergyEfficiencyInLifeStylesFINAL.pdf

Huliganga, R. (2008a, May 14-16). Phase-Out of Inefficient Lamps – Philippines. *Presented at the Phase-Out 2008 – Working Towards Global Phase-out of Inefficient Lighting*. Sofitel Hyland Hotel, Shanghai, China.

Ibrahim, S. (2008a, June 3-5). The PLN'S Demand Side Management Programs and Experiences - Introduction of CFL and Disincentive Tariff for Clipping the Peak Load. *Presented at the Asia Clean Energy Forum*. Asian Development Bank Headquarters, Manila, Philippines. Retrieved from http://www.adb.org/Documents/events/2008/ACEF/Session22-Ibrahim.pdf

International CFL Harmonisation Initiative (CFLI). 2007. Thailand Announces Plan to Phase Out Incandescent Lamps. Retrieved September 12, 2008 from http://apec.fivevision.com/www/cfl/webnews.php?DomainID=10&NewsID=149

International Task Force for Sustainable Products (ITFSP). 2008. *CDM enables installation of 400 million energy efficient light bulbs in India*. Retrieved September 12, 2008 from http://www.itfsp.org/lighting.htm

Leonardo Energy, 2007. Part 01: *Lightbulb Tax Funds Carbon Credit Purchase*. Retrieved on 12 September 2008 from http://www.leonardo-energy.org/drupal/node/3604

Organization of Eastern Caribbean States (OECS). (2007, May 24-25). "Communiqué." 45th Meeting of the OECS Authority. Retrieved September 12, 2008, from http://www.oecs.org/Documents/communiques_meetings/45th_Authority_Communique.pdf

Parker, D. (2008, June 17). *Lights out for the incandescent bulb*. Retrieved September 12, 2008, from http://www.beehive.govt.nz/release/lights+out+incandescent+bulb

Paulwell, P. (2007, June 6). Empowering our People through Industry, Enterprise, Technology, Energy and Commerce. Sectoral Presentation by the Minister of Industry, Technology, Energy and Commerce: Jamaica Houses of Parliament. Retrieved September 12, 2008, from http://www.mct.gov.jm/Paulwell's%20Budget%20Speech%20June%206%202007.pdf

Phumaraphand, N. (2008, June 6). Thailand DSM Programs: Financial Mechanism and Program Design - the Key to Success. *Presented at the Asia Clean Energy Forum*. Asian Development Bank Headquarters, Manila, Philippines.

Prime Minister of Japan and His Cabinet. (2008, June 9). In pursuit of "Japan as a Low-carbon Society" Speech by H.E. Mr. Yasuo Fukuda, Prime Minister at the Japan Press Club. Retrieved September 12, 2008, from http://www.kantei.go.jp/foreign/hukudaspeech/2008/06/09speech_e.html

Slade, M. (2008, May 14-16). The Phase-out of Inefficient Lighting in East Asia. *Presented at the Phase-Out 2008 – Working Towards Global Phase-out of Inefficient Lighting*. Sofitel Hyland Hotel, Shanghai, China.

Sujan, S. (2008, June 6). CFL in India. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

Sun, Y. (2008, May 14-16). *Replacement of Incandescent Lamps to CFLi in Japan*. Presented at the Phase-Out 2008 – Working Towards Global Phase-out of Inefficient Lighting. Sofitel Hyland Hotel, Shanghai, China.

Swiss Federal Office of Energy (SEFO). (2008, March 17). Electricity market and compensatory feed-in remuneration: Ordinance approved. Retrieved September 11, 2008 from http://www.bfe.admin.ch/energie/00588/00589/00644/index.html?lang=en&msg-id=17836

Taipei Times. (2008, March 30). Ministry plan phases out incandescent light bulbs. Sunday, Mar 30, 2008. Retrieved September 12, 2008, from http://www.taipeitimes.com/News/taiwan/archives/2008/03/30/2003407627

Thanh, H.D. (2008, June 6). Some Features of CFL in Vietnam. *Presented at the Regional Workshop on Phasing-in Quality: Establishing a Quality Identification System for CFLs in Asia.* Asian Development Bank Headquarters, Manila, Philippines.

United States Agency for International Development (USAID). (2007b, May). From Ideas to Action: Clean Energy Solutions for Asia to Address Climate Change. Annex 3 – Indonesia Country Report. Prepared by International Resources Group under the ECO-Asia Clean Development and Climate Program. Contract No. EPP-1-100-03-00013-00 Task Order 9.

Waide, P. (2007, October). *Global Efforts to Phase-Out Incandescent Lamps*. The IEA OPEN Energy Technology Bulletin 45 (October). Retrieved September 12, 2008, from http://www.iea.org/impargr/cip/pdf/Issue45Lighting.pdf

Wikipedia. (2008). *Electricity sector in Argentina*. Retrieved September 12, 2008, from http://en.wikipedia.org/wiki/Electricity_sector_in_Argentina#cite_note-LN4Mar08-21

Yassin, I. (2007). *Energy Efficiency Policy in Egypt and its Perspective*. IFPEEI Workshop – Proceedings. Retrieved September 12, 2008, from http://www.iiec.org/dmdocuments/Proceedings_IFPEEI%20Workshop_Appendix%20B_part2_1.pdf

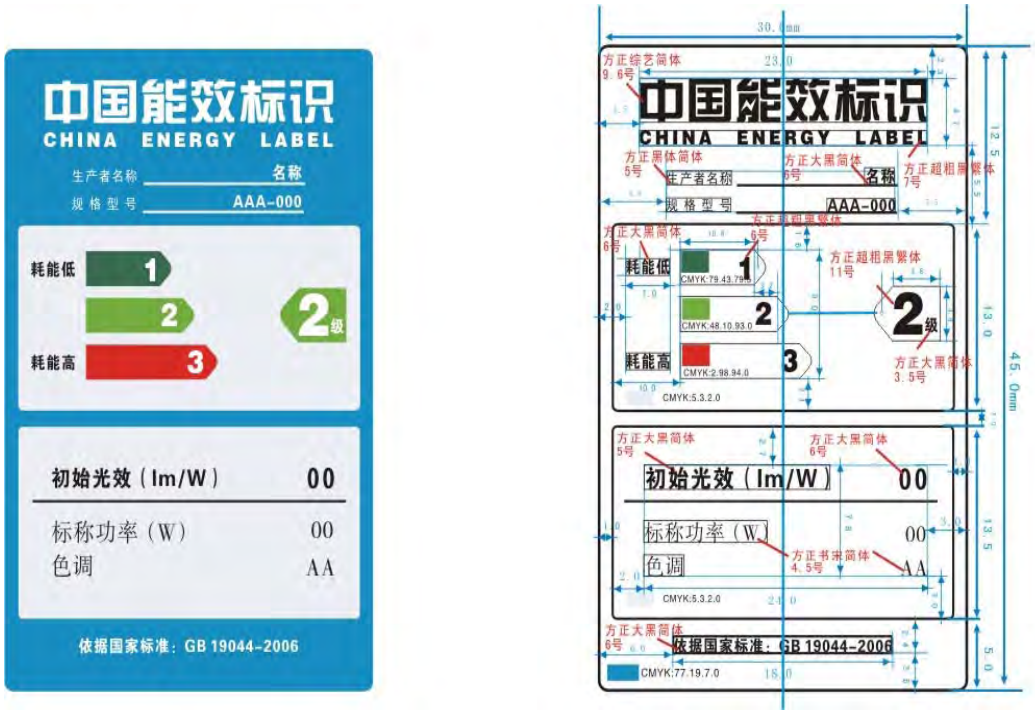
APPENDIX D: CFL ACTIVITIES IN ECO-ASIA FOCUS COUNTRIES

CHINA (Hua, 2008)

CFL production in China reached three billion in 2007, an increase of 25 percent over the 2.4 billion units produced in 2006. At least two manufacturing plants have annual production capacity of more than 300 million units. About 67 percent of CFLS manufactured in China are exported, with high quality products that meet Energy Star or United Kingdom Energy Saving Trust (UK EST) requirements shipped mainly to North America and Europe. Lower quality products which do not meet the above standards are being exported to Asia, South America, and other developing countries where CFL quality standards do not exist. About one billion units produced in China are sold domestically.

By the end of 2008, China is expected to complete amendments to their CFL performance standards, and implement testing for electromagnetic compatibility (EMC), on-and-off functions, and mercury levels in CFLs. In June 2008, it began to implement an energy labeling program **(Figure D1)**.

FIGURE D1. ENERGY LABELS FOR CFLs IN CHINA

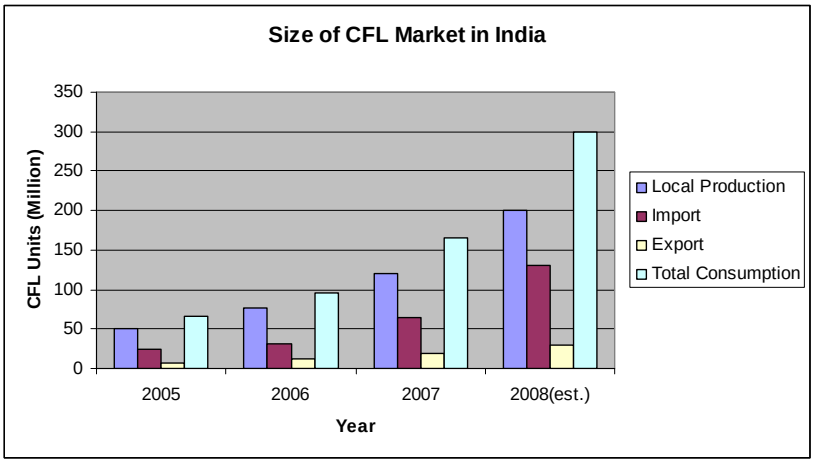


In 2007, the Chinese government announced a subsidy scheme to provide subsidies ranging from 30 to 50% for bulk purchasers, urban and rural residents to purchase energy-saving lamps. In 2008, the scheme supported the purchase of 50 million energy-saving lamps nationwide. Currently, China is making preparations to phase-out inefficient lighting through a GEF funded project, which aims to transform the market of efficient lighting and to accelerate the phase-out of incandescent lamps.

INDIA (Sujan, 2008)

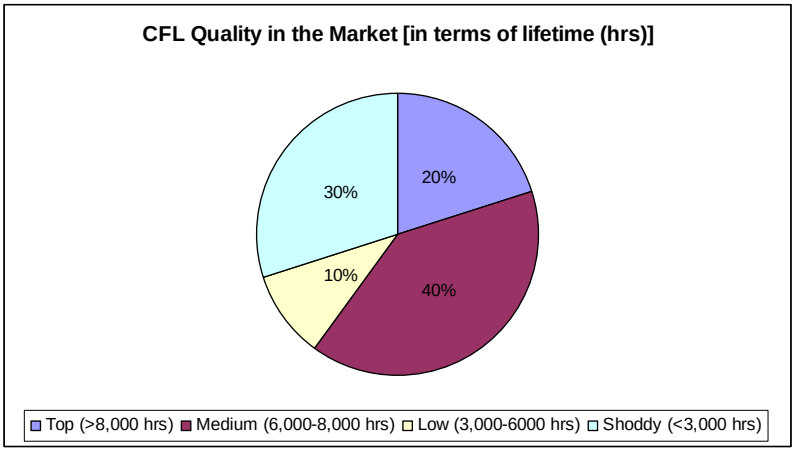
India imports around one-third of CFLs to satisfy local demand with the balance being supplied by Indian manufacturers. In 2008, total demand will grow to an estimated 300 million CFL units (**Figure D2**).

FIGURE D2. SIZE OF CFL MARKET IN INDIA



In terms of quality of products in the market, it is estimated that 30 percent of the products sold in the market last less than 3,000 burning hours (**Figure D3**).

FIGURE D3. PERCENTAGE OF CFL QUALITY IN THE INDIAN MARKET (IN TERMS OF LIFETIME)



The Bureau of Indian Standards (BIS) is considering amending the CFL standards to increase the power factor value of 0.85 to become mandatory in 2009, and a phased decrease in mercury content from 4-40 mg down to 3-5 mg within the next two years. It is also considering endorsement labeling through BIS certification.

INDONESIA (Ibrahim, 2008b)

The growth of CFL units in Indonesia increased dramatically since the implementation of Perusahaan Listrik Negara's (PLN's)[15] Demand-Side-Management (DSM) Programs. From less than 10 million units in 2001 to more than 71 million in 2007 **(Figure D4)**.

FIGURE D4. NO. OF CFLs DISTRIBUTED IN INDONESIA (2001-2008)

PLN's customer base in 2007 reached thirty-five million, with addition of one million customers per year. With an estimated three CFLs per household and five fittings per household, current installed CFLs numbers to 105-120 Million. The annual CFL market is estimated to be 135 million (assuming 50 percent of the lamps will be replaced by existing customers, two additional lamps will be purchased by existing customers and five lamps will be purchased by new customers).

For its donation program, it has required the following CFL technical specifications:

TABLE D1. PLN'S TECHNICAL SPECIFICATIONS FOR ITS DONATION PROGRAM

Items	Specification
Color	6,000-7,000°K (Cool Daylight)
Safety Standard	SNI 04.6504.2001
Burning Hours	Min. 5,000 hrs.
Guarantee	Min. 12 months
Power factor	Min. 0.5
Efficacy (after 100 hrs.)	Min. 55 Lm/W at 220 V
Operating Voltage	170-240 Volts
Wattage	8 W (equivalent to 40 W Incandescent

15 PLN's official name is PT PLN (Persero).

PHILIPPINES (Huliganga, 2008b); (Ablaza, 2008).

The Philippines is implementing the Philippine Efficient Lighting Market Transformation Project (PELMATP), which runs from 2005-2009. Under the project, it has revised the minimum energy performance standards (MEPS) for compact fluorescent lamps (CFLs) and proposed a new label for its labeling scheme, which will both be mandatory. The setting of its MEPS **(Table D2)** is intended to eliminate the least efficient lamps in terms of efficacy in lumens per watt.

TABLE D2. MINIMUM EFFICACY LEVELS FOR A CFL (BARE)[16]

Input Power of Lamp (W)	Initial Luminous Efficacy (lm/W)	
	Correlated Color Temperature (CCT)	
	≤ 4000K (Warm White)	> 4000K (Daylight)
≥ 2 to < 5	45	41
≥ 5 to < 9	50	46
≥ 9 to < 15	55	52
≥ 15 to < 25	60	57
≥ 25	65	62

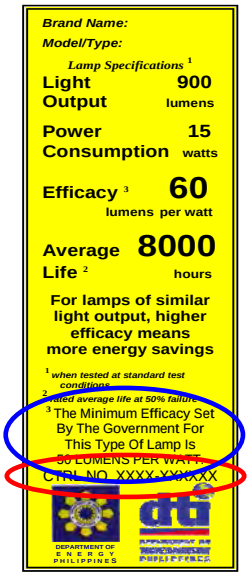
Source: Philippine National Standard (PNS) 2050-2:2006
(Development of the Implementing Rules and Regulations Ongoing)

FIGURE D5. COMPARISON OF EXISTING AND PROPOSED ENERGY LABELS FOR CFLs

The Department of Energy runs an information and education campaign dubbed "Palit-Ilaw Program"[17] to increase consumers' awareness on energy-efficient light bulbs. The Philippines has announced it will phase out incandescent bulbs by January 2010. The move is expected to generate a US$2B savings in avoided generation of at least 2,000 MW at peak time, enough to meet the 700 MW capacity additions needed each year for the next three years. It amounts to USD 500 million in savings for consumers each year – equivalent to about 15 US cents per night per household – as well as 2.5M tons of CO_2 avoided per year.

Under the Philippine Energy Efficiency Project, which runs from 2009-2010, a total of 13 million energy-saving lights will be given away free to homeowners and businesses as part of a government push to cut the nation's power bills. The CFLs will be distributed to customers nationwide in exchange for their incandescent bulbs. Each CFL is expected to save

Existing



Proposed

16 The minimum initial efficacy of an encapsulated lamp model (lamp model with an integrated cover) shall be no less than 85 percent of the requirements indicated in the table.

17 Literally means "Change Light", the program refers to the changeover from incandescent bulbs to CFLs with corresponding equivalent wattage rating and light output specified in the Energy Performance Label and conforms to PNS and MEPS specifications.

customers 400 pesos, around $8.50, each year for the next 7 to 10 years. ADB estimates that the CFL give-away will generate savings of about $100 million every year in fuel costs and will allow Philippines utilities to defer an investment of $450 million in power generation and associated network capacity. The project will also generate greenhouse gas reductions of 245,000 tons of CO_2 emissions per year, and generate carbon credits for the Philippines under the Clean Development Mechanism. The project is funded by a US$31.1 million loan from ADB to the Philippines government, and a US$1.5 million grant from Japan's Asian Clean Energy Fund, established under ADB's Clean Energy Financing Partnership Facility, and US$13.9 million from the Philippines government.

THAILAND (Asawutmangkul, 2008)

Currently, Thailand's Department of Alternative Energy Development and Efficiency (*DEDE*) is working on a draft Ministerial Regulation for Minimum Energy Performance Standards (MEPS) and High Efficiency Performance Standards (HEPS) for self-ballasted lamps and single capped fluorescent lamps. Below is the proposed HEPS in comparison with other High Efficiency Target Values.

TABLE D3. COMPARISON OF HEPS FOR SELF-BALLASTED CFLs

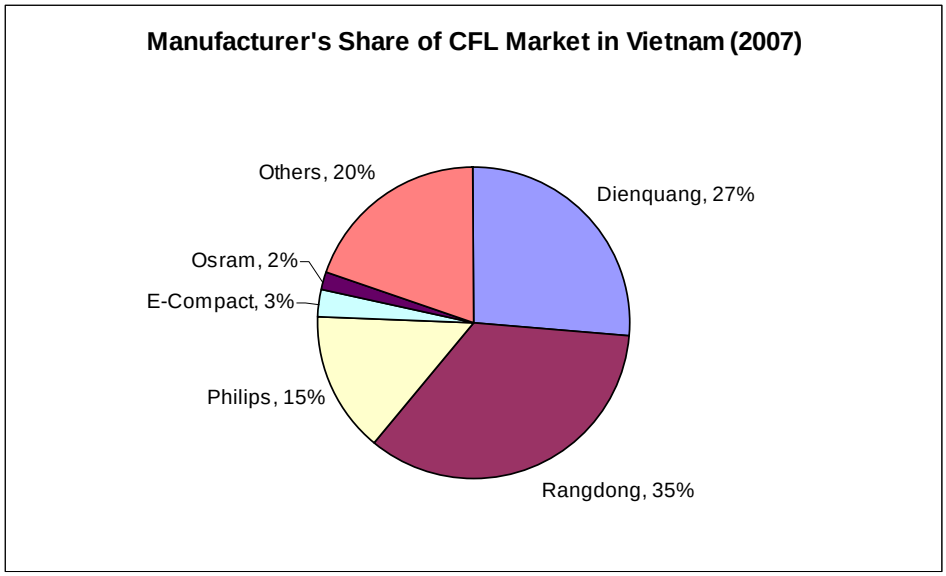
Category	EGAT No. 5	Energy Star v.4	China CQC	ELI	DEDE (prop)
(Watts)	**Efficacy Levels (Lm/W) @ T ≤ 4 400 °K**				
5-8	50	50	50	50	53-65
9-14	55	55	58	55	60-70
15-24	60	65	65	60	65-75
25-60	65	65	70	65	70-85

Thailand expects to phase out thirty million incandescent by 2010. To do this, the Electricity Generating Authority of Thailand (EGAT) will give away 800,000 No.5 labeled-CFLs to residential and public sectors in all provinces throughout the country. Under its low price program, it is also selling CFLs at 55 Baht (USD1.7). This has resulted to increase in sales of CFLs and establishment of two local CFL manufacturers.

VIETNAM (Thanh, 2008)

Demand for CFLs has grown fast in the recent years. In 2007, sales of CFLs in Vietnam rose to 21 million units, a majority of which are supplied by local manufacturers that have quickly expanded their capacity to ensure their position in the market **(Figure D6)**.

FIGURE D6. MANUFACTURERS SHARE OF CFL MARKET IN VIETNAM (2007).



In Vietnam, 15W CFLs cost about USD 0.90 - USD 2. CFLs with a lifetime of 4,000-6,000 hours cost between USD 1.7-3, while lower quality products (lifetime 2,000-3,000 hours) are sold from USD1.5 and below. As more consumers get familiar with the commodity, authorities saw the need to develop a standard to establish quality for CFLs. Vietnam is improving the testing capability of its laboratories (currently there are five accredited laboratories in the country), and it is developing CFL standards based on ELI specifications. Proposals have been requested in June 2008 to assess the capacities of the three upgraded laboratories for formulating a comprehensive investment plan on National Lighting Product Quality Certification and Testing laboratory. A voluntary labeling scheme is also under consideration (either endorsement or comparative) and is expected to be approved in the first quarter of 2009.

From 2007-2010, Vietnam Electricity (EVN) plans to bulk purchase and distribute five million CFLs through its distribution channels. The program is expected to reduce 95 MW peak load at maximum in 2011 and results in energy savings of 600 million KWh from 2007-2013.

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