STATUS REPORT ON LIGHTING MONITORING, VERIFICATION AND ENFORCEMENT ACTIVITIES AND PROGRAMMES IN CAMBODIA, INDONESIA, LAO PDR, THE PHILIPPINES, THAILAND AND VIET NAM

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Abbreviations

ADB	Asian Development Bank
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BRESL	Barrier Removal to the Cost Effective Development and Implementation of Energy Efficiency Standards and Labeling
CO_2	carbon dioxide
EEC-SSN	Energy Efficiency and Conservation Sub-Sector Network
GEF	Global Environment Facility
GHG	greenhouse gas
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
LUCF	land-use change and forestry
MEPS	minimum energy performance standards
MRA	mutual recognition agreement
Mt	megatonne (one million tonnes)
MVE	monitoring, verification and enforcement
t	tonne
TWh	terawatt-hours
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

Southeast Asia comprises 11 countries[1], with a total population of nearly 593 million, and covers an area of 4,500,000 km^2. *Country Lighting Assessments* published by the UNEP en.lighten initiative estimate that, as of 2010, on-grid lighting in Southeast Asia consumed nearly 85 TWh of electricity a year, or just over 14% of the approximately 596 TWh of the total electricity used in the region per year. This costs the region's economies, and primarily the region's consumers, approximately $9.9 billion each year, with annual emissions of 50 Mt of CO_2.

The transition to efficient lighting would reduce the region's lighting electrical consumption by one third, resulting in annual savings of: approximately 32 TWh of electricity; nearly 19 Mt of CO_2 emissions; and over $3 billion in electricity costs.

Achieving these potential savings requires robust and effective national programmes and policies to encourage the transition to more energy efficient lighting. To this end, all 11 countries in Southeast Asia have begun to address the issue of inefficient lighting. The extent of their efforts varies, with Indonesia, the Philippines, Thailand and Viet Nam being the most active. The formal phase-out of inefficient lighting has been announced in Malaysia and the Philippines. In Thailand and Lao PDR, the formal phase out of inefficient lighting is being considered, while Viet Nam intends to gradually restrict and remove products not meeting performance requirements.

Within Southeast Asia, most countries have performance testing standards in place, but only Indonesia[2], Malaysia and the Philippines have mandatory minimum energy performance standards (MEPS). Six countries[3] have either mandatory or voluntary labels for at least some lighting products. Even where countries have standards and labelling programmes in place, the presence of non-compliant, inefficient lighting products in the market place compromises the effectiveness of these programmes and policies. Regional and national strategies for the transition to efficient lighting should include monitoring, verification and enforcement (MVE) schemes to: protect the market from products that fail to perform as declared or as required; ensure that consumer satisfaction aligns with expectations; and that policymakers, government regulators, programme administrators and other officials can meet their programme objectives. Compliance activities would also protect suppliers by ensuring that they are all subject to the same programme entry conditions.

This report specifically examines the status of the MVE activities and programmes for lighting products in six Southeast Asia countries – Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam. These six countries account for approximately 74% (441 TWh) of the total energy consumption in the region and 77% (940 Mt CO_2) of the region's CO_2 emissions. Of this, approximately 61.5 TWh and 35.6 Mt CO_2 are attributable to lighting.

Based on the UNEP en.lighten *Country Lighting Assessments*, a transition to efficient lighting in these six countries would result in annual savings of: nearly 24 TWh of electricity; approximately 14 Mt of CO_2 emissions; and over $2.4 billion in electricity costs. The six countries have an estimated off-grid lighting population of 111.4 million. Based on the UNEP en.lighten *Off-grid Country Lighting Assessments*, a full transition to energy efficient off-grid lighting would result in energy savings of 19.3 million barrels of crude oil energy equivalent; cost savings of $1.423 billion; and a reduction of approximately 7 million tonnes of CO_2.

For each country, the report describes the:

- Efficient lighting policy context and the legal basis and strategy for MVE activities;
- Organisations involved in MVE activities and their responsibilities;

[1] As defined by the United Nations. http://unstats.un.org/unsd/methods/m49/m49regin.htm
[2] Although these are currently under revision
[3] Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam

- Details of the current MVE framework, such as entry conditions, registration system, product performance database, market surveillance, verification testing, enforcement guidelines, penalties for non-compliance;
- Obstacles to, and opportunities for, MVE.

Information from UNEP en.lighten *Off-grid Country Lighting Assessments* also is included.

The efficient lighting policy context and a summary of the MVE elements in the six target countries are shown in the following tables.

Summary of efficient lighting policies in Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam

Country	National energy policy	National energy efficiency policy	Formal phase-out commitment	MEPS	Labelling	IEC member
Cambodia	Yes	Yes	No	No	No	Associate
Indonesia	Yes	Yes	No	Yes (under review)	Yes (under review)	Full
Lao PDR	No	Under development	Under consideration	No	No	Affiliate
Philippines	-	Yes	Yes	Yes	Yes	Full
Thailand	-	Yes	Yes	Yes (V)	Yes (V)	Full
Viet Nam	-	Yes	No	Yes (V)	Yes (V)	Associate

Notes: V = voluntary

Summary of monitoring, verification and enforcement activities

Country	Entry requirements	Registration system	Product performance database	Market surveillance	Verification programme	Enforcement framework	National lighting test laboratories
Cambodia	Yes	Yes (V)	No	No	No	Yes	0
Indonesia	Yes	Yes	No	No	No	No	6
Lao PDR	n/a	No	No	Yes	No	No	0
Philippines	Yes	Yes (V)	Yes	Yes	No	Yes	3
Thailand	Yes	Yes (V)	Yes	Yes	Yes	Yes	2
Viet Nam	Yes	Yes (V)	No	Yes	Yes	Yes	3

Notes: State-owned laboratories that have photometric measurement equipment and are involved in photometric testing

All six countries face barriers in terms of MVE systems, infrastructure and professional capacity. Furthermore, the absence of dedicated MVE regulations and implementation strategies and plans to direct and coordinate monitoring, verification and enforcement activities in many countries adversely affects their ability to put in place systems and resources to tackle MVE in a structured manner. Although there are existing organisations and regional initiatives that offer support for MVE activities and occasional specialist conferences and workshops are held within the region on these issues, MVE systems are complex, and the number of individuals and organisations involved are numerous. As a result, existing exchanges may be limited in impact. In some cases, donors support the development of lighting MVE systems. However, such interventions are often short term and the institutional knowledge and experience may not be maintained long-term. There is a need for a mechanism for structured and long term support for training and knowledge sharing on MVE for policy makers, MVE programme managers and testing laboratory staff.

UNEP en.lighten initiative's MVE efforts and associated *lites.asia* workshops provide resources and support for the region and countries to develop MVE strategies. The en.lighten Global Partnership can help each country leverage international resources and find opportunities to share and learn best practices from peers worldwide, choosing program models that are appropriate for their social, political and economic situation,

identifying new partners with whom they can cooperate, and aggregating their efforts to achieve sustainable and significant successes in efficient lighting. UNEP, bilateral donors including Australia, and other regional and International organisations can assist the six countries to build an enduring culture of knowledge exchange and facilitate a sustainable regional infrastructure for MVE training and support.

The specific technical skills and infrastructure requirements for lighting test facilities are very resource intensive, both to develop and operate, and to adapt to new requirements and/or products. Collaborative testing activities, training and interlaboratory comparison exercises can increase regional MVE capacity. The significant financial and resource barriers to establishing new national testing laboratories can to some extent be countered by exploration of opportunities for sharing testing capacity through mutual recognition agreements and infrastructure. The region is exploring the potential benefits of aligning test methods, performance standards and certification procedures that would enable mutual recognition agreements.

The ASEAN Economic Community offers a vision for regional harmonization. As plans evolve, countries can consider how best to incorporate efficient lighting strategies and supporting MVE infrastructure and capacities.

Introduction

Southeast Asia comprises 11 countries[4], with a population of nearly 593 million, and covers an area of 4,500,000 km^2. *Country Lighting Assessments* (UNEP 2012a) estimate that, as of 2010, on-grid lighting in Southeast Asia consumed nearly 85 TWh of electricity a year, or just over 14% of the approximately 596 TWh of the total electricity used in the region per year. This costs the region's economies, and primarily the region's consumers, approximately $9.9 billion each year, with annual emissions of 50 Mt of CO_2.

The transition to efficient lighting would reduce the region's lighting electrical consumption by one third, resulting in annual savings of: approximately 32 TWh of electricity; nearly 19 Mt of CO_2 emissions; and over $3 billion in electricity costs. A breakdown of these figures by country is given in **Table 3** in Annex I. Further information on the advantages of energy efficient lighting for the region and the obstacles to its promotion can be found in the en.lighten *Regional Report on Efficient Lighting in Southeast Asia* (UNEP 2011) and the *lites.asia* (2013) position paper on energy efficient lighting in Southeast Asia.

Achieving these potential savings depends on implementing robust and effective national programmes and policies to encourage the transition to more energy efficient lighting. All 11 countries in Southeast Asia have begun to address the issue of inefficient lighting. The extent of their efforts varies, with Indonesia, the Philippines, Thailand and Viet Nam being the most active. The formal phase-out of inefficient lighting has been announced in Malaysia[5] and the Philippines[6]. In Thailand and Lao PDR, the phase out of inefficient lighting is being considered. Viet Nam intends to gradually restrict and remove products not meeting performance requirements.

Most countries in the region have performance testing standards in place. Only Indonesia[7], Malaysia and the Philippines have mandatory minimum energy performance standards (MEPS). Six countries[8] have either mandatory or voluntary labels in place for at least some lighting products. Awareness raising campaigns on energy efficiency and conservation have been conducted in all but Myanmar and Timor Leste.

Even where countries have energy efficient lighting standards and labelling programmes in place, the presence of non-compliant, inefficient lighting products in the market place compromises the effectiveness of some programmes and policies. Countries in the region are actively discussing how to more rapidly transition to efficient lighting by strengthening their monitoring, verification and enforcement (MVE) schemes. Such efforts will contribute to reducing regional energy intensity[9].

In general terms, efficient lighting MVE schemes comprise a suite of activities that:

- Monitor the products in the market place to identify potential areas of non-compliance;
- Verify the characteristics of products against the efficiency claims made for them or the criteria specified for that type of product by the national programme or policy;
- Take enforcement action against parties responsible for lighting products that are found to be non-compliant.

These compliance activities protect the market from lighting products that fail to perform as declared or as required; ensure that consumer satisfaction is in line with their expectations; and that policymakers, government regulators, programme administrators and other officials meet their programme objectives. Compliance activities also protect suppliers by ensuring that they are all subject to the same programme entry conditions.

[4] Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor Leste and Viet Nam

[5] Peter Chin Fah Kui. 2010. Incandescent Lamps to be Phased Out Gradually. Malaysia. Accessed September 2010 at: http://peterchin.my/?p=735 (link no longer live)

[6] Energy-Efficient Lighting Products Act of 2013, An act requiring the use of energy-efficient lighting products, providing penalties for violations thereof, and for other purposes.

[7] Currently under revision.

[8] Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam

[9] Regarding general energy efficiency targets in the region, see: "ASEAN Energy Efficiency Development and Its Associated Activities," published by ASEAN Centre for Energy, May 2014. Accessed 12 August 2014 at: http://aseanenergy.org/media/documents/2014/06/03/a/s/asean_energy_efficiency_development.pdf

Purpose

This report examines the status of the efficient lighting MVE activities and programmes in six Southeast Asia countries (Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam) as part of the UNEP en.lighten initiative's *Securing the climate change benefits of efficient lighting in Southeast Asia and Pacific economies via MVE capacity building activities*[10]. This effort is a bilateral partnership with the Australian Government and has three objectives:

- Increasing UNEP en.lighten's outreach to support countries' rapid transition to energy efficient lighting;
- Building stronger capacity within government agencies and intergovernmental entities that promote and develop energy efficiency policies in the region;
- Reducing greenhouse gas (GHG) emissions related to lighting in this region, by strengthening lighting monitoring, verification and enforcement (MVE) schemes and infrastructure.

UNEP en.lighten is delivering policy and technical training and support materials, including lighting MVE best practice guidelines, and assisting countries to assess their lighting markets and evaluate the energy and environmental performance of efficient lighting products. Other regional resources are listed in Annex II.

The six countries in this study account for approximately 74% (441 TWh) of the total energy consumption in the region and 77% (940 Mt CO_2) of the region's CO_2 emissions. Approximately 61.5 TWh and 35.6 Mt CO_2 are attributable to lighting. Based on UNEP en.lighten *Country Lighting Assessments*, a complete transition to efficient lighting would result in annual savings of: nearly 24 TWh of electricity; approximately 14 Mt of CO_2 emissions; and over $2.4 billion in electricity costs. Details by country are in Table 3 in Annex I.

Looking more broadly at greenhouse gas (GHG) emissions[11], the World Resources Institute (2014) estimates that in 2010 these countries together generated approximately 1,658 $MtCO_2$, with emissions per capita ranging from 1.6 tCO_2 in the Philippines to 5.8 tCO2 in Thailand. For details, refer to Table 1 and Figure 1 and Figure 2.

Table 1: Estimated GHG emissions for Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam (2010). Note that these quantities exclude emissions from land-use change and forestry (LUCF)

Country	Total GHG Emissions ($MtCO_2e$)	Total GHG Emissions (tCO_2e per capita)
Cambodia	26.01	1.8
Indonesia	823.41	3.4
Lao PDR	21.37	3.3
Philippines	148.93	1.6
Thailand	381.94	5.8
Viet Nam	256.77	3.0
Total	**1,658.42**	

10 www.enlighten-initiative.org/CountryActivities/SoutheastAsiaandPacificMVEProject.aspx
11 Carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF6)

Figure 1: Estimated GHG emissions for Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam (2010). Note that these quantities exclude emissions from land-use change and forestry (LUCF)

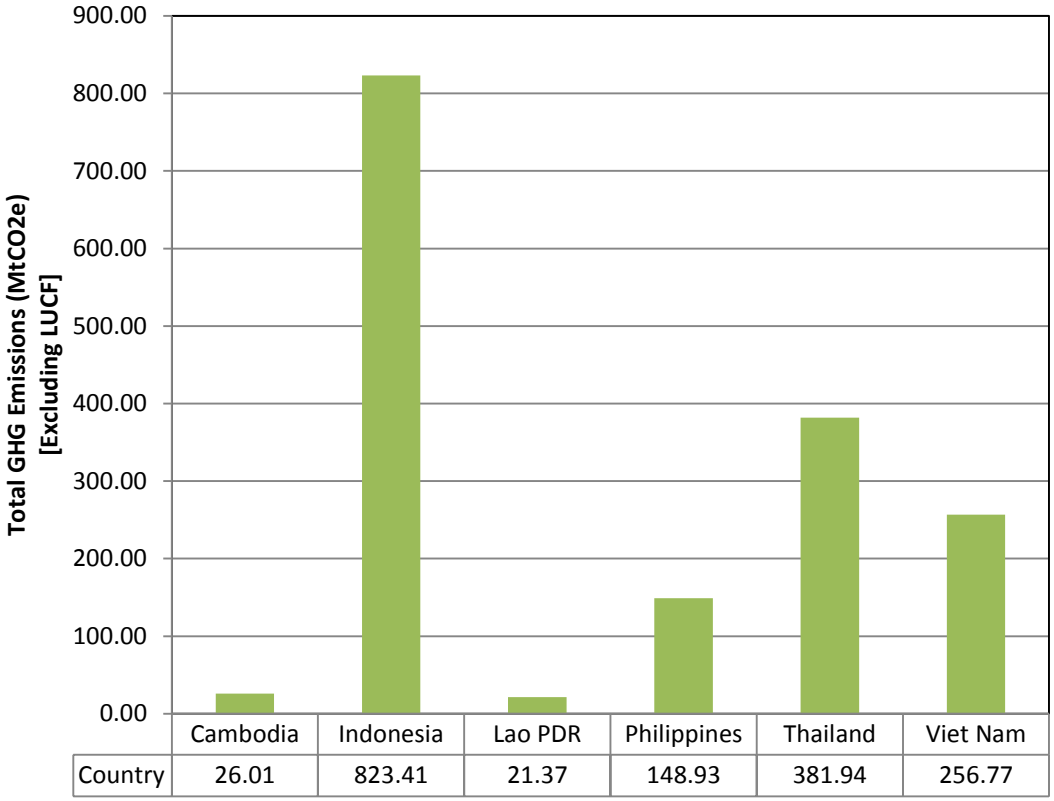


Figure 2: Estimated greenhouse gas emissions per capita for Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam (2010). Note that these quantities exclude emissions from land-use change and forestry (LUCF).

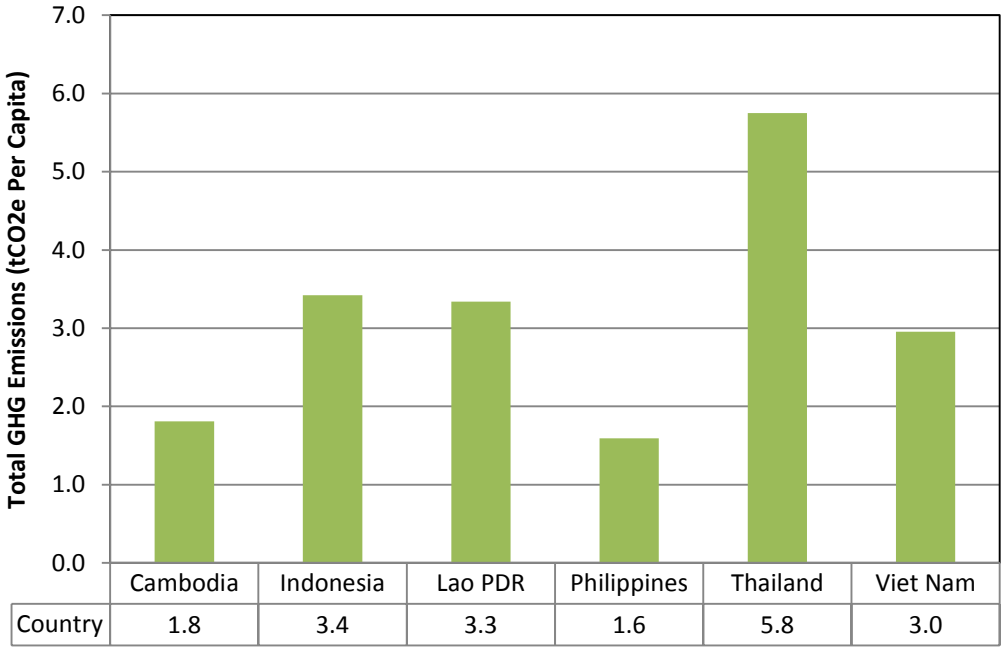
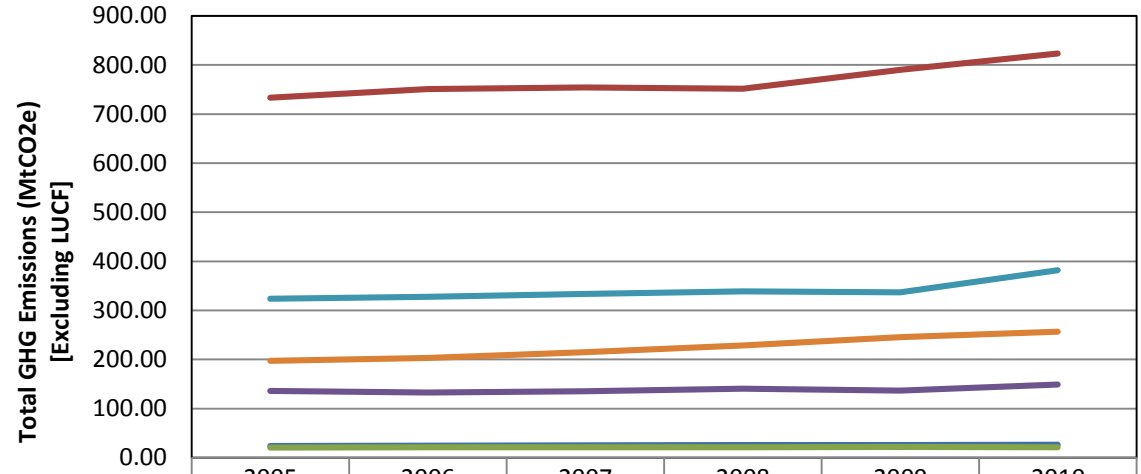


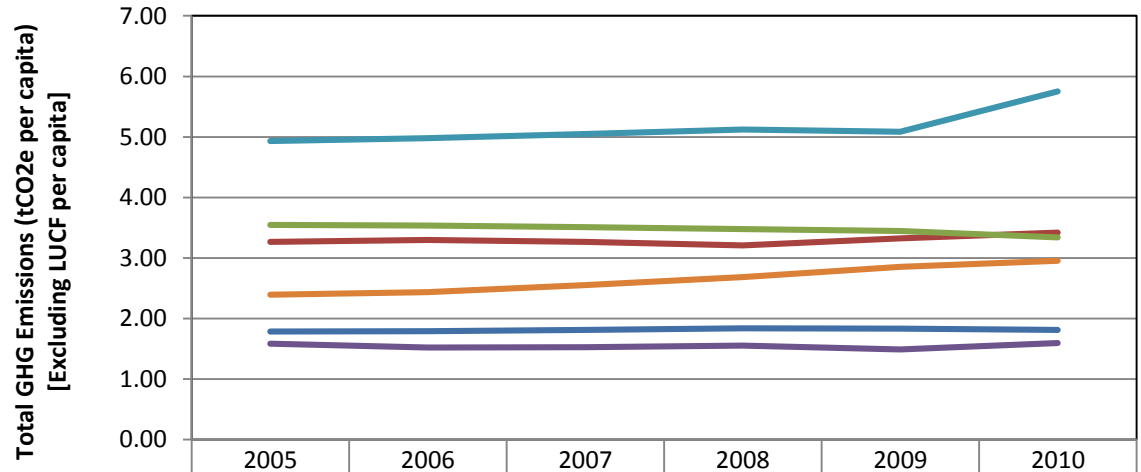
Figure 3 and **Figure 4** show the estimated trend in these emissions over recent years, again based on published World Resources Institute data.

Figure 3: Estimated GHG emissions for Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam (2005-2010)



	2005	2006	2007	2008	2009	2010
Cambodia	23.84	24.25	24.93	25.62	25.90	26.01
Indonesia	733.54	751.10	753.96	751.76	789.97	823.41
Laos PDR	20.53	20.85	21.11	21.35	21.59	21.37
Philippines	135.87	132.82	135.50	140.53	136.66	148.93
Thailand	323.45	327.94	333.67	338.89	337.09	381.94
Viet Nam	197.40	202.79	215.11	228.40	245.60	256.77

Figure 4: Estimated greenhouse gas emissions per capita for Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam (2005-2010)



	2005	2006	2007	2008	2009	2010
Cambodia	1.78	1.79	1.81	1.84	1.83	1.81
Indonesia	3.27	3.30	3.26	3.21	3.33	3.42
Lao PDR	3.55	3.54	3.51	3.48	3.44	3.34
Philippines	1.58	1.52	1.52	1.56	1.49	1.59
Thailand	4.93	4.98	5.05	5.12	5.09	5.75
Viet Nam	2.40	2.43	2.55	2.68	2.85	2.95

The following sections discuss in detail the status of efficient lighting policy and monitoring, verification and enforcement activities in Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam.

Status of Efficient Lighting Policy and Monitoring, Verification and Enforcement Activities in Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam

This section provides an overview of the current status of efficient lighting in six countries (Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam), focusing on their lighting monitoring, verification and enforcement (MVE) policies and programmes[12] and any minimum energy performance standards (MEPS) for lighting products. For each country, this section describes:

- Efficient lighting policy context and the legal basis and strategy for MVE activities (a summary of this policy context can be found in Table 4 and Table 5 in Annex I);
- Organisations involved in MVE activities and their responsibilities;
- Details of the current MVE framework, such as entry conditions, registration system, product performance database, market surveillance, verification testing, enforcement guidelines, penalties for non-compliance;
- Obstacles to, and opportunities for, MVE.

A further project, under UNEP en.lighten's *Off-grid Lighting Policy Framework*[13], has investigated the status of off-grid lighting policy and activities in Southeast Asia. A brief summary of the information gathered for the six countries is included in this section for completeness, along with information from the available UNEP en.lighten *Off-Grid Country Lighting Assessments*, the results of which are summarised in Table 6 in Annex I.

Cambodia

Cambodia has a population of approximately 14.14 million and a GDP of $11,242 million. Its total on-grid electricity consumption is 2.14 TWh, with emissions of 5.24 Mt of CO_2. Lighting accounts for 0.32 TWh (14.9%) of this electricity consumption, accounting for emissions of 0.36 Mt of CO_2 and a cost of $28.99 million. Through its *Country Lighting Assessments,* UNEP en.lighten estimates that Cambodia has a lighting savings potential of 4.89% of total on-grid electricity use – equivalent to savings of 0.10 TWh, 0.12 Mt of CO_2 emissions and $9.57 million.

Off-grid lighting

Cambodia's off-grid population is 76.0% (10.7 million). UNEP en.lighten's *Off-Grid Country Lighting Assessment* for Cambodia estimates an off-grid savings potential of 691.3 Mt of CO_2 and $220.0 million. Cambodia does not have any national laws in place establishing the minimum energy performance standards (MEPS) for off-grid lighting products and does not have any plans to develop any off-grid lighting regulations, citing legal and financial barriers to adoption. There are no national policies or programmes to encourage the use of off-grid lighting technologies although some small scale projects are reported. Cambodia does not require mandatory testing of off-grid lighting prior to distribution or sale and does not take any action to ensure that unauthorised products do not enter the market.

[12] This information is largely based on data previously compiled for the UNEP en.lighten *Regional Report on Efficient Lighting in Southeast Asia*[Error! Bookmark not defined.] and the *lites.asia* position paper on energy efficient lighting in Asia[Error! Bookmark not defined.]. It also draws on bilateral interviews with country representatives and the *lites.asia* information on national standards and labelling activities[12]. In the case of Cambodia, Indonesia, Lao PDR, Philippines and Thailand, it is complemented by information from the country update presentations delivered at the *lites.asia* regional policy meeting in Kuala Lumpur in April 2014[12]. Detailed information on the status of individual MVE elements for each country is from primary research.

[13] www.enlighten-initiative.org/CountryActivities/Off-GridLighting.aspx

Efficient lighting policy context and monitoring, verification and enforcement regulations

Cambodia has developed a climate change strategic plan, *Cambodia Climate Change Strategic Plan (CCCSP) 2013-2023*, which includes energy security and low carbon development. Each Ministry is responsible for developing its own sectoral climate change strategic plan and the Ministry of Industry Mines and Energy is currently in the process of preparing its *Sectoral Climate Change Strategic Plan and Action Plan*.

Cambodia considers energy efficiency and conservation as an important component of sustainable energy development and intends to develop a national strategy. Lighting is as a major opportunity for demand side management.

A regulatory framework exists for the *Safety Label for Electrical and Electronic Household Products.* However, Cambodia does not have any formal plans for phasing out inefficient incandescent lamps, nor does it have performance standards or regulations related to the use or sale of efficient electric appliances.

In September 2006, the Ministry of Industry, Mines and Energy adopted Prakas No. 1003, Determination of types of electrical and electronic products to be complied with Cambodian industrial standards as mandatory standards. This specifies which types of electrical and electronic products produced in the country, and imported from foreign countries, for use and market in Cambodia must comply with the mandatory standards specified in the Prakas. It further specifies that manufacturers and companies that produce or import the products listed shall use the Cambodian standard mark on their products after receiving a license for its use from the Ministry of Industry, Mines and Energy before marketing in Cambodia.

These mandatory test standards have been established by adopting the relevant IEC test method standards and include specifications for double-capped fluorescent lamps and tungsten filament lamps for general lighting service; safety requirements for tungsten filament and self ballasted lamps for general lighting service (compact fluorescent lamps); and general requirements for luminaires (lighting chains). Cambodia has a mandatory label for safety of electrical and electronic household products and energy performance labels of other countries on certain imported items are replaced with a translated version.

The Government of Japan has been providing on-the-job training sessions on energy conservation for local engineers, supporting the collection of data and information for energy management identification of the present energy consumption.

A demonstration project, *Promoting and Demonstrating Energy Conservation in Siem Reap, Cambodia*, was implemented between January 2011 and December 2012 as part of the Energy and Environment Partnership-Mekong project (2012) supported by the government of Finland and the Nordic Development Fund. This project included awareness raising activities, capacity building, and distribution of compact fluorescent lamps (30,000 units) at discounted prices to private institutions and public premises to raise awareness of the benefits of these lamps.

Cambodia is a member of ASEAN and an associate member of the IEC. It has no public or government lighting test laboratories.

Organisations involved in monitoring, verification and enforcement

The organisations involved in monitoring, verification and enforcement, and their roles, are described below:

Ministry of Industry and Handicrafts and Ministry of Mines and Energy

The Ministry of Industry and Handicrafts and Ministry of Mines and Energy are the ministries responsible for governing and nurturing industry, the mining industry and the energy industry of Cambodia. Via the Institute of Standards Cambodia, the Ministry of Industry and Handicrafts is responsible for licensing products for use of the Cambodian standard mark prior to their entry into the market in Cambodia.

The Institute of Standards Cambodia is the national standards institution for Cambodia (Uk 2014); it is responsible for:

- Developing national standards for products, commodities, materials, services, practices and operations and promote to ensure the adoption of such standards;
- Establishing and maintaining laboratories, libraries, facilities and other equipment for the purpose of furthering standardization and increasing the quality of goods and services;
- Certifying the compliance of products, commodities, substances, materials and equipment with standards for local consumption or export;
- Certifying the conformity to safety standards for products, commodities, substances, materials and equipment for local consumption or export;
- Certifying compliance with management system standards for production and services;
- Suspending, withdrawing and cancelling licenses, product standard marks or certificates of conformity, certificates of registration or management systems, certificates of registration or accreditations;
- Providing educational, training and consultancy services to promote standardization and quality;
- Recognising laboratories, facilities and other equipment of local or foreign entity, for the purposes of the Institute;
- Providing for cooperation with any person, international organization or foreign association having objective similar to those of the Institute;
- Fostering and promoting the implementation of standards and standardization as a means of advancement in the national economy, health, safety and public welfare;
- Collaborating with authorities involved in industry, commerce and trade and other organizations to ensure the implementation of standards.

The Department of Energy Technique, under the Ministry of Mines and Energy, collaborates with the Climate Change Department of the Ministry of Environment to translate energy efficiency labels for selected electrical appliances sold in the Cambodian market.

If a programme were developed for checking products in the market place it is expected that the Ministry of Mines and Energy, the Ministry of Industry and Handicraft and the Ministry of Commerce would collaborate in managing it.

Climate Change Department of the Ministry of Environment[14]

The Climate Change Department of the Ministry of Environment has a remit to contribute to sustainable development under climate change conditions and in accordance with the policy of the Royal Government of Cambodia (2014). Its roles and responsibilities of relevance to MVE are to:

- Develop, in collaboration with relevant agencies, national strategy, action plan and policy and legal instruments related to climate change;
- Conduct an assessment of potential GHG emissions mitigation and promote the implementation of GHG mitigation projects in Cambodia with appropriate technology;
- Promote mainstreaming of climate change in the national development and sectoral plans and coordinate the implementation of clean development mechanism and carbon credit projects in Cambodia;
- Promote research, education, dissemination, training, workshop and meeting to promote awareness on climate change and motivate participation of local communities in implementation of climate change response project;
- Develop projects and programs and coordinate, monitor and evaluate the implementation of all climate change related projects and programs in Cambodia;
- Mobilise required resources, particularly to attract grants for implementation of policy, strategy, legal instruments, plans and programs on climate change;
- Enhance collaboration with national agencies, development partners, civil society, and private sector for effective implementation of response measures to climate change as well as the UNFCCC.

[14] www.camclimate.org.kh

In this capacity, the Climate Change Department was the lead partner in the *Promoting and Demonstrating Energy Conservation in Siem Reap, Cambodia* project.

Cambodia Import-Export Inspection and Fraud Repression Directorate-General[15]

The Cambodia Import-Export Inspection and Fraud Repression Directorate-General, or CAMCONTROL, under the Ministry of Commerce has four Departments - Department of Consumer Protection and Fraud Repression, Department of Technical Affairs and Public Relation, Department of General Policy and Dispute Resolution and Department of Laboratory) and 27 branches nationwide. It has responsibility for controlling the quality testing of products.

Monitoring, verification and enforcement elements

Cambodia does not have a strategic framework for MVE of lighting products, nor does it have a budget mechanism in place for an MVE programme. A *National Climate Change Trust Fund* has been proposed as a possible budget mechanism for the future. The current status of the individual MVE elements is described below:

Entry conditions

Imported and domestic lighting products regulated under Prakas No. 1003 for sale in Cambodia must comply with mandatory standards and be licensed to use the Cambodia standard mark. It is reported that mandatory testing is required for these products. This testing is coordinated by CAMCONTROL, while custom officers check imported products in terms of nature and quantity.

Registration system

A registry of licensed products is kept by the Ministry of Industry and Handicraft (via the Institute of Standards Cambodia). It records registration to use the Cambodian standard mark and International standards marks (for 49 standards) for electric and electronic products. Products listed in Prakas No. 1003 - fluorescent lamps, incandescent lamps, lighting chains, self ballast lamp for general lighting service - may be voluntarily registered. Proof of compliance with mandatory standards specified in the Prakas is required for registration. There is no restriction on access to the registry by other government departments.

Product performance database

Cambodia does not have a product performance database for lighting products but there is interest in developing one.

Market surveillance

Currently no market surveillance programme is in place to monitor compliance with licensing. However, programmes are in place for other products[16] which could be used as a model for a lighting product market surveillance programme. Should such a programme be developed it is likely that the Ministry of Industry and Handicraft, Ministry of Industry, Mines and Energy, Ministry of Environment and Ministry of Commerce would be involved in managing it.

Verification

Currently, there is no programme in place for performance testing the energy performance of lighting products sourced from the market although Cambodia does recognise the results from the programmes for performance testing of lighting products in China, India, Malaysia and Thailand and uses the efficiency labels from other countries such as Thailand, for some appliances, including fridges and fans. Testing programmes are in place for other products[16] in Cambodia which could be used as a model for a lighting product testing programme. Should such a programme be developed it is likely that the Ministry of Industry and Handicraft, Ministry of Industry, Mines and Energy, Ministry of Environment and Ministry of Commerce would be involved in managing it and a National Climate Change Trust Fund could be considered as a funding option.

[15] www.camcontrol.gov.kh/about_us.php?action=submenu&sid=3

[16] Air conditioners, refrigerators, fans, washing machines, TVs, microwaves and rice cookers.

Enforcement

The agencies responsible for enforcement are the Ministry of Industry and Handicraft, Ministry of Mines and Energy. However, Cambodia does not currently have a legal framework in place for authorising the enforcement of non-compliance.

Obstacles and opportunities for monitoring, verification and enforcement

Cambodia's immediate plans for standards and labelling for energy end-use are focussed on:

- Preparing voluntary or mandatory standards, rules and regulations regarding the use of energy;
- Training customers regarding some appliances that are imported with the energy performance labels of the country of manufacturing (some products are being supplied with false Thai high performance labels);
- Developing a national standard and labelling programme for energy end-use in Cambodia.

These activities offer an opportunity for the integrated development of a strategic plan for MVE of lighting products. However, to facilitate this, support is required for:

- Baseline understanding of current lighting product market (lighting technologies in use) and quality of efficient lighting (and comparison to other countries in the region);
- Energy efficiency policy and regulatory development;
- Advising on energy efficiency activities;
- Learning about good practices from other countries in the region;
- Collaboration and experience and knowledge sharing with neighbouring countries;
- Development of harmonized performance standards with Lao PDR and Myanmar (possibly learning from recent initiatives in Viet Nam or other countries In the region);
- Standards development;
- Awareness raising.

Indonesia

Indonesia has a population of approximately 239.97 million and a GDP of $706,558 million. Its total on-grid electricity consumption is 147.96 TWh, with emissions of 427.32 Mt of CO_2. Lighting accounts for 22.19 TWh (15.0%) of this electricity consumption, accounting for emissions of 17.03 Mt of CO_2 and a cost of $1,961.93 million. Through its *Country Lighting Assessments,* UNEP en.lighten estimates that Indonesia has a lighting savings potential of 6.32% of total on-grid electricity use – equivalent to savings of 9.35 TWh, 7.17 Mt of CO_2 emissions and $650.6 million.

Off-grid lighting

Indonesia's off-grid population is 35.5% (85.2 million). UNEP en.lighten's *Off-Grid Country Lighting Assessment* for Indonesia estimates that it has an off-grid savings potential of 5.5 Mt of CO_2 and $792.0 million. Indonesia does not have any national laws in place establishing the minimum energy performance standards (MEPS) for off-grid lighting products. Indonesia does not have any plans to develop any off-grid lighting regulations, citing legal, financial and social barriers to adoption. Although some private enterprises and individual projects have been conducted, at the present time there is not any plan for national policies or programmes to encourage the use of off-grid lighting technologies. Indonesia does not require mandatory testing of off-grid lighting prior to distribution or sale but does operate border and customs controls and undertakes market surveillance to ensure that unauthorised products do not enter the market.

Efficient lighting policy context and monitoring, verification and enforcement regulations

Government Regulation of the Republic of Indonesia No. 70/2009 on Energy Conservation introduced mandatory comparative labelling and MEPS requirements for compact fluorescent lamps. However, due to the obstacles faced by local manufacturers in meeting the MEPS requirements, the MEPS programme is currently under revision.

The *Ministerial Regulation (Ministry of Energy and Mineral Resources) No 6/2011 on Energy Efficiency Labelling on CFL* came into force in May 2013 and mandates that all compact fluorescent lamps must carry

an energy efficiency label[17]. To qualify for the label, manufacturers/importers must issue a Declaration of Conformity[18] stating that their product complies with the regulations and submit it to the Directorate General of New-Renewable Energy and Energy Conservation of the Ministry of Energy and Mineral Resources. The performance that is claimed in the label should be based on test results[19] from a recognized/accredited laboratory and must be confirmed by an accredited/appointed conformity institution/certification body.

Indonesia is finalising a draft regulation to define the MVE framework for lighting products, including sampling and testing procedures. It is a member of APEC and ASEAN, a full member of the IEC and participates in the BRESL project.

Organisations involved in monitoring, verification and enforcement

The Government of Indonesia (2014) organisations involved in monitoring, verification and enforcement, and their roles, are described below:

Ministry of Energy and Mineral Resources

The Ministry of Energy and Mineral Resources[20] is responsible for energy sustainability and security. Within the Ministry, the Directorate General of New-Renewable Energy and Energy Conservation is responsible for efficiency policy development, efficiency standards and labelling, market monitoring, financial incentives, as well as training and international cooperation. The Directorate for Electricity is responsible for safety standards.

Ministry of Trade

The Ministry of Trade is responsible for market surveillance, and ensuring that all lighting products on the market have the energy efficiency label.

National Accreditation Body of Indonesia

The National Accreditation Body of Indonesia[21] awards accreditation to certification bodies and third party Conformity Assessment Bodies involved in certification, inspection, testing and calibration.

Agency for the Assessment and Application of Technology

The Agency for the Assessment and Application of Technology[22] is a government institution under the coordination of the Ministry of Research and Technology responsible for technology assessment and implementation in accordance with the provisions of legislation in force.

National testing laboratories

There are six national testing laboratories in Indonesia with facilities to test lighting products. Five of which are accredited:

- B4T - Center for Material and Technical Products
- P3TEK - Centre for Research and Technological Development of Electricity and Renewable Energy
- Central Laboratory Operations Cibitung, Sucofindo PT (Persero)
- Product Quality Testing Center of Jakarta (BMPBEI)
- Lab. Kalibrasi Baristand Industri

Indonesia has established a laboratory forum to discuss energy efficiency matters and has conducted proficiency tests and round robin testing for its laboratories through the BRESL project.

Monitoring, verification and enforcement elements

Regulations are currently being drafted to define the MVE framework for lighting products. Currently, the following elements are in place:

[17] SNI 04-6958-2003, Household and similar electrical appliances - Energy rating labels
[18] SNI ISO/IEC 17050-1:2010, Conformity assessment - Supplier's declaration of conformity - Part 1: General requirements
[19] Against SNI IEC 60969: 2009, Ballasted lamps for general lighting services - performance requirements
[20] www.esdm.go.id
[21] www.kan.or.id
[22] www.bppt.go.id

Entry conditions
All compact fluorescent lamps must carry an energy label and submit a Declaration of Conformity, supported by test results from a recognised/accredited laboratory.

Registration system
Indonesia has a registration system in place for lighting products administered by the Directorate General of New-Renewable Energy and Energy Conservation of the Ministry of Energy and Mineral Resources. It covers the energy label and is mandated for all compact fluorescent lamps.

Product performance database
Currently, Indonesia does not have a product performance database for lighting products although there is interest in developing one.

Market surveillance
The Ministry of Trade is responsible for market surveillance activities but currently no market surveillance activities are undertaken for lighting products.

Verification testing
The MVE regulations currently being drafted include provision for verification testing, including specifications for sampling and testing procedures. No systematic verification testing is currently undertaken.

Enforcement guidelines and penalties for non-compliance
The MVE regulations currently being drafted include enforcement guidelines and a specification for penalties for non-compliance.

Obstacles and opportunities
Indonesia is currently finalising draft regulations to define the MVE framework for lighting products. However, support is required for:

- Review of the draft MVE regulation with a focus on verification;
- MVE training for policy makers and regulators;
- Drafting of detailed plan and schedule (roadmap) for MEPS re-adoption;
- Guidance on product selection and sampling procedures for verification testing;
- Assistance with labelling display surveys and monitoring processes;
- Capacity building for testing laboratories, in terms of staff training (in particular, on uncertainty measurement and calculation) and participation in regional proficiency test programme;
- Capacity building for local manufacturers to transition to the manufacture of affordable, higher quality efficient lighting products (to meet the needs of consumers with low purchasing power).

Lao PDR
Lao PDR has a population of approximately 6.50 million and a GDP of $9,500 million. Lao PDR's total on-grid electricity consumption is 2.23 TWh, with emissions of 1.63 Mt of CO_2. Lighting accounts for 0.38 TWh (13.4%) of this electricity consumption, accounting for emissions of 0.08 Mt of CO_2 and a cost of $32.71 million. Through its *Country Lighting Assessments,* UNEP en.lighten estimates that Lao PDR has a lighting savings potential of 4.64% of total on-grid electricity use – equivalent to savings of 0.13 TWh, 0.03 Mt of CO_2 emissions and $9.43 million.

Off-grid lighting
Lao PDR's off-grid population is 45.0% (2.8 million). UNEP en.lighten's *Off-grid Country Lighting Assessment* for Lao PDR estimates that it has an off-grid savings potential of 179.5 Mt of CO_2 and $81.0 million. Lao PDR does not have any national laws in place establishing the minimum energy performance standards (MEPS) for off-grid lighting products. The country has a plan to develop efficient off-grid lighting regulations but does not yet have enough donor support required to proceed. As with the other countries in the region, Lao PDR has legal and financial barriers for the adoption of MEPS. The country lacks national policies or programmes to encourage the use of off-grid lighting technologies. No testing of off-grid lighting is required prior to

distribution or sale; consequently poor-performing products may enter the market.

Efficient lighting policy context and monitoring, verification and enforcement regulations

Lao PDR has yet to develop a comprehensive national strategy for energy efficiency, according to a recent publication by the Asian Development Bank (2013). Lao PDR has an electricity law, No. 02/97/NA: *The Law on Electricity*[23], which requires energy efficiency of electricity supply, but has no specific regulation pertaining to energy efficiency of electrical appliances or lighting products. The Asian Development Bank has been supporting the development of a strategy and policies for energy efficiency in Lao PDR; these documents are now at the draft stage.

The World Bank is collaborating with the state-owned electricity generating company, Electricité du Lao PDR, to promote demand-side management and conduct energy audits in 50 buildings. This project included the replacement of 0.4 million inefficient incandescent lamps in the residential sector with compact fluorescent lamps and exchanging T8 linear fluorescent lamps with T5 linear fluorescent lamps.

Lao PDR does not have national performance standards for lighting, but does specify relevant IEC test method standards for lamps or lighting products. The country is a member of ASEAN and an affiliate member of the IEC. It has no public or government lighting test laboratories.

Organisations involved in monitoring, verification and enforcement

The organisations involved in monitoring, verification and enforcement, and their roles, are described below:

Ministry of Energy and Mines

Ministry of Energy and Mines is responsible for energy policy and overall strategic guidance. Within this Ministry, the Department of Energy Policy and Planning is responsible for formulating national energy policies and plans. The Department of Energy Management is in charge of drafting energy-related laws, regulations, guidelines, and technical and safety standards. It also monitors government agencies, state-owned enterprises, and private operators to ensure that they operate in accordance with the rules and regulations. The Department is also responsible for inspecting the technical standards of electrical equipment and appliances, either domestically produced or imported.

Monitoring, verification and enforcement elements

In the absence of a standards and labelling programme for lighting, Lao PDR does not have budget mechanism for an MVE programme. However, some MVE elements are in place.

Entry conditions

Not applicable because no MEPS, labels or conditions for import into the country exist.

Registration system

It has been reported that a registry is maintained of lighting products[24] imported into the country but no further information is available.

Product performance database

There is no product performance database for lighting products although there is interest in developing one.

Market surveillance

Lao PDR has a market surveillance programme managed and implemented by the Department of Energy Management, Ministry of Energy and Mines.

Verification

Presently Lao PDR does not have a verification programme. Lao PDR does not have any non-lighting electrical appliance performance testing programmes that could be used as a model for a lighting product testing programme. However, Lao PDR recognises the results from the programmes for performance testing of lighting products in Thailand (compact fluorescent, T5 fluorescent, and, light emitting diode lamps).

[23] www.mfa.gov.sg/content/dam/mfa/images/om/vientiane/Lao%20Law/Electricity%20law%20and%20Decree%20FINAL.pdf
[24] Compact fluorescent lamps, T5 fluorescent lamps, LED lamps

Enforcement

Lao PDR lacks a legal framework to authorise the enforcement of non-compliance.

Obstacles and opportunities

Lao PDR has no domestic lamp manufacturing capability and is dependent on imports (primarily from Thailand, Viet Nam, China, Japan and Europe). Developing an effective quality control mechanism for lamps is noted by interviewees as a major challenge.

To develop a strategy and policies for energy efficiency and a strategic plan for MVE for lighting products. Lao PDR seeks support for:

- A baseline assessment of the current lighting product market (lighting technologies in use) and benchmark of the quality of efficient lighting against other countries in the region;
- Development of policy and legislation on efficient lighting standards and MVE;
- Collaboration, experience and knowledge sharing with neighbouring countries;
- Development of harmonized performance standards with Cambodia and Myanmar (possibly learning from recent initiatives in Viet Nam);
- Feasibility and cost-effectiveness study on establishment of testing laboratories in Lao PDR;
- Training (of government staff) to understand testing and how to interpret results and act upon outcomes (for example, when using accredited third party test laboratories or assessing proposals for shared test resources with neighbouring countries).

Philippines

The Philippines has a population of approximately 93.26 million and a GDP of $199,589 million. Its total on-grid electricity consumption is 55.62 TWh, with emissions of 80.22 Mt of CO_2. Lighting accounts for 8.34 TWh (15.0%) of this electricity consumption, accounting for emissions of 3.95 Mt of CO_2 and a cost of $1,885.89 million. Through its *Country Lighting Assessments,* UNEP en.lighten estimates that the Philippines has a lighting savings potential of 6.32% of total on-grid electricity use – equivalent to savings of 3.51 TWh, 1.67 Mt of CO_2 emissions and $760.96 million.

Off-grid lighting

The Philippines's off-grid population is 10.3% (9.6 million). UNEP en.lighten's *Off-Grid Country Lighting Assessment* for the Philippines estimates that it has an off-grid savings potential of 598.3 Mt of CO2 and $270.1 million.

Efficient lighting policy context and monitoring, verification and enforcement regulations

The Philippines has made a formal commitment to phase out inefficient lighting via the Energy-Efficient Lighting Products Act of 2013, which requires "the use of energy-efficient lighting products, providing penalties for violations thereof, and for other purposes".

The National Energy Efficiency Conservation Programme was launched by the Philippine Government in support of the 2011-2030 Philippine Energy Plan. As part of the National Energy Efficiency Conservation Programme, an Energy Conservation Bill is currently being re-drafted by the Department of Energy. This bill could include provisions to authorize the Department of Energy to develop and implement an energy standards and labelling programme for energy consuming appliances, lighting and other equipment.

The *National Energy Efficiency Conservation Programme* includes the *Energy Standards and Labelling Programme* which requires appliances and lighting products to meet prescribed energy efficiency levels and to carry an energy label at the point of sale. Under the programme, a mandatory energy label for compact fluorescent lamps was adopted in the Philippines in 2003. MEPS for compact fluorescent lamps and double- and single-capped fluorescent lamps were adopted in 2010, as well as performance requirements for linear fluorescent lamps, and a label for ballasts.

Currently the *Energy Standards and Labelling Programme* does not include a formal MVE policy or legal framework. However, the Philippines is currently implementing a three month long *SWITCH Philippines Policy Support Project* aimed at strengthening MVE within the programme. The main output will be a set of guidelines for an MVE scheme.

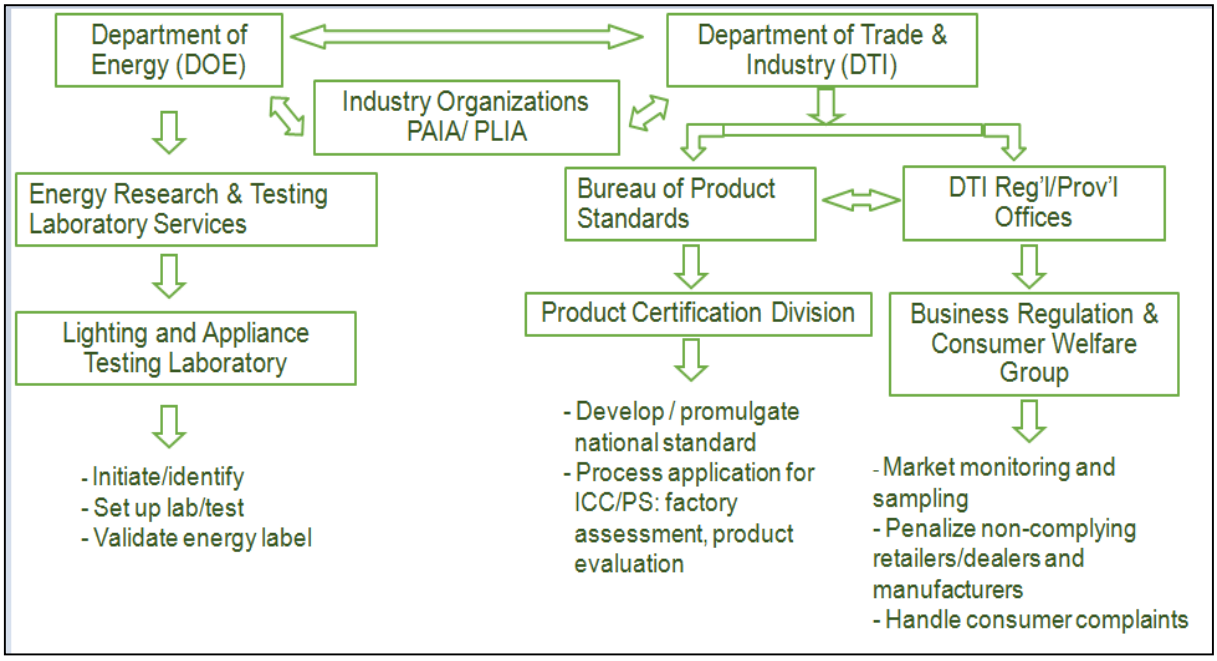
The Department of Energy recently developed and submitted to the National Department of Budget a $292,000 project application, *Institutional Capacity Building for Performance Testing of LED for General Lighting*, which would cover both MEPS and MVE activities.

The Philippines is a member of APEC and ASEAN and a full member of the IEC.

Organisations involved in monitoring, verification and enforcement

The institutional organisation for efficient lighting MVE in the Philippines is shown in **Figure 5**. The organisations involved in MVE and their roles are described below:

Figure 5: The institutional organisation for efficient lighting MVE in the Philippines



Department of Energy

The Department of Energy is responsible for the implementation of the Energy Standards and Labelling Programme in coordination with the Department of Trade and Industry (DTI).

Within the Department of Energy, the Energy Utilization Management Bureau is in charge of formulating and implementing plans and policies for the efficient use of energy resources, with a focus on energy use in buildings, streetlights and compact fluorescent lamp retrofits. This Bureau includes an Energy Efficiency division.

National testing laboratories

There are three national testing laboratories in the Philippines with facilities to test lighting products. Two of which are currently accredited:

- IIEE Foundation Inc. Testing Laboratory
- Scientific Environmental and Analytical Laboratory and Services, Inc. (SEALS)

The Department of Energy's Energy Research and Testing Laboratory Services is responsible for the verification (through quality and efficiency testing) of lighting products. It was previously nationally and ISO accredited for testing of compact fluorescent lamps and linear fluorescent lamps and ballasts. However, it is currently being re-established at a new location and no testing can be conducted at the moment. The new

laboratory may be operational by the end of 2014 and it will seek re-accreditation at this stage. Energy Research and Testing Laboratory Services laboratory does not have training and capacity for testing of light emitting diodes. However, it is currently awaiting a decision on a $13 million project proposal on standards development for light emitting diode products and associated training and laboratory testing capacity.

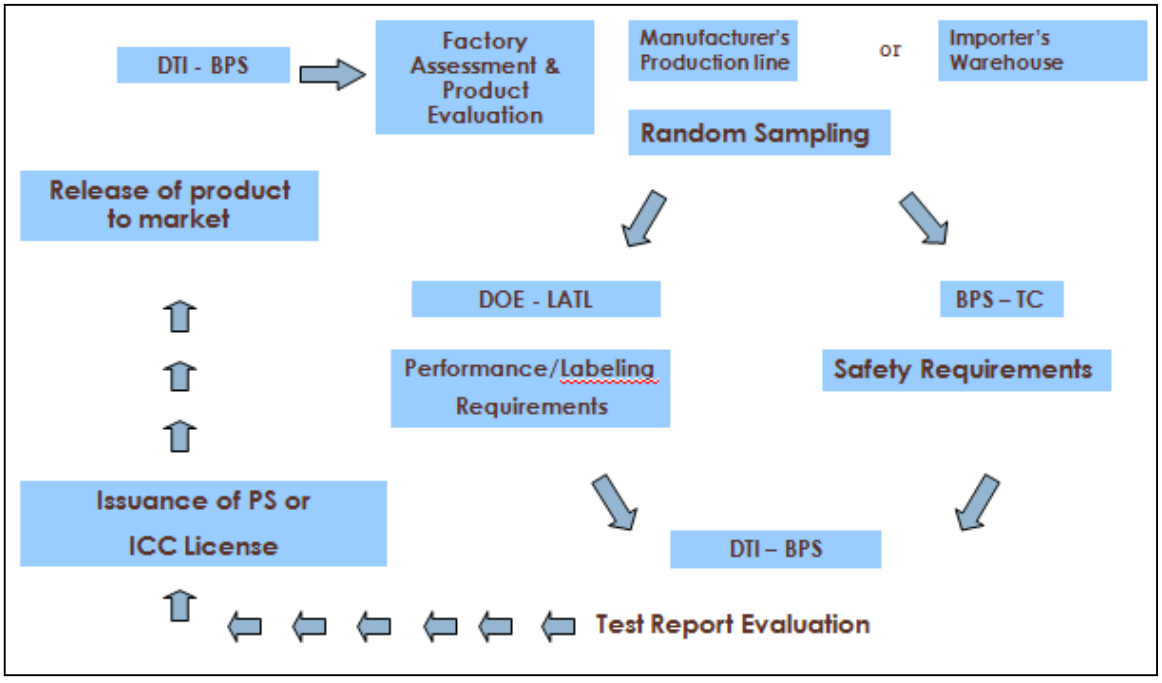
Department of Trade and Industry

The Department of Trade and Industry is responsible for product standards (focused on product safety) and coordinates with the Department of Energy on the implementation of the Energy Standards and Labelling Programme.

Within the Department of Trade and Industry, the Bureau of Products Standards[25] develops, promotes, and implements standards and related programs nationwide. It also participates and represents the country in various standards-related activities worldwide and is an active member of the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the Asia Pacific Economic Cooperation (APEC), and the ASEAN Consultative Committee for Standards and Quality. Figure 6 shows the product certification process.

The Bureau of Products Standards has regulatory responsibility for the lighting labelling and is in charge of the monitoring and enforcement activities in cooperation with Energy Research and Testing Laboratory Services. The Department of Trade and Industry Regional Development Operations Group coordinates their regional offices nationwide to carry out these monitoring and enforcement activities.

Figure 6: Philippine product certification process



Philippine Product Safety and Quality Foundation

The Philippine Product Safety and Quality Foundation is a non-stock/non-profit foundation that works closely with Philippine industries and the Bureau of Product Standards in upholding and promoting safety and quality. It conducts regular market surveillance activities of regulated products.

Bureau of Customs

The Bureau of Customs, under the Ministry of Finance, is responsible for the control of the products entering the national market. Although details are recorded of all products entering through customs, this is not currently available for use.

[25] Bureau of Product Standards

Monitoring, verification and enforcement elements

Although there is currently no formal policy or legal framework in place for MVE for lighting products, a budget mechanism is in place for MVE activities as part of the regular budget of Energy Research and Testing Laboratory Services. The current status of the individual MVE elements is described below:

Entry conditions

Compact fluorescent lamps, linear and circular fluorescent lamp and fluorescent lamp ballasts for sale in the Philippines must meet prescribed energy efficiency levels and carry an energy label at the point of sale. All products covered by the energy labelling program in the market must carry Import Commodity Clearance (ICC) or the Philippine Standard (PS) license marks.

Registration system

A registration system is in place for lighting products covering the energy label, MEPS, the Import Commodity Clearance and Philippine Standard marks for compact fluorescent lamps, linear and circular fluorescent lamp ballasts The Department of Trade and Industry administers the processing of applications for these marks and the Department of Energy administers the processing of requests for validation of energy labels. During the product certification process, a sample of the products selected at random from the manufacturer's production line or the importer's warehouse is tested by Energy Research and Testing Laboratory Services for compliance. To qualify for registration, laboratory test reports for compliance to safety and performance standards must be submitted, along with an approved request for validation of the energy label.

Product performance database

The Philippines has a product performance database for lighting products which is accessible to the public for searching via the Department of Energy website[26]. There is no fee to include a product on the database. Entry into the database is not mandatory as part of product registration process.

Market surveillance

The Philippines has a programme in place for checking products in the market place. This is managed and implemented by Department of Energy and Department of Trade and Industry. There is currently no documented protocol for this conducting this activity and market monitoring activities are carried out on an ad hoc basis. One such activity was documented as part of the *lites.asia* collaborative labelling display survey project[27], where the regional Department of Trade and Industry offices carried out market surveillance exercises in May and June 2013 in five provinces: Abra, Ifugao, Cebu, Kalibo and Mt Province. These areas were targeted as these they were suspected of being a market for uncertified or low quality compact fluorescent lamps. There is a defined budget for this activity. However the amount is variable and there is no regular schedule.

Verification

Currently, there is no programme in place for performance testing the energy performance of lighting products sourced from the market but there is intent to develop such a programme, which is currently at the proposal stage. The programme would be managed by Department of Energy and Department of Trade and Industry. The Philippines does not currently recognise the results from the programmes for performance testing of lighting products in other countries but there is interest in doing so, possibly under a harmonized scheme within the region.

Enforcement

The Philippines has a legal framework in place for authorising the enforcement of non-compliance, the responsible agency for which is the Department of Trade and Industry, the administrators being the Undersecretary of the Regional Operations Group and Undersecretary of the Consumer Protection Group. Where non-compliance is found, all non-conforming or non-complying goods/products must be withdrawn (or are removed) from the premises of the establishment. The owner/manager of the subject establishment is given a Notice of Violation and shall appear before the Department of Trade and Industry provincial office concerned within 48 hours from notice. The framework also includes a mechanism for consumers to submit

[26] www.doe.gov.ph
[27] www.lites.asia/downloads/labelling-display-survey

suspected non-compliance (via the Department of Trade and Industry Regional or Provincial offices, the Bureau of Philippines Standards or the Consumer Protection and Advocacy Bureau. The penalties for non-compliance are specified in Department of Trade and Industry Department Administrative Order 2:2007. There is no provision for the publication of the outcomes of enforcement nor for any funds collected from non-compliance penalties to be directed to the MVE program budget.

Obstacles and opportunities

The *SWITCH Philippines Policy Support Project* is currently developing a set of MVE guidelines which is intended to provide a framework for future MVE activities. However, in parallel with this, support is required for:

- MVE policy/regulator training;
- Policy regulations for MVE;
- Laboratory training on LED testing;
- Product registration database management;
- Training for customs authorities on efficient lighting products.

Interest has also been expressed in taking part in the proposed UNEP en.lighten interlaboratory comparison and market assessment exercises and in learning from the best practice in monitoring and verification schemes in other countries.

Thailand

Thailand has a population of approximately 69.12 million and a GDP of USD 318,522 million. Its total on-grid electricity consumption is 146.67 TWh, with emissions of 296.10 Mt of CO_2. Lighting accounts for 18.21 TWh (12.4%) of this electricity consumption, accounting for emissions of 9.45 Mt of CO_2 and a cost of USD 2,099.47 million. Through its *Country Lighting Assessments,* UNEP en.lighten has calculated that Thailand has a lighting savings potential of 4.46% of total on-grid electricity use – equivalent to savings of 6.54 TWh, 3.40 Mt of CO_2 emissions and USD 670.7 million.

Off-grid lighting

UNEP en.lighten has not produced an *Off-grid Country Lighting Assessment* for Thailand, which has 99.3% electrification. However, according to the IEA's publication, *World Energy Outlook 2013,* approximately 1 million people do not have access to grid electricity. This population is mainly concentrated in the border areas, particularly near the Thailand-Burma border. Thailand does not have any national laws in place establishing minimum energy performance standards (MEPS) for off-grid lighting products and has not indicated any plans to develop off-grid lighting regulations. Although Thailand notes legal and financial barriers to adopting MEPS for off-grid lighting, perhaps the very high electrification rate relative to the rest of the region is also a factor. However, Thailand offers low-interest finance and subsidies for off-grid lighting products and operates awareness raising campaigns to encourage the use of off-grid lighting technologies. Thailand does not require mandatory testing of off-grid lighting prior to distribution or sale, nor take any action to ensure that unauthorised products do not enter the market.

Efficient lighting policy context and monitoring, verification and enforcement regulations

In Thailand, the legal framework and overarching strategy for energy efficiency is conferred by the *Energy Conservation Promotion Act*[28], which includes provisions for establishing energy efficiency standards, and, the *20-Year Energy Efficiency Development Plan (2011-2030)*. This Plan is currently being revised by the Energy Policy and Planning Office under the Ministry of Energy and submission to the new Cabinet is expected in October 2014. The *Energy Conservation Fund (ENCON Fund)*, which was established under the Act, is a key financial mechanism for supporting energy efficiency and renewable energy development. In a recent article in The Nation[29], it was reported that the National Energy Policy Council have agreed to put conservation on top of the country's energy-policy agenda, ordering a nationwide shift to light-emitting diode lighting to help save nearly 2,000 megawatts of electricity annually.

[28] Enacted in 1992 and updated in 2007

[29] www.nationmultimedia.com/business/Without-proper-energy-plan-power-bill-could-double-30242089.html

Thailand has made a formal commitment to the phase-out of inefficient incandescent lamps. The extensive market transformation project, the *Incandescent Lamps Phase Out Program,* operated by the Electricity Generating Authority of Thailand from 2007-2010, used a variety of tools[30] to promote the permanent use of high efficiency and good quality compact fluorescent lamps in place of incandescent lamps for general lighting service. Partly supported by the *Energy Conservation Fund*, it focused on a market-based approach without mandatory enforcement.

No mandatory MEPS are in place for lighting in Thailand. However, there are voluntary MEPS for compact fluorescent lamps and double- and single-capped fluorescent lamps. Thailand has a long track record of working collaboratively with industry to improve the efficiency of lighting products. For example, under the Electricity Generating Authority of Thailand's *Low Efficiency Fluorescent Lamps Phase-out Program (1993-1995)*, a collaborative agreement was made with major local manufacturers in September 1995, to cease production of large diameter tubes (40W, 20W), which saw the transformation of the market to smaller diameter tube fluorescent lamps (36W, 18W) without the government offering direct incentives to manufacturers or consumers.

Under the *Energy Efficiency Labelling No. 5 Programme*, Thailand operates voluntary labelling programs for compact fluorescent lamps and double-capped fluorescent lamps. The *Thai Green Label Scheme*, which was formally launched in August 1994 by the Thailand Environment Institute in association with the Ministry of Industry, includes provisions for electronic ballasts for fluorescent lamps, fluorescent lamps and compact fluorescent lamps. Additionally, a study is underway to investigate the feasibility of a voluntary labelling program for light emitting diode lamps.

Thailand is a member of APEC and ASEAN and a full member of the IEC. Thailand participates in the BRESL project. It is the coordinator of the Energy Efficiency and Conservation Sub-Sector Network (EEC-SSN)[31] of the ASEAN Centre for Energy.

Organisations involved in monitoring, verification and enforcement

The organisations involved in MVE, and their roles, are described below:

Department of Alternative Energy Development and Efficiency

The Department of Alternative Energy Development and Efficiency[32] is the governmental department responsible for all aspects of energy use. This remit includes responsibility for standards and labels development, in conjunction with the Thai Industrial Standards Institute, and for the operation of the *Energy Efficiency Labelling No. 5 Programme*, in conjunction with the Electricity Generating Authority of Thailand. In addition, the Department arranges technology transfer, promotion and training and disseminates knowledge related to the public.

Electricity Generating Authority of Thailand

The Electricity Generating Authority of Thailand[33] is the state enterprise under Office of the Prime Minister that is solely responsible for all electric power production and transmission in Thailand. In conjunction with Department of Alternative Energy Development and Efficiency, it is responsible for the operation of the *Energy Efficiency Labelling No. 5 Programme* and managing (and funding) the product testing undertaken during the application process for the programme and for verification testing of products in the market.

Thai Industrial Standards Institute

The Thai Industrial Standards Institute[34] is the national standards body of Thailand and is responsible the regulation of Thailand's energy efficiency performance standards.

[30] Distribution of free lamps and subsidies, awareness raising campaigns and labelling
[31] The working group responsible for developing harmonized performance standards for appliances
[32] www.dede.go.th
[33] www.egat.co.th
[34] www.tisi.go.th

Electrical and Electronics Institute

The Electrical and Electronics Institute is an autonomous institute under the Ministry of Industry Industrial Development Foundation. Its testing laboratory is responsible for the product testing undertaken as part of the application process for use of the energy label.

Energy Policy and Planning Office

The Energy Policy and Planning Office[35] is the focal agency in the development of national energy policies and measures. Its principle roles are to monitor, evaluate and act as the focal point for coordinating and supporting the implementation under the established energy policies, management and development plans.

National testing laboratories

Thailand has two national laboratories accredited for testing lighting products - the government-owned laboratory at the Thai Industrial Standards Institute and the Electrical and Electronics Institute testing laboratory.

Monitoring, verification and enforcement elements

In support of the *Energy Efficiency Labelling No. 5 Programme*, Thailand conducts significant MVE activities for which Electricity Generating Authority of Thailand has set a budget through the Thai tariff mechanism. The current status of the individual MVE elements is described below:

Entry conditions

Eligible products wishing to use the voluntary No. 5 energy efficiency label must apply to Electricity Generating Authority of Thailand for use of the label and submit products to the Electrical and Electronics Institute for testing to confirm the performance levels claimed.

Registration System

Thai Industrial Standards Institute administers a registration system for lighting products. For the labelling programme, it covers brand, type, model, size, colour, lumen/watt. Minimum and high efficiency performance standards for lighting equipment such as self-ballasted lamps, single-capped fluorescent lamps and double-capped fluorescent lamps registration are voluntary. All lighting equipment must be registered for the electromagnetic compatibility standard.

Product performance database

Thailand has a product performance database for lighting products which is accessible to the public for searching via the Electricity Generating Authority of Thailand website[36]. There is no fee to include a product on the database; entry into the database is not mandatory as part of the product registration process.

Market surveillance

Thailand has a programme to check products in the market place. Surveillance of certification marks by the Thai Industrial Standards Institute is carried out to ensure that the certified products continue to conform to the applicable standards and that the manufacturer is still capable of maintaining the quality of the certified product. One such activity was documented as part of the *lites.asia* collaborative labelling display survey project[37], where EGAT undertook an extensive survey in January and February 2013 in four provinces[38] to understand the status of labelling of the compact fluorescent lamps sold in the lighting market and to examine any non-compliance issues with labelled compact fluorescent lamps. There is currently no documented protocol for conducting this activity and it has no defined budget.

Verification

Thailand has a programme for performance testing of the energy performance of lighting products sourced from the market. This is part of an agreed strategy developed by Department of Alternative Energy Development and Efficiency and Electricity Generating Authority of Thailand. The activity is carried out on an annual basis by Thai Industrial Standards Institute and Electricity Generating Authority of Thailand against a documented protocol and the testing is carried out by the Electrical and Electronics Institute. Electricity

[35] www.eppo.go.th
[36] http://labelno5.egat.co.th
[37] www.lites.asia/downloads/labelling-display-survey
[38] Bangkok, Nonthaburi, Pathum Thani and Samut Prakan

Generating Authority of Thailand allocates the budget for this activity every year.[39] Thai Industrial Standards Institute recognises the results from the programmes for performance testing of lighting products in other countries, however a witness test by a Thai Industrial Standards Institute official is required, and Electricity Generating Authority of Thailand accepts the results of other countries for registration in principle if they are from accredited laboratory. However, Thailand is in the process of switching to a self declaration system, starting with light emitting diodes.

Enforcement

Thailand has a legal framework in place for authorising the enforcement of non-compliance which, through the key role that the Department of Alternative Energy Development and Efficiency has played in harmonization of energy efficiency standards in ASEAN, is influencing a larger economic region. The administrators of the framework are Thai Industrial Standards Institute and the Department of Alternative Energy Development and Efficiency. In particular, Thai Industrial Standards Institute has the role to protect consumers from non-compliance especially in relation to safety requirements.

Some guidelines are in place for the control measures that are applied should a product fail to meet the declared performance on the label during the verification check testing procedure. If the test results demonstrate that the product still meets the requirements of the No. 5 label, the manufacturers/ importer would be forced to edit the information published and the Electricity Generating Authority of Thailand supplies new labels based on the new test results. If the test results show that the product does not meeting the No. 5 label requirements, the Electricity Generating Authority of Thailand will call back all distributed labels of the unqualified models and exclude these models from participation in the labelling program for at least one year. There is no provision for the publication of the outcomes of enforcement nor for any funds collected from non-compliance penalties to be directed to the MVE program budget.

Obstacles and opportunities

The voluntary nature of the current MEPS and labelling for lighting products is perceived by the country contacts interviewed to be one of their major challenges, along with convincing the government of the importance and benefits of the introduction of mandatory MEPS. Support is therefore required for:

- Analysis of current data to identify the benefits of specific targeted programs for the residential sector;
- Undertaking a market baseline assessment (in the absence of a comprehensive product registration database);
- Impact assessment of transition to light emitting diode lamps;
- Benchmarking the current labelling programme against those in other countries and assistance with MEPS development;
- The development of an MVE strategy and provision of MVE training;
- Setting up a full registration system.

Test laboratory training for light emitting diode testing and interlaboratory comparison to evaluate current test capacity and accuracy for all lighting products is also required.

Viet Nam

Viet Nam has a population of approximately 86.94 million and a GDP of $106,427 million. Its total on-grid electricity consumption is 85.5 TWh, with emissions of 129.68 Mt of CO_2. Lighting accounts for 12.03 TWh (14.1%) of this electricity consumption, accounting for emissions of 4.70 Mt of CO_2 and a cost of $1,123.34 million. Through its *Country Lighting Assessments,* UNEP en.lighten estimates that Viet Nam has a lighting savings potential of 4.99% of total on-grid electricity use – equivalent to savings of 4.26 TWh, 1.66 Mt of CO_2 emissions and $337.62 million.

Off-grid lighting

Viet Nam's off-grid population is 2.4% (2.1 million). UNEP en.lighten's *Off-Grid Country Lighting Assessment* for Viet Nam estimates that it has an off-grid savings potential of 133.9 Mt of CO_2 and $60.4 million.

[39] About 2.3 M Baht ($71, 400) for testing and about 2.9 M Baht ($90,000) for appliance procurement.

Efficient lighting policy context and monitoring, verification and enforcement regulations

Viet Nam does not have any specific plan or policy to completely eliminate inefficient lighting products. However, in future, policy makers will gradually restrict and remove those products that do not meet performance requirements.

The legal and administrative framework for the introduction and implementation of MEPS and energy labelling in Viet Nam is provided by[40]:

- Decree 80/2006: The 2006-2010 Electricity Saving Program;
- Decree 79/2006/ND-CP: National Strategic Program on Energy Saving and Effective Use;
- Decree 73/2011: Regulation on sanctions for violations of energy efficiency regulations;
- Decision 51/2011: Overview of the plans for implementing MEPS and Labelling in Viet Nam;
- Decree 21/2011: Detailed regulations and measures for implementation of the Law on energy efficiency and conservation;
- Circular 7, April 2012: Regulations for the implementation of energy labelling in Viet Nam.

Decision No. 51/2011 promulgated by the Prime Minister on 12 September 2011, states that from 1 January 2013, importation, production, and circulation of tungsten light bulbs with capacity higher than 60W will be prohibited. From 1 January 2014, import and production of lamps that do not meet minimum energy performance standards will be prohibited.

Through the *Viet Nam Energy Efficiency Standards and Labelling Program*, the Government of Australia (2014) is providing support for the implementation of MEPS for appliances and equipment, alongside a program of energy labelling, under this legislation. The project consists of a range of activities designed to build sustainable capacity within Viet Nam to set and enforce standards, test appliances and monitor and evaluate the MEPS and labelling program. Activities under the project of relevance to MVE include:

- Working with the Viet Nam Standards and Quality Institute to ensure that test and performance standards are consistent with international best practice and appropriate to local circumstances;
- Contributing to the design and implementation of an online registration system and providing resources to assist in the processing of applications;
- Working with the Ministry of Industry and Trade and the regional Department of Industry and Trade offices to develop a robust enforcement regime, consisting of compliance surveys and verification testing, and to establish relevant enforcement policies, procedures and staff manuals;
- Supporting the development of local test capacity and technical and commercial skills in laboratories through training and local and international round robin testing;
- Assisting in the development of initiatives to communicate the MEPS and labelling program to manufacturers, installers, retailers and consumer.

Mandatory labelling and voluntary MEPS for lighting products[41] are currently in place, with the introduction of mandatory MEPS scheduled for January 2015. There are also plans to develop labelling for light emitting diode lamps, to be implemented in 2016.

The *UNDP-GEF Energy Efficiency Public Lighting* project is aimed at building both technical and policy support for transition to more energy efficient public lighting. This project seeks to assist local governments to promote and implement new and efficient lighting systems through innovative delivery mechanisms, impacting appropriate regulations for the public lighting systems, facilitating standards for street lighting and schools, providing technical assistance to local manufacturers, and developing mechanisms to extend lighting service to new areas.

The UNEP-GEF, *Phasing out Incandescent Lamps through Lighting Market Transformation in Viet Nam* project, commenced in 2010 with the objective to promote a large scale market transformation towards efficient lighting.

[40] www.lites.asia/files/otherfiles/0000/0224/Sharing_experience_with_Indonesia_Viet Nam_Bui_Ngoc_Bich.pdf
[41] Linear fluorescent tubes, compact fluorescent lamps, electromagnetic ballasts, electronic ballasts

Viet Nam is a member of APEC and ASEAN and an associate member of the IEC. Viet Nam participates in the BRESL project.

Organisations involved in monitoring, verification and enforcement

The organisations involved in monitoring, verification and enforcement, and their roles, are described below:

Ministry of Industry and Trade

Under Viet Nam standards and labelling legislation, the Ministry of Industry and Trade is the regulator for these activities; it is responsible for market surveillance and undertakes this function together with the 63 regional offices of the Department of Industry and Trade which are the 'local offices' of Ministry of Industry and Trade in regional/local government. Both Ministry of Industry and Trade and Department of Industry and Trade have powers to undertake market surveillance activities, test product performance and carry out enforcement activities.

Within the Ministry of Industry and Trade, the Office for Energy Efficiency and Conservation is responsible for certifying products and managing labelling.

Directorate for Standards and Quality

The Directorate for Standards and Quality[42] is the national standards body under the Ministry of Science and Technology in Viet Nam and has responsibility to advise the Government on issues in the fields of standardization, metrology and quality management in the country. Within the Directorate, the Viet Nam Standards and Quality Institute is responsible for Viet Nam national standards development

National testing laboratories

Viet Nam has three national laboratories with facilities for testing lighting products, two of which are accredited:

- Technical Center for Standards and Quality 1 (QUATEST 1)
- Technical Center for Standards and Quality 2 (QUATEST 2)

In addition, specialized laboratories accredited by the standards of the Vietnam Laboratory Accreditation Scheme, laboratories accredited by accreditation bodies which have signed mutual recognition agreements (International Laboratory Accreditation Cooperation and Asia Pacific Laboratory Accreditation Cooperation) and laboratories certified by the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components may test energy using products as a basis for the certification of energy saving products.

Monitoring, verification and enforcement elements

A small budget for MVE activities is available from Government and successful completion of the *Viet Nam Energy Efficiency Standards and Labelling Program* should see the integration of a robust MVE scheme into the Viet Nam standards and labelling programme. The current status of the individual MVE elements is described below:

Entry conditions

To qualify for mandatory labelling, the manufacturer or supplier must register each batch or lot of products and supply a test report from an the Ministry of Industry and Trade approved independent laboratory or the manufacturer must be certified by the Ministry of Industry and Trade inspectors. The Ministry of Industry and Trade must be advised of any changes to the design of the model if it impacts on energy performance, and provide a new independent test report.

Registration system

An online registration system has been developed as part of the *Viet Nam Energy Efficiency Standards and Labelling Program*. This is administered by the Office for Energy Efficiency and Conservation within Ministry of Industry and Trade. Registration for MEPS and energy labelling for compact fluorescent lamps, linear

[42] www.tcvn.gov.vn

fluorescent lamps and ballasts is mandated, while registration of public lighting may be undertaken voluntarily.

Product performance database

Currently, Viet Nam does not have a product performance database for lighting products.

Market surveillance

Viet Nam has a programme in place for checking products in the market place. Market surveillance is managed by the Office for Energy Efficiency and Conservation within the Ministry of Industry and Trade and carried out by the Department of Industry and Trade on an ad hoc basis.

One such survey was documented as part of the *lites.asia* collaborative labelling display survey project[43] between 19 December 2013 and 26 January 2014 of lighting products offered for sale in the cities of Hanoi, Ho Chi Minh, Quang Tri and Can Tho. The objective of the survey was to determine the extent to which lighting products offered for sale in the Viet Nam market are correctly labelled and, with respect to the endorsement label for lighting technologies, to gain an understanding of the prevalence of the high efficiency label by product type and location.

Verification

The compliance regime being developed by the *Viet Nam Energy Efficiency Standards and Labelling Program* also includes the development of a strategic plan for verification testing. This will be managed by Office for Energy Efficiency and Conservation within the Ministry of Industry and Trade.

Under the current system, if complaints are received, the Ministry of Industry and Trade is required to send samples of the product to the General Department of Energy for testing (Circular 7). Further samples of products may be requested and tested. Where a product fails to meet the required standard, the supplier must pay for the testing costs and carry the cost of rectifying the situation.

Specific activities have also been undertaken to help develop the technical capacity of Viet Nam's lighting testing laboratories. For example, in an activity under the cooperation agreement between UNEP and the Global Efficient Lighting Centre[44], the Centre investigated the general status of QUATEST 1 and QUATEST 3 on lighting test capacities and laboratory management situations and discussed in detail with the two laboratories their requirements on staff training, equipment upgrading, technical capacity enhancement and quality management improvement. In addition, Ministry of Industry and Trade has commissioned round robin testing of some lamps. At this stage, lamp testing laboratories in Viet Nam do not service other countries, but this would be a possibility.

Viet Nam collaborates with foreign laboratories in Thailand and Korea for the testing of some electrical appliances such as air conditioners, fridges and washing machines.

Enforcement

Viet Nam has a legal framework in place for authorising the enforcement of non-compliance and the *Viet Nam Energy Efficiency Standards and Labelling Program* will establish relevant enforcement policies, procedures and staff manuals. The enforcement process is administered by the Ministry of Industry and Trade.

Obstacles and opportunities

Viet Nam is already benefiting from the extensive experience of the Australian government in developing, implementing and maintaining standards and labelling programmes and the successful completion of the *Viet Nam Energy Efficiency Standards and Labelling Program* should see the integration of a robust MVE scheme into the Viet Nam standards and labelling programme.

Issues such as access to skilled staff (and capacity) to carry out monitoring and compliance activities and testing are of moderate concern.

[43] www.lites.asia/downloads/labelling-display-survey
[44] www.gelc.com/shownews.asp?id=28

Conclusions

The current status of lighting MVE activities in the six countries in this study is summarised in Table 2. All have some lighting MVE activities, including quality assurance and/or regulatory enforcement programmes. Countries with MVE infrastructure include The Philippines, Thailand and Viet Nam. Indonesia is finalising draft regulations to define the MVE framework for lighting products. Cambodia and Lao PDR each have at least one MVE element in place and are investigating additional elements.

Table 2: Summary of lighting MVE activities in Cambodia, Indonesia, Lao PDR, Philippines, Thailand and Viet Nam

Country	Entry requirements	Registration system	Product performance database	Market surveillance	Verification programme	Enforcement framework	National lighting test laboratories
Cambodia	Yes	Yes (V)	No	No	No	No	0
Indonesia	Yes	Yes	No	No	No	No	6
Lao PDR	n/a	No	No	Yes	No	No	0
Philippines	Yes	Yes (V)	Yes	Yes	No	Yes	3
Thailand	Yes	Yes (V)	Yes	Yes	Yes	Yes	2
Viet Nam	Yes	Yes (V)	No	Yes	Yes	Yes	3

Notes: State-owned laboratories that have photometric measurement equipment and are involved in photometric testing

The countries face lighting MVE capacity barriers to varying extent, namely:

- **System:** MVE structures that enable the monitoring of lighting products (and the associated product declarations) either during production or sale and provide a framework for verification and enforcement activities are not comprehensive. For example, the infrastructure may only address electrical safety, or, products registered under voluntary labelling/endorsement programmes;
- **Infrastructure:** In the region and in countries where lighting test laboratories are already in place, the number of facilities and availability of suitable, well-maintained equipment, the need for ongoing professional training and financial restrictions for setting up and maintaining laboratories, are noted as barriers to starting and implementing more comprehensive lighting MVE activities;
- **Professional:** Access to energy, efficiency and lighting professionals with experience in planning, implementing and maintaining MVE programmes and developing the underpinning regulations and strategies is limited; training is required for policy makers, MVE programme managers and testing laboratory staff.

The absence of budgets and dedicated lighting MVE regulations and implementation strategies and plans to direct and coordinate monitoring, verification and enforcement activities in many countries adversely affects region's and the countries' abilities to tackle MVE in a structured manner.

Overcoming the systems and professional capacity issues go hand-in-hand. Although there are existing organisations and regional initiatives that offer support for MVE activities and occasional specialist conferences and workshops are held within the region on these issues, MVE systems are complex, and the number of individuals and organisations involved are numerous. As a result, existing exchanges may be limited in impact. In some cases, donors support the development of lighting MVE systems. However, such interventions are often short term and the institutional knowledge and experience may not be maintained long-term. There is a need for a mechanism for structured and long term support for training and knowledge sharing on MVE for policy makers, MVE programme managers and testing laboratory staff.

The current UNEP en.lighten initiative MVE efforts and associated *lites.asia* workshops provide resources and support for the region and countries to develop MVE strategies. The en.lighten Global Partnership can help each country leverage international resources and find opportunities to share and learn best practices from peers worldwide, choosing program models that are appropriate for their social, political and economic

situation, identifying new partners with whom they can cooperate, and aggregating their efforts to achieve sustainable and significant successes in efficient lighting. UNEP, bilateral donors including Australia, and other regional and International organizations can assist the six countries to build an enduring culture of knowledge exchange and facilitate a sustainable regional infrastructure for MVE training and support.

The specific technical skills and infrastructure requirements for lighting test facilities are very resource intensive, both to develop and operate, and to adapt to new requirements and/or products. Collaborative testing activities, training and interlaboratory comparison exercises can Increase regional MVE capacity. The significant financial and resource barriers to establishing new national testing laboratories can to some extent be countered by exploration of opportunities for sharing testing capacity through mutual recognition agreements and infrastructure. The region is exploring the potential benefits of aligning test methods, performance standards and certification procedures that would enable mutual recognition agreements.

A forthcoming UNEP report will provide detailed information on the MVE testing laboratory infrastructure for lighting in the six target countries and examines the particular barriers that must be addressed to extend infrastructure capacity for lighting products. The specific technical skills and infrastructure requirements for lighting test facilities are very resource intensive, both to develop and for maintenance of the ongoing technical capacity to continue functioning, and to adapt to new requirements and/or products. Thus, maximising the effectiveness of existing capacity through training and interlaboratory comparison exercises is crucial.

The significant financial and resource barriers to the establishment of new national testing laboratories can to some extent be countered by exploration of opportunities for sharing testing capacity through mutual recognition agreements and infrastructure. The ASEAN Economic Community offers a vision for regional harmonization. As plans evolve, the region and its countries can consider how best to incorporate efficient lighting strategies and supporting MVE infrastructure and capacities.

Annex I: Supporting Data

Table 3: Statistics on energy consumption, emissions and potential savings from efficient lighting in Southeast Asia (*Country Lighting Assessments*, UNEP, 2010)

Country	Total electricity consump-tion	CO_2 emission total	Electricity consump-tion in lighting	CO_2 emission in lighting	Lighting share of electricity consump-tion	Efficient lighting saving potential	Efficient lighting electricity saving potential	Efficient lighting saving potential	Efficient lighting saving potential	Current cost in lighting	Efficient lighting cost savings potential	Efficient lighting saving potential
	TWh	Mt CO_2	TWh	Mt CO_2	% of total	TWh	% of total electricity use	Mt CO_2	% of total electricity CO_2 emissions	$ million	$ million	% of current lighting costs
Brunei Darussalam	3.42	13.05	0.46	0.34	13.3%	0.20	5.73%	0.14	1.11%	25.83	8.26	31.98%
Cambodia	2.14	5.24	0.32	0.36	14.9%	0.10	4.89%	0.12	2.27%	28.99	9.57	33.03%
Indonesia	147.96	427.32	22.19	17.03	15.0%	9.35	6.32%	7.17	1.68%	1,961.93	650.60	33.16%
Lao PDR	2.87	1.63	0.38	0.08	13.4%	0.13	4.63%	0.03	1.79%	32.71	9.43	28.84%
Malaysia	105.43	223.59	17.55	11.69	16.6%	5.74	5.45%	3.83	1.71%	2,037.20	554.86	27.24%
Myanmar	5.19	13.42	0.74	0.13	14.3%	0.26	5.09%	0.05	0.34%	44.24	9.67	21.85%
Philippines	55.62	80.22	8.34	3.95	15.0%	3.51	6.32%	1.67	2.08%	1,885.89	760.96	40.35%
Singapore	41.07	28.96	4.40	2.25	10.7%	1.55	3.77%	0.79	2.73%	709.81	237.01	33.39%
Thailand	146.67	296.10	18.21	9.45	12.4%	6.54	4.46%	3.40	1.15%	2,099.47	670.70	31.95%
Timor-Leste	0.07	0.20	0.01	0.01	19.9%	0.00	6.76%	0.00	1.73%	1.74	0.51	29.14%
Viet Nam	85.50	129.68	12.03	4.70	14.1%	4.26	4.98%	1.66	1.28%	1,123.34	337.62	30.06%
Totals	**595.93**	**1,219.41**	**84.65**	**50.00**	**14.2%**	**31.66**	**5.32%**	**18.86**	**1.55%**	**9,951.15**	**3,249.18**	**32.65%**

Source: UNEP en.lighten initiative; except value in italics for Lao PDR, personal communication from Viengsay Chantha (Lao PDR Ministry of Energy and Mines)

Table 4: Policy context and membership summary for Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam

Country	National energy policy	National energy efficiency policy	Formal phase-out commitment	APEC member	ASEAN member	BRESL member	IEC member
Cambodia	Yes	Yes	No	No	Yes	No	Associate
Indonesia	Yes	Yes	No	Yes	Yes	Yes	Full
Lao PDR	No	Under development	Under consideration	No	Yes	No	Affiliate
Philippines	No	Yes	Yes	Yes	Yes	No	Full
Thailand	Yes	Yes	Yes	Yes	Yes	Yes	Full
Viet Nam	No	Yes	No	Yes	Yes	Yes	Associate

Table 5: Policy interventions summary for Cambodia, Indonesia, Lao PDR, the Philippines, Thailand and Viet Nam. (CF: compact fluorescent; LED: light emitting diode)

Country	Lamp type	Policy Interventions									
		MEPS	HEPS	Comparative labelling	Endorsement labelling/ certification	Import registry	Domestic product registry	Mandatory testing	Market surveillance program	Registry of non-compliant products	Fines or penalties
Cambodia	CF	No	No	No	No	Yes	Yes	Yes	No	No	Yes
	LED	No	No	No	No	Yes	Yes	Yes	No	No	Yes
	Incandescent	No	No	No	No	Yes	Yes	Yes	No	No	Yes
	Halogen incandescent	No	No	No	No	No	No	No	No	No	No
	Other	No	No	No	No	Yes	Yes	Yes	No	No	Yes
Indonesia	CF	Under review	No	Under review	No	Yes	Yes	Yes	Yes	No	Yes
	LED	In preparation	Under consideration	Under consideration	Under consideration	-	-	-	-	-	-
	Incandescent	-	-	-	-	-	-	-	-	-	-
	Halogen incandescent	-	-	-	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-	-	-
Lao PDR	CF	No	No	No	No	Yes	Yes	n/a	n/a	n/a	n/a
	LED	No	No	No	No	Yes	Yes	n/a	n/a	n/a	n/a
	Incandescent	No	No	No	No	Yes	Yes	n/a	n/a	n/a	n/a
	Halogen incandescent	No	No	No	No	Yes	Yes	n/a	n/a	n/a	n/a
	Other	No	No	No	No	Yes	Yes	n/a	n/a	n/a	n/a
Philippines	CF	Yes	-	Yes	-	-	Yes	Yes	Yes	-	-
	LED	-	-	-	-	-	Yes	No	-	-	-
	Incandescent	Yes	-	-	-	-	Yes	No	-	-	-
	Halogen incandescent	-	-	-	-	-	Yes	No	-	-	-
	Other	Yes	-	-	-	-	Yes	Yes	Yes	-	-
Thailand	CF	Voluntary	Voluntary	Voluntary	-	--	-	Yes	Yes	-	Yes
	LED	-	-	Voluntary	-	-	-	-	-	-	-
	Incandescent	-	-	-	-	-	-	-	-	-	-
	Halogen incandescent	-	-	-	-	-	-	-	-	-	-
	Other	-	-	Voluntary	-	-	-	-	-	-	-
Viet Nam	CF	Voluntary	Voluntary	Yes	Voluntary	Yes	Yes	Yes	Yes	-	Yes
	LED	-	-	-	-	-	-	-	-	-	-
	Incandescent	-	-	-	-	-	-	-	-	-	-
	Halogen incandescent	-	-	-	-	-	-	-	-	-	-
	Other	Voluntary	Voluntary	Yes	Voluntary	Yes	Yes	Yes	Yes	-	Yes

Note: A hyphen indicates that no information (either positive or negative was supplied by the country in response to the survey questionnaire used to develop the table

Table 6: Off-grid lighting statistics for Cambodia, Indonesia, Lao PDR, Philippines and Viet Nam

Country Name	Off-grid population	Off-grid population	Off-grid lighting cost savings potential	Off-grid lighting CO_2 emissions savings potential
	million	% of total population	million$	Mt CO_2
Cambodia	10.7	76.0	220.0	691.3
Indonesia	85.2	35.5	792.0	5.5
Lao PDR	2.8	45.0	81.0	179.5
Philippines	9.6	10.3	270.1	598.3
Viet Nam	2.1	2.4	60.4	133.9
Totals	**110.4**		**1,423.5**	**1,608.5**

Source: UNEP en.lighten initiative (2014a). An *Off-Grid Country Lighting Assessment* was not published for Thailand, which has 99.3% electrification.

Annex II: Regional Initiatives for the Promotion of Efficient Lighting Monitoring, Verification and Enforcement

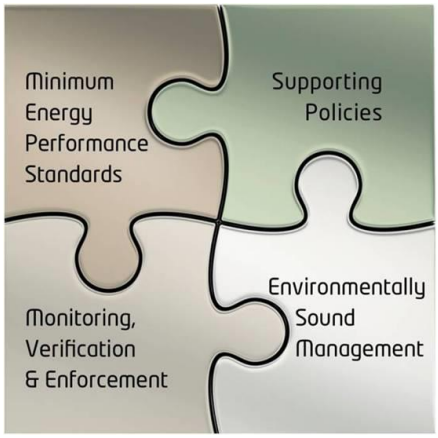
Many initiatives offer information, policy and technical resources to Southeast Asia to tackle the promotion of efficient lighting monitoring, verification and enforcement (MVE).

International knowledge sharing and resource providers

en.lighten

The en.lighten initiative[45] was established in 2009 by UNEP with support from the Global Environment Facility (GEF) and private sector partners to accelerate a global market transformation to environmentally sustainable, energy efficient lighting technologies, as well as to develop strategies to phase-out inefficient incandescent lamps to reduce CO_2 emissions and the release of mercury from fossil fuel combustion. It serves as a platform to build synergies among international stakeholders; identify global best practices and share this knowledge and information; create policy and regulatory frameworks; address technical and quality issues; and encourage countries to develop national and/or regional efficient lighting strategies (UNEP 2014b).

MVE is one of the four key elements of the initiative's integrated policy approach to the global transition to energy efficient lighting and significant resources have been developed to support national governments with this aspect of their national strategy.



At the core of these resources is the *Achieving the Global Transition to Energy Efficient Lighting Toolkit* (UNEP 2012b) a practical reference manual that identifies essential elements that need to be considered before and after inefficient lighting phase-out schemes have been initiated. *Section 4: Ensuring product availability and conformance* provides best practice information about market surveillance, compliance schemes and testing capacities to ensure the success of policies intended to transform the market to efficient lighting by increasing the range of complaint products. These topics are further discussed by MVE experts in periodic en.lighten webinars, recordings of which are available on the en.lighten website[46], and, through the *Ask the Expert*[47] facility on the UNEP en.lighten website, where questions can be submitted at any time to MVE experts.

UNEP en.lighten has also compiled country data allowing countries to compare their status in the transition to efficient lighting with that of other countries. This is illustrated graphically in the *Global Policy Map*[48] which

45 www.enlighten-initiative.org
46 learning.enlighten-initiative.org/Webinars.aspx
47 learning.enlighten-initiative.org/AsktheExpert.aspx
48 www.enlighten-initiative.org/ResourcesTools/GlobalPolicyMap.aspx

provides an overview of energy efficient lighting policies in over 150 countries around the world. The detailed information highlights national lighting policies aimed at the phase-out of inefficient lighting in all sectors, and their replacement with energy efficient lighting products, including country policy status summaries on MVE activities.

The more detailed *Country Lighting Assessments*[49] estimate the savings potential of a country from transition to energy efficient lighting. These assessments consider savings potentials for both the on-grid lighting market, encompassing the residential, commercial/industrial and outdoor lighting sectors, and the off-grid lighting market, in countries that have a high number of off-grid end users.

The UNEP en.lighten Global Efficient Lighting Partnership Programme[50] offers participating countries the opportunity to work with UNEP en.lighten and other countries within their region to achieve a coordinated transition to efficient lighting. Participation in this strategic programme, which sets shared objectives and provides technical support to partner countries, assists countries to design and implement a set of policies and approaches that will enable the transition to energy-efficient lighting quickly and cost-effectively. The Center of Excellence, comprised of en.lighten expert Taskforces representing over 30 organizations from 46 countries, provides targeted technical expertise to support the development of these policies in a manner that maximizes the time and resources required to implement viable National or Regional Efficient Lighting Strategies[51] and coordinated regional activities.

The Global Efficient Lighting Centre (GELC)[52] is a joint collaboration between UNEP and the National Lighting Test Centre (NLTC). GELC supports countries by assisting in the establishment, or strengthening, of national and/or regional lighting laboratories by:

- Providing technical advice for the development and implementation of effective product quality surveillance mechanisms for national, regional and global institutions;
- Developing quality checking control tests commissioned by governments and the private sector;
- Providing professional guidance to countries for establishing new, or enhancing existing, lighting laboratories and quality management systems;
- Offering technical training for the testing of lighting products;
- Improving manufacturing techniques for energy efficient products;
- Providing expert guidance for policy and regulatory issues associated with the production of efficient lighting.

CLASP

CLASP[53] is an international resource for energy efficiency standards and labels for appliances, lighting, and equipment. It develops and shares practical and transformative policy and market solutions in collaboration with global experts and local stakeholders. CLASP's MVE resources include a best practice guidebook on MVE, *Compliance Counts: A Practitioner's Guidebook on Best Practice Monitoring, Verification, and Enforcement for Appliance Standards & Labelling*, a MVE Publications Library[54] and MV&E Economy Access[55] a searchable database of MVE information in economies around the world (2014).

International Energy Agency 4E Solid State Lighting Annex

The International Energy Agency 4E Solid State Lighting Annex (IEA 4E SSL Annex) was established in 2009 under the framework of the International Energy Agency (IEA)'s Efficient Electrical End-Use Equipment (4E) Implementing Agreement to provide advice to its ten member countries[56] on implementing quality assurance programmes for solid state lighting (IEA 2014). It is undertaking three major collaborative tasks, to:

- Develop performance criteria for quality assurance in solid state lighting products;

49 www.enlighten-initiative.org/ResourcesTools/CountryLightingAssessments/WhataretheCountryLightingAssessments.aspx
50 www.enlighten-initiative.org/CountryActivities/GlobalEfficientLightingPartnershipProgramme.aspx
51 www.enlighten-initiative.org/CountryActivities/GlobalEfficientLightingPartnershipProgramme/DevelopingaNationalEfficientLightingStrategy.aspx
52 learning.enlighten-initiative.org/CapacityBuilding.aspx
53 www.clasponline.org
54 www.clasponline.org/Resources/MVEResources/MVEPublicationLibrary
55 www.clasponline.org/Resources/MVEResources/MVEEconomyAccess
56 Australia, China, Denmark, France, Japan, The Netherlands, Republic of Korea, Sweden, United Kingdom and United States of America

- Determine the robustness of solid state lighting test procedures through international round-robin laboratory testing campaigns and, where necessary, suggest improvements to test methodologies;
- Recommend suitable accreditation frameworks for solid state lighting testing laboratories.

The Annex specifically provides support for MVE activities for solid state lighting through:

- Market monitoring exercises;
- Benchmarking performance of solid state lighting products;
- Best practice in MVE programme activities;
- Global interlaboratory comparison exercises.

Although the activities of the Annex focus on the ten member countries, many of the outputs and participation in the interlaboratory comparison exercises are open to non-member countries (Coyne 2014).

Regional cooperation organisations

APEC

Asia-Pacific Economic Cooperation (APEC) is a forum for 21 Pacific Rim member economies[57] that seeks to promote free trade and economic cooperation throughout the Asia-Pacific region. The Asia-Pacific Economic Cooperation Expert Group on Energy Efficiency and Conservation (APEC EGEE&C)[58] promotes energy conservation and the application of energy efficiency practices and technologies in the APEC region. It does this by: advancing the application of demonstrated energy efficiency practices and technologies; contributing to international efforts to reduce the adverse impacts of energy production and consumption; and improving the analytical, technical, operational, and policy capacity for energy efficiency and conservation within APEC Economies.

This includes MVE best practices exchange and building compliance capacity in the APEC region**.** Recent activities include a project to compile and disseminate information on MVE processes used by regulatory and enforcement agencies to ensure compliance in standards and labelling programs within APEC economies and the resulting publication, *Survey of Market Compliance Mechanisms for Energy Efficiency Programs in APEC Economies*[59]. Currently underway are a project to assess the verification testing capacity in the APEC region and identify cost effective options for collaboration[60] and a project to catalyse MVE best practices exchange and building compliance capacity in the APEC region (APEC 2014). This project aims to create an APEC network of MVE authorities to ensure long-term sustainability of a MVE network in the APEC region and build capacity for economies to implement effective and robust MVE policies.

ASEAN

The Association of Southeast Asian Nations (ASEAN) is a political and economic organization of ten countries[61] in Southeast Asia. Under Programme Area No. 4, Energy Efficiency and Conservation, ASEAN works to promote cooperation in energy efficiency and conservation by enhancing public awareness and creating markets for energy efficient products made in ASEAN (2014). This includes a strategy to investigate an ASEAN Energy Efficiency and Conservation labelling system with the objective for all electrical products manufactured and marketed in the ASEAN to be labelled adequately showing their efficiency ratings. The implementing agency for these activities is the ASEAN Centre for Energy (AEMAS 2014). In May 2014, the Centre released a report, *ASEAN Energy Efficiency Development and Its Associated Activities*.

BRESL

The Barrier Removal to the Cost Effective Development and Implementation of Energy Efficiency Standards and Labeling (BRESL 2014) project is a five year international co-operation project sponsored by the United Nations Development Programme (UNDP) and the Global Environment Facility[62]. Its six participating

[57] Australia; **Brunei Darussalam**; Canada; Chile; People's Republic of China; Hong Kong, China; **Indonesia**; Japan; Republic of Korea; **Malaysia**; Mexico; New Zealand; Papua New Guinea; Peru; **The Philippines**; Russia; **Singapore**; Chinese Taipei; **Thailand**; The United States; and **Viet Nam**
[58] www.egeec.apec.org
[59] publications.apec.org/publication-detail.php?pub_id=1285
[60] www.clasponline.org/RFPsPartnerships/RFPs/ClosedRFPs/2013/RFP11-13
[61] Brunei Darussalam; Cambodia; Indonesia; Lao PDR; Malaysia; Myanmar; Philippines; Singapore; Thailand; and Viet Nam
[62] Scheduled to complete at the end of 2014/early 2015

countries include Indonesia, Thailand and Viet Nam[63] and its target products include compact fluorescent lamps and ballasts for linear fluorescent lamps[64]. Its remit includes:

- Policy-making support to government;
- Capacity building of public institutions and testing and certification infrastructure;
- Manufacturing and market development support;
- Technical and demonstration support;
- Awareness raising and promotion; and, regional cooperation.
- As part of these activities it is attempting to develop a harmonised testing protocol and energy efficiency standards for compact fluorescent lamps and ballasts in the region.

Funding organisations

Developing and implementing MVE strategies and programmes can be expensive. However, where schemes can demonstrate significant potential cost savings and environmental and developmental benefits, finance can be leveraged from regional and international funding organisations such as the Asian Development Bank (ADB)[65], the Global Environment Facility (GEF)[66] and the World Bank[67]. For example, Vietnam has received GEF grants for two projects currently under implementation - *Local Development and Promotion of LED Technologies for Advanced General Lighting*[68] and *Phasing out Incandescent Lamps through Lighting Market Transformation in Vietnam*[69] and the *Philippine Energy Efficiency Project*[70] and *Mitigation of Climate Change through Increased Energy Efficiency and the Use of Clean Energy*[71] both received ADB financing.

International Standards Bodies

CIE

The International Commission on Illumination (CIE)[72] is an independent, non-profit organisation devoted to worldwide cooperation and the exchange of information on all matters relating to the science and art of light and lighting, colour and vision, photobiology and image technology. It serves member countries on a voluntary basis but, since its inception in 1913, it has become a professional organization and has been accepted as representing the best authority on the subject. As such, it is recognized by International Standards Organization (ISO) as an international standardization body.

IEC

The International Electrotechnical Commission (IEC)[73] is the international body that prepares and publishes international standards for all electrical and electronic technologies, including lighting products. The technical committee with responsibility for drafting lighting standards is TC 34, *Lamps and Related Equipment*, and subcommittee SC 34A, *Lamps*, prepares international standards for lamps, LEDs and glow starters. Membership of IEC and participation in these committees enables countries to contribute to the standards development process.

ISO

The International Standards Organization (ISO)[74] is an independent, non-governmental organisation made up of members from the national standards bodies of 161 member countries. It is the world's largest developer of voluntary international standards and has published over 19,500 international standards covering almost all aspects of technology and business.

ISO is not involved in the certification to any of the standards it develops. Certification is performed by

[63] In addition to Bangladesh, China and Pakistan
[64] Along with refrigerators, room air conditioners, electric motors, electric fans, and rice cookers
[65] www.adb.org
[66] www.thegef.org
[67] www.worldbank.org
[68] www.thegef.org/gef/project_detail?projID=5555
[69] www.thegef.org/gef/project_detail?projID=3755
[70] www.adb.org/projects/42001-013/main
[71] www.adb.org/projects/43207-012/main
[72] From its French title, the Commission Internationale de l´Eclairage; www.cie.co.at/
[73] www.iec.ch
[74] www.iso.org

external certification bodies. However, ISO's Committee on Conformity Assessment (2014) has produced a number of standards that relate to the certification process. The voluntary criteria contained in these publications are an international consensus on good practice relating to certification.

Accreditation bodies and mutual recognition agreements

Many countries have established accreditation bodies with the primary purpose of ensuring that organisations undertaking assessments against national, regional and international standards are subject to oversight by an authoritative body (ILAC 2014). In turn, these accreditation bodies, which have been evaluated by peers as competent, sign arrangements that enhance the acceptance of products and services across national borders, thereby creating a framework to support international trade through the removal of technical barriers.

These arrangements are managed by the International Accreditation Forum[75], in the fields of management systems, products, services, personnel and other similar programmes of conformity assessment, and the International Laboratory Accreditation Cooperation (ILAC)[76], in the field of laboratory and inspection accreditation.

Regional mutual recognition agreements (MRA) for accredited lighting testing laboratories provide a mechanism to facilitate the sharing of testing results across the region and help extend the testing laboratory capacity available to countries in support of their strategies for the transition to more efficient lighting. Such agreements must usually be brokered via a recognised cooperation body. For Southeast Asia, the relevant regional cooperation body is the Asia Pacific Laboratory Accreditation Cooperation[77] (2014). Its primary objectives are:

- To provide a forum for exchange of information and to promote discussion among laboratory and inspection body accreditation bodies, and among organisations that are interested in laboratory and inspection body accreditation, and related activities;
- To improve the standard of accreditation services provided by members;
- To organise proficiency testing and related activities in the region;
- To build up and to maintain mutual confidence in the technical competence among Full Members and to work towards further development of the Asia Pacific Laboratory Accreditation Cooperation multilateral mutual recognition arrangement (MRA);
- To promote the mutual recognition arrangement among Full Members, to other regional arrangements and to individual national and regional accreditation bodies;
- To promote international acceptance of endorsed test, calibration and inspection reports and other documents issued by laboratories and inspection bodies accredited by signatories to the Asia Pacific Laboratory Accreditation Cooperation MRA;
- To cooperate with other national, regional and international bodies with similar or complementary objectives.

Asia Pacific Laboratory Accreditation Cooperation was established in conjunction with International Laboratory Accreditation Cooperation and is represented on International Laboratory Accreditation Cooperation's Executive Committee.

[75] www.iaf.nu
[76] www.ilac.org
[77] www.aplac.org/home.html

References

AEMAS. 2014. ASEAN Centre for Energy – Implementing Agency. Accessed on 10 May 2014 at: www.aenodemas.org//10

APEC. 2014. Catalysing MV&E Best Practices Exchange and Building Compliance Capacity in the APEC Region. Accessed on 12 May 2014 at: aimp2.apec.org/sites/PDB/Lists/Proposals/DispForm.aspx?ID=1420

APLAC. 2014. About APLAC. Accessed on 11 May 2014 at: www.aplac.org/about.html

ASEAN. 2014. Programme Area No. 4: Energy Efficiency & Conservation. Accessed on 10 May 2014 at: www.asean.org/news/item/programme-area-no-4-energy-efficiency-conservation

Asian Development Bank. 2013. Lao PDR Energy Sector Assessment, Strategy, and Road Map. Accessed on 14 May 2014 at: www.adb.org/sites/default/files/lao-pdr-energy-assessment-2013-update.pdf

BRESL. 2014. Barrier Removal to the Cost Effective Development and Implementation of Energy Efficiency Standards and Labeling project. Accessed on 12 May 2014 at: www.bresl.com

CLASP. 2014. Monitoring, verification and enforcement. Assessed on 10 May 2014 at: www.clasponline.org/en/WhatWeDo/MonitoringVerificationEnforcement

Climate Change Department, Ministry of Environment, Cambodia. 2014. CCD roles and functions. Accessed on 13 May 2014 at: www.camclimate.org.kh/index.php/ccd/discussion-corner/ccd-roles-and-functions.html

Government of Indonesia. 2014. Portal Nasional Republik Indonesia. Accessed on 14 May 2014 at: indonesia.go.id

Coyne, Steve. 2014. IEA 4E SSL Annex Summary. Accessed on 12 May 2014 at: www.lites.asia/files/otherfiles/0000/0280/Kuala_Lumpur_lites.asia_meeting_1.3_IEA_SSL_Annex_Steve_Coyne.pdf

Energy and Environment Partnership—Mekong. 2011. Energy Savings Siem Reap-Promoting and Demonstrating Energy Conservation in Siem Reap, Cambodia. Accessed on 13 May 2014 at: www.eepmekong.org/_downloads/PPF18120903_CCCD.pdf

Government of Australia. 2014. Viet Nam Energy Efficiency Standards and Labeling Program. Accessed on 15 May 2014 at: www.energyrating.gov.au/Viet Nam-energy-efficiency-standards-and-labeling-program

IEA 4E SSL Annex. 2014. SSL Annex home. Access on 12 May 2014 at: ssl.iea-4e.org

ILAC, 2014. About ILAC. Accessed on 15 July 2014 at: www.ilac.org

ISO, 2014. Certification to ISO management system standards. Accessed on 15 July 2014 at: www.iso.org/iso/home/standards/certification.htm

lites.asia. 2013. Efficient Lighting in Asia: Regional Position Paper: Current Status, Opportunities and Constraints.

Uk, Sarikh. 2013. Personal communication

UNEP en.lighten initiative. 2011. Regional Report on Efficient Lighting in Southeast Asia.

ibid. 2012. Achieving the Transition to Energy Efficient Lighting. Accessed on 8 May 2014 at: learning.enlighten-initiative.org/toolkit.aspx

ibid. On-grid Country Lighting Assessments (2010 base). www.enlighten-initiative.org/ResourcesTools/CountryLightingAssessments/WhataretheCountryLightingAssessments.aspx

ibid. 2014. Off-grid Country Lighting Assessments. Accessed on 12 May 2014 at: www.enlighten-initiative.org/ResourcesTools/CountryLightingAssessments.aspx

ibid. About en.lighten. Accessed on 12 May 2014 at: www.enlighten-initiative.org/About.aspx

World Resources Institute. 2014. Country GHG emissions. Accessed on 10 May 2014 at: www.wri.org/resources/data-sets/country-ghg-emissions