

Chapter 8

Minimum Energy Performance Standards

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1. Introduction

Minimum energy performance standards (MEPS) for appliances and equipment are a widely used, cost-effective tool to improve the efficiency of products available or sold. They are used to define the minimum performance criteria that regulated thermal as well as electrical energy-using products have to meet before they can be manufactured or imported and placed in the market. They are designed to restrict the availability of low-efficiency products in the market by banning the sale of products that do not meet specified minimum energy-efficiency levels.

MEPS can be used as a regulatory tool to improve energy efficiency and to curb the impacts of climate change. MEPS aligned with international targets and best practices can be adopted to save energy and costs for consumers in Lao People's Democratic Republic (Lao PDR).

At the launch of the Super-Efficient Appliance Deployment Call to Action at the United Nations Climate Change Conference in Glasgow in 2021 (COP26), 14 economies pledged to double the efficiency of lighting, air conditioners, refrigerators, and industrial motors by 2030 (Mavandad and Malinowski, 2022). Model regulation guidelines were also developed for lighting, air conditioners, refrigerators, and industrial motors by United for Efficiency (U4E), a public-private partnership comprising the International Copper Association, National Resources Defense Council, and the United Nations Environment Programme.

Several economies in the Association of Southeast Asian Nations (ASEAN) region have adopted MEPS and energy labelling with mandatory enforcement (Table 8.1).

Table 8.1. Countries Adopting MEPS and Energy Labelling

Country	Implementation Agency	Participation Mode
Viet Nam	Ministry of Industry and Trade	Mandatory/Voluntary
Thailand	Electricity Generating Authority of Thailand	Voluntary
Malaysia	Energy Commission of Malaysia	Mandatory
Singapore	National Environment Agency	Mandatory
Indonesia	Ministry of Energy and Mineral Resources	Mandatory/Voluntary
Philippines	Department of Energy	Mandatory

MEPS = minimum energy performance standards.

Source: Author.

A list of equipment and appliances with MEPS in some regional economies is shown in Table 8.2.

Table 8.2. Equipment/Appliances with MEPS Implemented for Regional Economies

Equipment/ Appliances	Viet Nam	Thailand	Malaysia	Singapore	Indonesia	Philippines
Air Conditioners	√	√	√	√	√	√
Lamps	√	√	√	√	√	√
Refrigerators	√	√	√	√	√	√
Domestic Fans	√	√	√		√	√
Televisions	√	√	√	√		
Washing Machines	√	√	√			√
Microwave Ovens		√	√			
Electric Rice Cookers		√	√		√	
Freezers			√			
Clothes Dryers				√		
Water Heaters	√	√				
Electric Kettles		√				
Electric Irons		√				
Water Pumps		√				

MEPS = minimum energy performance standards.

Source: Author.

2. Energy-Efficiency Indicators

Various types of energy-efficiency indicators are used to define the energy-efficiency levels for equipment and appliances due to their unique functions and performance, such as air conditioners (consumption based on cooling load), water heaters (consumption based on volumetric heating/standby), and washing machines (consumption based on washing load/weight). Commonly used indicators include the Energy Star Index (%), energy-efficiency ratio, efficiency (%), cooling seasonal performance factor (CSPF), and lumens per watt (lm/W). These indicators reflect the product's energy efficiency and serve as a guide for consumers to select a product based on its energy performance.

3. MEPS Adoption

In the adoption and implementation of MEPS, the following social, economic, and environmental factors must be considered:

- (i) **Energy reduction potential.** The impact of energy savings that can be realised based on usage distribution and reduction potential must be considered in the selection of appliances.
- (ii) **Industry readiness.** The level of energy performance to be specified needs to consider the readiness of manufacturers.
- (iii) **High-energy performance.** These products have inherent higher costs, which could affect consumers' acceptance.

On the enforcement side, standards for product performance levels as well as regulations must be developed for MEPS implementation. Investment in human resources for effective management and enforcement is inevitable.

3.1. Product Selection

Due to the wide range of electrical appliances available in the market, selected appliances should be targeted for MEPS and labelling implementation. Targeted appliances to be regulated should be assessed based on their overall energy reduction potential. High-energy appliances have higher energy savings potential. The market penetration of a product also has a direct impact on energy savings as more widespread use of a product will result in greater energy consumption reduction.

3.2. Product Standards

For any appliance to be regulated, product standards must be in place so that the energy performance level of the product can be determined. Existing standards mandated by other economies could be referred to in the standards development process. Standards in use by other countries could be adopted (without any changes) or adapted with minor changes to suit the local environment and conditions. Product performance standards to be developed must outline the capacity range to be included or excluded, energy performance levels to be achieved, and testing method to be used.

3.3. Testing Standards

To verify the compliance of a product with energy-efficiency standards, tests based on accepted testing methods as stipulated in the product standards must be carried out. Testing standards set out specific testing methods and procedures required for the product so that the energy efficiency of the product can be verified. These standards provide independent assurance and enhance customers' confidence of the quality, reliability, and safety of products.

3.4. Product Registration

Appliances that fall under MEPS, known as 'regulated goods', should be registered with the relevant registration bodies. The registration of products, by manufacturers or importers, serves the purpose of monitoring and enforcing MEPS compliance.

4. MEPS Implementation

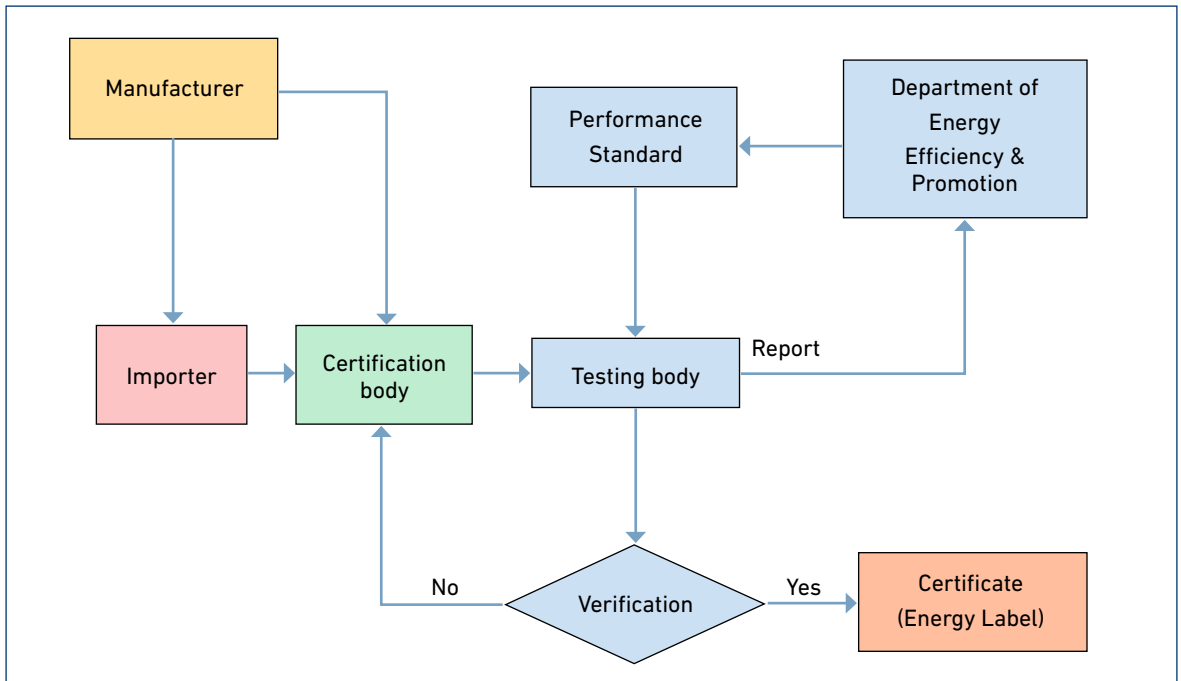
A systematic approach should be employed for MEPS implementation in Lao PDR. Table 8.3 depicts the roadmap, and Figure 8.1 summarises the implementation of MEPS and energy labelling.

Table 8.3. Roadmap and Implementation Programme for MEPS in Lao PDR

Phase	Milestones Activities	Target Groups	Organisations Involved	Time Schedule
Phase 1	Stakeholders engagement	DEEP	Engineering institutions and associations Regulatory bodies Standard-writing organisations Consumer associations	1 year
Phase 2A	Setting up of registration requirements	DEEP	DEEP	3 years
Phase 2B	Setting up of certification and assessment bodies/standard-working group/testing bodies for MEPS	DEEP and IS	DEEP and IS	1 year
Phase 3A	Certification and assessment bodies	DEEP and IS	DEEP and IS	1 year
Phase 3B	Standards working group	DEEP and IS	All stakeholders	2 years
Phase 3C	Testing lab	DEEP and IS	Appointed lab	5 years

DEEP = Department of Energy Efficiency and Promotion, IS = Institute of Standards, MEPS = minimum energy performance standards.
Source: Yau (2020).

Figure 8.1. Flow Diagram of MEPS and Energy Labelling Programme



MEPS = minimum energy performance standards.

Source: Author.

Involvement of government agencies and stakeholders are crucial. Relevant stakeholders, such as regulatory bodies, engineering institutions, manufacturers, importers, and consumer bodies, must be identified and incorporated for successful implementation.

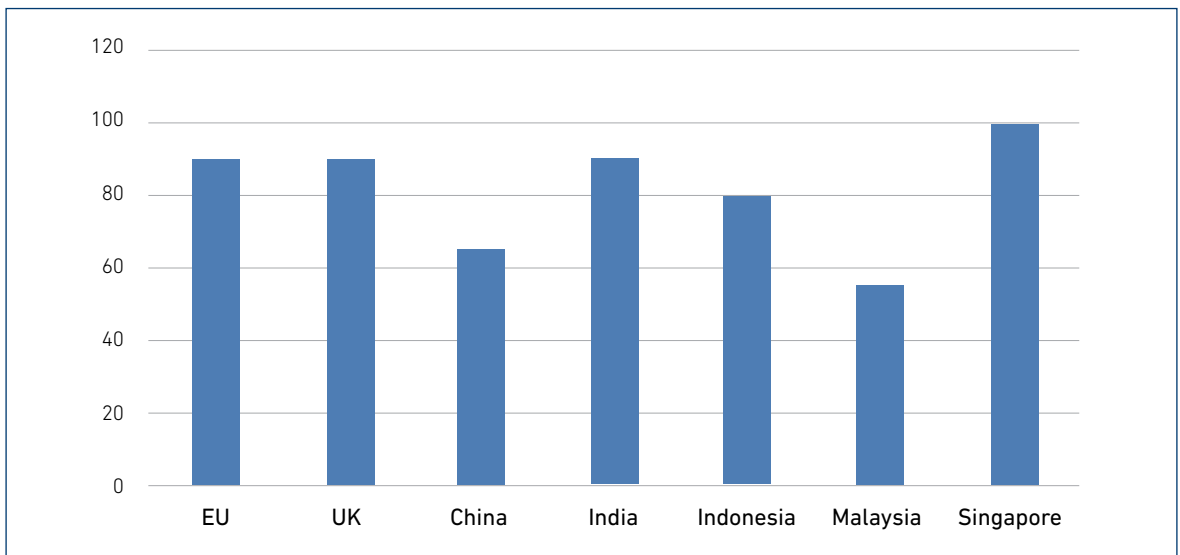
5. Specific MEPS Methodology

The methodology used for setting MEPS for commonly used equipment and appliances should be aligned with U4E's Model Regulation Guidelines.¹

5.1. Lighting

The metric used for lighting efficiency is lamp luminous efficacy or lm/W. The advent of LED has brought about tremendous improvement in lamp luminous efficacies from below 20 lm/W (incandescent lamps) to greater than 80 lm/W. Figure 8.2 shows a comparison of LED MEPS for some countries that have implemented lighting MEPS.

Figure 8.2. LED Lighting – MEPS Comparison
(lumens per watt)



EU = European Union, LED = light-emitting diode, MEPS = minimum energy performance standards, UK = United Kingdom.

Source: Mavandad and Malinowski (2022).

¹ U4E, Model Regulation Guidelines, <https://united4efficiency.org/resources/model-regulation-guidelines/>

With the exception of the European Union and the United Kingdom, most countries have not adopted technology-neutral standards. Separate technology-specific standards have been set for other non-LED fittings, such as conventional fluorescent tubes utilising magnetic or electronic ballasts, compact fluorescent lamps (CFLs), and incandescent lamps. Adopting technology-specific MEPS has not led to a significant reduction of lighting energy consumption, as it allows inefficient fittings to still be assessable in the market. Implementing technology-neutral MEPS for lamps will help phase out less-efficient lamps such as CFLs and incandescent lamps, however.

5.2. Air Conditioners

The CSPF is used to define efficiencies of air conditioners. Implementation of MEPS by some regional economies is shown in Table 8.4.

Table 8.4. Air Conditioner MEPS of Regional Economies

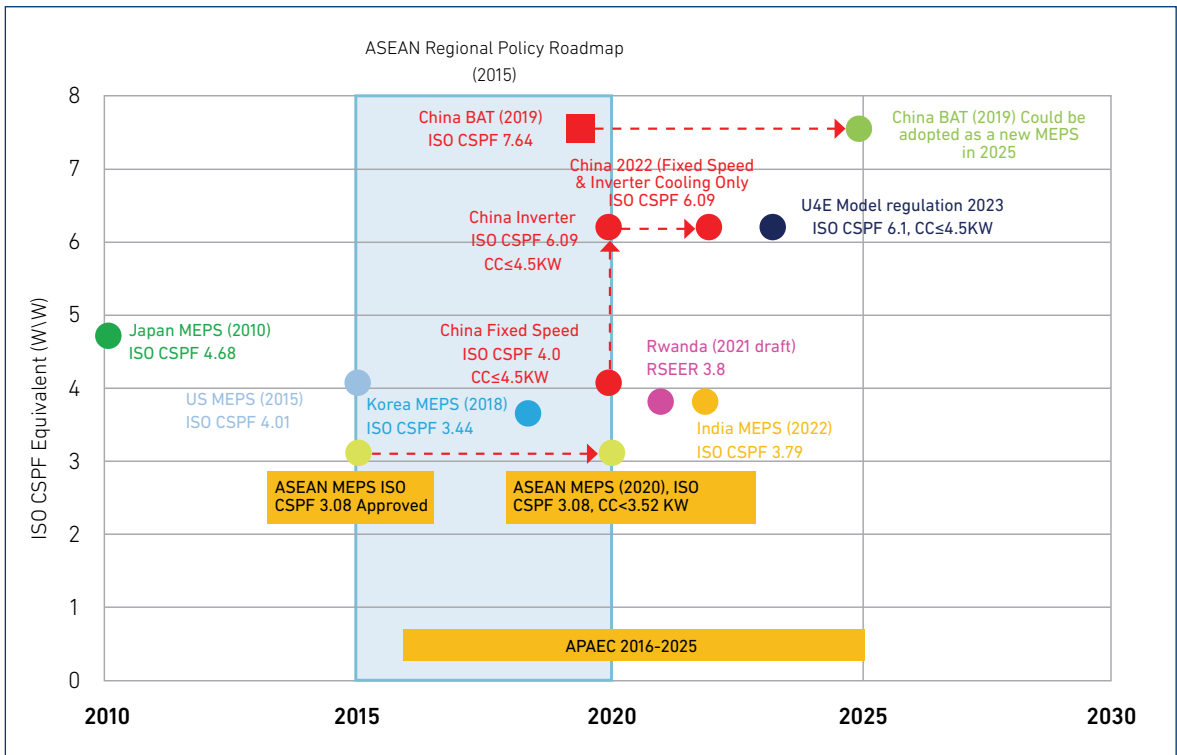
Regional Economies	CSPF as MEPS	Adoption Year	Remarks
Japan	4.68	2010	
China	4.00	2020	
	6.09	2023	
	7.64	2025	Proposed
Singapore	4.60	2023	
	6.09	2025	
Thailand	3.90	2023	Sold mostly with 4.00–4.30 CSPF
Indonesia	3.40	2023	Target 4.00–4.20 by 2025
	4.00–4.20	2025	Target
Malaysia	3.10	2014	For cap. < 4.5 kW
	2.90	2014	For cap. ≥ 4.5 kW, < 7.1 kW
ASEAN	3.70	2023	
	6.09	2024	

ASEAN = Association of Southeast Asian Nations, CSPF = cooling seasonal performance factor, MEPS = minimum energy performance standards.

Source: Author.

China is the global leader for split air conditioner efficiency, with its MEPS ahead of those of other countries and regions, including the European Union, Japan, United Kingdom, and United States. Its current MEPS is set at a CSPF of 6.09 W/W with an ambitious target of 7.64 W/W for 2025.² As the cooling demand is high for most economies and air conditioners are used often, China’s air conditioner MEPS should be the standard to be targeted. Most manufacturers already have the technology and know-how, so this is achievable. Figure 8.3 shows the regional roadmap for air conditioner MEPS.

Figure 8.3. Regional Roadmap for Air Conditioner MEPS



ASEAN = Association of Southeast Asian Nations, BAT = best-available technology, CSPF = cooling seasonal performance factor, ISO = International Organization for Standardization, MEPS = minimum energy performance standards, US = United States.

Source: ASEAN-SHINE (2021).

² CSPF, a ratio of cooling seasonal total load (W) over cooling seasonal energy consumption (W).

5.3. Refrigerators

Refrigerator energy efficiencies are measured based on annual energy consumption (kilowatt-hours [kWh] per year). The methodology used to determine their MEPS varies depending on size (capacities in litres [L]) and configuration (number of doors). Due to the wide range of refrigerators available in the market, most countries have adopted ratings for single- and double-door configurations.

Some countries specify refrigerator MEPS based on Energy Star ratings, which are converted from the annual energy consumption based on the refrigerator's capacity and configuration. The calculation methodology used to determine the star ratings varies. In Singapore, the MEPS specified is 'two-tick' for capacities up to 900 L, with and without freezers. The maximum annual energy consumption for 400-L refrigerators without freezers is 334 kWh/year and with freezers, 434 kWh/year. In Malaysia, the minimum mandatory rating is two-star, and for a typical double-door refrigerator with a 400-L capacity, the maximum allowable consumption is 630 kWh/year. Higher efficiency or lower maximum allowable consumption has been proposed.

Table 8.5 is the MEPS for refrigerators in Malaysia; two-star is the required rating that must be met. The star rating is determined from the Star Index Value, which is calculated using tested energy-efficiency factor derived from measured electrical power consumption of the appliance.

Table 8.5. Star Ratings of Refrigerators in Malaysia

Star Rating	Star Index Value
5	Star Index $\geq +25\%$
4	$(+10\%) \leq \text{Star Index} < (+25\%)$
3	$(-10\%) \leq \text{Star Index} < (+10\%)$
2	$(-25\%) \leq \text{Star Index} < (-10\%)$
1	$(-35\%) \leq \text{Star Index} < (-25\%)$

Source: Suruhanjaya Tenaga (Energy Commission of Malaysia).

Table 8.6 demonstrates the MEPS for refrigerators in Singapore. The annual energy consumption determined corresponds to Singapore's minimum required rating of 'two-tick'. Of the two MEPS, it is easier to determine a refrigerator's performance under Singapore's MEPS.

Table 8.6. MEPS for Refrigerators in Singapore

Type of Refrigerators	Adjusted Volume, $V_{\text{adj tot}}$	Maximum Annual Energy Consumption (AEC) in kWh
Refrigerator without freezer	≤ 900 liters	$(368 + (0.0892 \times V_{\text{adj tot}})) \times 0.461$
Refrigerator with freezer	≤ 900 liters	$(465 + (1.378 \times V_{\text{adj tot}})) \times 0.427$
Refrigerator with freezer and through-the-door ice dispenser	≤ 900 liters	$(585 + (1.378 \times V_{\text{adj tot}})) \times 0.409$

kWh = kilowatt-hour, MEPS = minimum energy performance standards.

Source: National Environment Agency of Singapore.

6. Strengths, Weaknesses, Opportunities, and Threats

Figure 8.4 summarises some attributes that are unique for establishing MEPS in Lao PDR.

Figure 8.4. Strengths, Weaknesses, Opportunities, and Threats for MEPS in Lao PDR

Strengths	Weaknesses
Political : Has The right ministry to lead MEPS implementation	People : Low awareness on benefits of MEPS
Economic : Implementation of MEPS leads to reduced energy consumption in the residential and end-user sector	Legal : Lack of EE&C legislative framework & enabling infrastructure
Societal : Has support from stakeholders and professional bodies	Resources : Lack of responsible agency/resources to develop MEPS
Technology : Readily available and will be supported by ASEAN and other advanced nations on EE technologies	Financial Support : Needs funding mechanism to support MEPS development
Legal : Keen to implement Policies which are beneficial to nation	Technical Capacity : Lack of standard on MEPS & Energy Efficiency guidelines
	Infrastructure : Lack of testing facilities
Opportunities	Threats
Markets : Great potential to reduce energy consumption	Dumping Ground : Becomes dumping ground of inefficient & energy-guzzling appliances/equipment by manufacturers
People : Potential to create awareness through public promotions and education	Cheap Appliances : Barriers to implementation of energy-saving measures
Industry : Build capacity of ESCOs and establish an ESCO association	Affordability : People end up paying more in using inefficient appliances/equipment due to higher consumption of electricity
Government Support : Commitment to implement MEPS	
Technology : Utilization of best available technologies from manufacturers	

ASEAN = Association of Southeast Asian Nations, EE = energy efficiency, EE&C = energy efficiency and conservation, MEPS = minimum energy performance standards.

Source: Author.

The low electricity tariff of US\$0.024–US\$0.045/kWh – coupled with low public awareness of energy efficiency – is a barrier towards energy consumption reduction efforts in Lao PDR. Moreover, the current absence of MEPS allows for the manufacturing and importing of low energy-efficiency equipment and appliances. The adoption of MEPS would present an opportunity for Lao PDR to lower energy consumption in the residential and end-use sectors.

7. Policy Recommendations

The implementation of MEPS is expected to take time in Lao PDR due to the availability of a wide range of equipment and appliances, lack of sufficient testing facilities, lack of sufficient performance standards, and needed capacity building. However, implementation of MEPS would help Lao PDR reduce energy consumption.

The implementation of MEPS should be carried out in stages.

Short-term plan (within 2–3 years from the commencement of MEPS implementation):

- (i) **Create energy-efficiency awareness.** The lack of energy-efficiency awareness is hindering consumers from buying into the concept of energy savings. An energy-efficiency awareness programme should be set up regarding the importance of energy consumption reduction. It could be carried out through school curricula, public road shows, and seminars and workshops.
- (ii) **Establish an implementing agency to lead and to execute the MEPS implementation plan.** This agency/department should be tasked to develop the necessary product specifications and testing procedures, manage certification bodies, and set up the registration bodies.
- (iii) **Develop performance and testing standards.** This should be carried out through a consultative programme. Stakeholders, such as professional bodies, industrial and commercial associations, academia, and research institutions, whose involvement are crucial to the implementation of MEPS should be identified and incorporated into the programme. These stakeholders should assist in assessing the effectiveness of targeted product impact on the energy reduction objective and establishing the energy-efficiency levels achievable depending on manufacturers' readiness and best available technologies.

Long-term plan (within 4–5 years from the commencement of MEPS implementation):

- (i) **Establish testing facilities.** Testing facilities, an important element of MEPS, are required to carry out product compliance tests. In the absence of accredited testing facilities, an interim measure would be to accept independent third-party testing for energy-efficiency verification. International and regional facilities will be available to assist with the testing conforming to the standards set.

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